Public Utility District 1 of Thurston County

Hazards Mitigation Plan for the Thurston Region

Updated March 2019

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<td>17</td>
</tr>
</tbody>
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CERTIFIED COPY OF RESOLUTION
ADOPTED AT THE REGULAR MEETING OF THE COMMISSIONERS
OF
PUBLIC UTILITY DISTRICT NO. 1 OF THURSTON COUNTY

The President and Secretary of Public Utility District No. 1 of Thurston County certify that this Resolution was adopted by a majority vote of the Commissioners of Public Utility District No.1 of Thurston County in attendance at the meeting held at the office of the District, Suite 301, 921 Lakeridge Way S.W., Olympia, Washington, 98502 on Someday, November XX, 20XX, and that said Resolution has not been revoked.

RESOLUTION NO. 17-XX

RECITALS

The Public Utility District No. 1 of Thurston County (the District), as a public utility district in the state of Washington and operating in Thurston, Pierce, Lewis, Grays Harbor, and Mason Counties, is vulnerable to the human and economic costs of natural disasters.

The District recognizes the importance of reducing or eliminating those vulnerabilities for the overall good and welfare of the community.

The District has been an active participant in the Natural Hazards Mitigation Planning Workgroup and Task Force, which established a comprehensive, coordinated planning process to eliminate or decrease these vulnerabilities.

District staff have identified, justified and prioritized a number of proposed projects and programs needed to mitigate the vulnerabilities of Thurston PUD to the impacts of disasters.

The proposed projects and programs identified by the District have been incorporated into the 2016 edition of the Hazards Mitigation Plan for the Thurston Region that has been prepared and issued for consideration and implementation by the communities of Thurston County.

RESOLUTION

NOW, THEREFORE, THE COMMISSIONERS OF THE DISTRICT DO HEREBY RESOLVE AS FOLLOWS:

Section 1. The District hereby accepts, approves, and adopts its designation portion of the 2016 update to the “Natural Hazards Mitigation Plan for the Thurston Region,” and affecting the District’s operations in Thurston, Pierce, Lewis, Grays Harbor, and Mason Counties.

Section 2. District Staff are requested and instructed to pursue available funding opportunities for implementation of the mitigation initiatives designated therein.

Section 3. The District will, upon receipt of such funding or other necessary resources, seek to implement the proposals contained in its section of the strategy.
Section 4. The District will continue to participate in the updating and expanding of the *Hazards Mitigation Plan for the Thurston Region* as needed and appropriate.

______________________________
Linda Oosterman  
Commissioner and President of  
Public Utility District No. 1 of Thurston County

ATTEST:

______________________________
Russell E. Olsen  
Commissioner and Secretary
# Community Profile

## Public Utility District 1 of Thurston County

**Community Profile**

**Public Utility District 1 of Thurston County**

<table>
<thead>
<tr>
<th>Total Water Systems</th>
<th>163</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Customer Connections</td>
<td>4,145</td>
</tr>
<tr>
<td>Total People Served</td>
<td>10,362</td>
</tr>
</tbody>
</table>

**Total Owned Group A Systems**

<table>
<thead>
<tr>
<th>Total Owned Group A Systems</th>
<th>31</th>
</tr>
</thead>
</table>

**Total Managed Group A Systems**

<table>
<thead>
<tr>
<th>Total Managed Group A Systems</th>
<th>12</th>
</tr>
</thead>
</table>

**Total Group A Connections**

| Total Group A Connections | 3,335 |

**Total Group A People Served**

| Total Group A People Served | 8,337 |

**Total Group B Systems**

| Total Group B Systems | 132 |

**Total Managed Group B Systems**

| Total Managed Group B Systems | 1 |

**Total Group B Connections**

| Total Group B Connections | 810 |

**Total Group B People Served**

| Total Group B People Served | 2,025 |

**Wells**

| Wells | 180 |

**Miles of Water Main Pipelines**

| Miles of Water Main Pipelines | 55 |

**Pump Houses**

| Pump Houses | 142 |

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**Who We Are:** Public Utility District No. 1 of Thurston County (Thurston PUD) was officially formed in 1938 by a vote of the people. Thurston PUD provides water planning and utility services to the citizens of Thurston County, and also owns and operates water systems in Pierce, Lewis, Grays Harbor, and Mason counties.

**Governance:** The PUD is governed by three Commissioners, elected by the voters of Thurston County and elected to serve six-year terms. The Commissioners represent the three Commission districts in Thurston County.

**Mission**

The District is a progressive, innovative service organization dedicated to serving our customer owners and the community. The District strives to provide the highest quality utility service to homes, business, and industry at the most reasonable cost practical.

**Service Summary**

**Description:** Group A water systems have 15 or more service connections or regularly serve 25 or more people 60 or more days per year.

<table>
<thead>
<tr>
<th>Total Owned Group A Systems</th>
<th>31</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Managed Group A Systems</td>
<td>12</td>
</tr>
<tr>
<td>Total Group A Connections</td>
<td>3,335</td>
</tr>
<tr>
<td>Total Group A People Served</td>
<td>8,337</td>
</tr>
</tbody>
</table>

**Description:** Group B water systems serve fewer than 15 connections and fewer than 25 people per day.

<table>
<thead>
<tr>
<th>Total Owned Group B Systems</th>
<th>132</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Managed Group B Systems</td>
<td>1</td>
</tr>
<tr>
<td>Total Group B Connections</td>
<td>810</td>
</tr>
<tr>
<td>Total Group B People Served</td>
<td>2,025</td>
</tr>
</tbody>
</table>

---

**Background**

**Who We Are:** Public Utility District No. 1 of Thurston County (Thurston PUD) was officially formed in 1938 by a vote of the people. Thurston PUD provides water planning and utility services to the citizens of Thurston County, and also owns and operates water systems in Pierce, Lewis, Grays Harbor, and Mason counties.

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Thurston PUD Plan Development Process

Plan Development Staff

Thurston PUD’s Director of Planning and Compliance, Kim Gubbe and Administrative Assistant, Carrie Bowen attended all the Hazards Mitigation Workgroup meetings. Operations Specialist Brian Wilson worked with Kim to edit the plan and add additional initiatives when Carrie resigned from Thurston PUD.

The Thurston PUD’s Hazards Mitigation Committee assisted in the preparation of Thurston PUD’s Hazards Mitigation Plan. Thurston PUD’s Hazards Mitigation Committee is made up of members from the Operation’s Team.

<table>
<thead>
<tr>
<th>Title</th>
<th>Representatives</th>
</tr>
</thead>
<tbody>
<tr>
<td>Director of Operations and Compliance</td>
<td>Kim Gubbe</td>
</tr>
<tr>
<td>Operations Specialist, Project Lead</td>
<td>Brian Wilson</td>
</tr>
</tbody>
</table>

Plan Development

The following activities supported the development and review of Thurston PUD’s local hazards mitigation planning process:

<table>
<thead>
<tr>
<th>Date</th>
<th>Location</th>
<th>Activity</th>
<th>Subject</th>
</tr>
</thead>
<tbody>
<tr>
<td>10/22/15</td>
<td>Thurston PUD</td>
<td>Hazards Mitigation Committee</td>
<td>Briefing on upcoming work to be done on the Hazards Mitigation Plan.</td>
</tr>
<tr>
<td>6/26/16</td>
<td>Thurston PUD</td>
<td>Commissioner Meeting</td>
<td>Review of the Hazards Mitigation Plan for the Thurston Region and TPUD Annex</td>
</tr>
<tr>
<td>11/17/16</td>
<td>Thurston PUD</td>
<td>Meeting / Work Session</td>
<td>Thurston PUD Risk Assessment and Hazards Mitigation Plan</td>
</tr>
<tr>
<td>9/1/17</td>
<td>Thurston PUD</td>
<td>Customer Newsletter</td>
<td>We asked our customers to review our Annex on our website. We also asked them to send in comments regarding the Annex by September 15, 2017.</td>
</tr>
<tr>
<td>8/1/19</td>
<td>Thurston PUD</td>
<td>Meeting / Work Session</td>
<td>Reviewed Additional Initiatives at the request of the State.</td>
</tr>
<tr>
<td>2/19/19</td>
<td>Thurston PUD</td>
<td>Update Plan</td>
<td>Added Initiatives and process details.</td>
</tr>
<tr>
<td>3/29/19</td>
<td>Thurston PUD</td>
<td>Update Plan</td>
<td>Calculated initiative cost and time line.</td>
</tr>
<tr>
<td>TBA</td>
<td>Thurston PUD</td>
<td>TPUD Adoption</td>
<td>Adoption of the Hazards Mitigation Plan for the Thurston Region and TPUD Annex</td>
</tr>
</tbody>
</table>

Thurston PUD sent a newsletter (Figure 1) to our customers. We asked them to review the Draft Thurston PUD Annex to the Hazards Mitigation Plan for the Thurston Region on our website and to send any comments they have regarding the Thurston PUD Annex to KGubbe@thurstonpud.org, by September 15, 2017. No comments were submitted. As noted before, all of our customers are welcome to come and speak at the public Board of Commissioners meeting that is held every other week. This will
allow our customers, or anyone in the community, to continue to participate in the plan maintenance process.

**Figure 1**

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### Initiative Identification Process

Projects were identified through focused **brain storming sessions** with the General Manager, Director of Planning and Compliance, and Superintendent. During these meetings, **Washington State and Thurston County mitigation initiatives were reviewed** to understand the broader implications and goals already identified. In doing so, we were able to determine there are two Thurston County initiatives we could piggy-back onto. In addition, we were also able to determine there are three Thurston County initiatives that we could apply directly to our jurisdictions unique needs and customer base.

- **CW-MH 7:** Strengthen interjurisdictional asset management capabilities. Having small and rural water systems spread throughout Thurston County, it’s important for us to communicate and plan with all available regional stakeholders.
- **CW-SH 1:** Develop a disaster debris management strategy. Wind storms are a problem throughout the county. High winds can knock down powerlines, shutting down our pumps in systems that don’t have backup generators. High winds can also knock down trees which can fall and rupture pipes underground or pull pipes up if their roots are wrapped around the line. Timely and focused response to these potential disasters will help prioritize and streamline repair efforts.

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On the front page of the Thurston PUD website, [www.thurstonpud.org](http://www.thurstonpud.org) you will find a link to the Draft Thurston PUD Annex to the Hazards Mitigation Plan for the Thurston Region. Please take the time to review the proposed mitigation initiatives to protect assets that serve the District’s customers. The plan is a requirement for Thurston PUD to be eligible to apply for and receive federal mitigation assistance grants from the Federal Emergency Management Agency. More information about the region’s plan can be found at [www.trpc.org/hazards](http://www.trpc.org/hazards). Please send any comments regarding the proposed initiatives or other elements of the annex to cbowen@thurstonpud.org. We will be accepting comments until September 15, 2017.
• CW-MH 6: Develop and maintain a hazards mitigation public outreach strategy. A focused outreach program will allow us to notify specific customers through mailings, newsletters, and website education. Also, annually hosting an outreach workshop at a local college or fire station is an outreach option.

• CW-PH 1: Develop emergency evacuation routes. Specific evacuation routes for each system in a hazard area will allow our customers to get to safety as quick as possible.

• CW-MH 11: Inventory and assess sheltering facilities. Providing our customers with local resources and shelter information can help them and their families be better prepared in an emergency. We will reach out to Thurston County Regional Planning for assistance since they have begun developing the list already.

Using the Thurston Region Hazards Assessment Maps, the next step was to review which water systems are affected by which type of hazards. Further research on mitigation initiatives for fire, earthquake, and volcanic hazards need to be identified.

In addition, we reached out to Tim Cook with the State Hazard Mitigation Office and Paul Brewster at the TRPC for a list of mitigation initiatives that were approved for funding in the past.

Our last identification method was to review the FEMA list, Types of Plans & Projects Available for Funding, and choose the project types that were most applicable to our jurisdiction. This included:

1. Generators
2. Storage tank retrofit for earthquakes
3. Soil stabilization
4. Wildfire mitigation
5. Post-disaster code enforcement

Altogether, Thurston PUD identified 9 initiatives while creating the Hazard Mitigation Plan.

Initiative Prioritization Process

Thurston PUD has done a Benefit Cost Review to help prioritize the above initiatives. We looked at the amount of time, customer benefit, expense, and outside funding available. With these analysis for everyone to review, our management team weighed the pros and cons of each initiative and we prioritized them accordingly. An emphasis was put on Hazard Preparedness initiatives because we believe we can complete them quickly and at a low cost compared to other projects. In addition, these projects impact a significant portion of our customers and help our field staff be more prepared in emergency situations.

Initiative Integration Process

Once mitigation initiatives have been identified, they are brought before our Board of Commissioners when they review the annual budget. After reviewing the initiatives, costs, implementation strategy, and the number of people and property affected, the Commissioners vote to approve the initiatives. It is highly likely all of the initiatives will be approved. If not, we will identify why and make the necessary changes.
In addition to a Benefit Cost Review, Thurston PUD’s Asset Management Plan drives the implementation of projects and is reflected in the District’s Capital Improvement Plan. These plans are reviewed annually and will include assessing the current state of initiatives as well as the time, expense, man power and funding available to move forward with each project. Upon approval by the Commissioners, the initiatives will be incorporated into our Asset Management and Capital Improvement Plan pending funding.

Applications for funding will be submitted to FEMA and possibly the DWSRF program.

When funding has been approved, the planning phase will begin. Depending on the type of project, this would happen in-house or the work would be contracted out to someone who specializes in the type of project to be completed. For example, retrofitting our reservoirs is beyond our staff resources and capabilities and a 3rd party would be brought in. This requires public notification, the contract going out to bid, reviewing bid packets, and selecting the contractor we think is best for the job.

Finally, the work will begin and completed within the FEMA guideline of 1, 3, or 5 years.
Thurston PUD Risk Assessment

Introduction

Chapters 4.0 through 4.6 of the core plan address the Disaster Mitigation Act risk assessment planning requirements. The Risk Assessment summarizes the hazards and the risks that pose the greatest threat to Thurston PUD. The Risk Assessment includes hazard profiles that describe the hazards, their causes, sources, severity, effects and impacts, probability of occurrence, historical occurrences, geographic extent or delineation, and the portion of the population, assets, and essential facilities potentially exposed to the hazard. The information is presented for general audiences and includes figures, maps, and tables.

Water Systems in Lewis, Pierce, Kitsap, King, and Grays Harbor County

Thurston PUD is a unique special purpose district with two offices in Thurston County. Although based out of the city of Lacey and Tumwater, Thurston PUD owns and manages water systems in multiple counties. For the purpose of this plan, only water systems within Thurston County were evaluated for mitigation initiatives. Reaching out to the Emergency Management departments of each of these other counties will be addressed as time permits to identify unique risks in these communities.

Hazard Analysis Definitions

The Hazards Mitigation Plan for the Thurston Region uses a subjective risk measurement process based on Thurston County’s Hazard Inventory and Vulnerability Assessment (HIVA). This methodology rates elements of each hazard’s risk characteristics using the descriptors high, moderate, and low. These descriptors are applied to the hazards’ probability of occurrence, vulnerability, and overall risk. The following is an overview of this risk measurement model:

Risk Rating: A description (high, moderate, or low) of the subjective estimate of the combination of any given hazards probability of occurrence and the regions vulnerability to the hazard.

- **High** – There is strong potential for a disaster of major proportions.
- **Moderate** – There is medium potential for a disaster of less than major proportions.
- **Low** – There is little potential for a disaster.

Probability of Occurrence: A description (high, moderate, or low) of the probability of a hazard impacting Thurston County within the next 25 years.

- **High** – There is great likelihood that a hazardous event will occur within the next 25 years.
- **Moderate** – There is medium likelihood that a hazardous event will occur within the next 25 years.
- **Low** – There is little likelihood that a hazardous event will occur within the next 25 years.
Vulnerability: A description (high, moderate, or low) of the potential impact a hazard could have on Thurston PUD. Vulnerability can be expressed as a combination of the severity of a hazards effect and its consequential impacts to the community. It considers the population, property, commerce, infrastructure, and services at risk relative to the entire county.

- **High** – The total population, property, commerce, infrastructure, and services of the county are uniformly exposed to the effects of a hazard of potentially great magnitude. In a worst-case scenario, there could be a disaster of major to catastrophic proportions.
- **Moderate** – The total population, property, commerce, infrastructure, and services of the county are exposed to the effects of a hazard of moderate influence; or the total population, property, commerce, infrastructure, and services of the county are exposed to the effects of a hazard of moderate influence, but not all to the same degree; or an important segment of population, property, commerce, infrastructure and services of the county are exposed to the effects of a hazard. In a worst-case scenario, a disaster could be moderate to major, but not catastrophic proportions.
- **Low** – A limited area or segment of population, property, commerce, infrastructure, or service is exposed to the effects of a hazard. In a worst-case scenario, there could be a disaster of minor to moderate proportions.

Hazard Profiles

The core plan includes detailed profiles of hazards that pose the greatest risk to Thurston PUD water systems in Thurston, Lewis and Pierce Counties. Because the core plan treats the entire county as the planning area, the core plan’s risk assessment is the definitive risk assessment for Thurston, Lewis and Pierce Counties. Each hazard profile fulfills all the following criteria:

1. There is a high probability of the natural hazard occurring in Thurston, Lewis and Pierce Counties within the next 25 years,
2. There is the potential for significant damage to buildings and infrastructure; and/or
3. There is the potential for loss of life.

The following hazards meet one or more of the above criteria. Every hazard profile was evaluated and updated during the plan update process.

Summary Risk Assessment

Based on the regional risk assessment and the local risk assessment in the subsequent section, the following hazards pose the greatest threat to Thurston PUD.
<table>
<thead>
<tr>
<th>Hazard</th>
<th>Probability of Occurrence</th>
<th>Vulnerability</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earthquakes</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Storms</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Flood</td>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td>Landslides</td>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Wildland Fire</td>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
<tr>
<td>Volcanic Events</td>
<td>Low</td>
<td>high</td>
<td>Low</td>
</tr>
</tbody>
</table>
Earthquakes

Severity
The epicenter of an earthquake is the point on the earth's surface directly above the earthquake's focus. The severity of an earthquake is dependent on the amount of energy released from the fault or epicenter. The Richter Magnitude Scale measures the intensity of ground motion. Each whole number increase in magnitude represents a ten-fold increase in measured amplitude, and 31 times more energy released. Three kinds of earthquakes are recognized in the Pacific Northwest: shallow earthquakes have the potential to produce magnitudes mostly less than 3.0 but as high as 7.5, subduction zone earthquakes are considered to be the most destructive with potential magnitudes of 9.0 or greater, and deep earthquakes with recorded magnitudes of 7.5.

Impacts
Impacts of earthquakes can damage water pipeline, water system pump houses, older concrete reservoirs, and power systems. Road damage can delay restoration and servicing of the water systems. Water systems without backup generators will be unable to provide water to customers should power be disrupted. Water customers may need to boil water before consumption until the water can be tested and determined to be safe.

Probability of Occurrence
History suggests a high probability of occurrence of another damaging earthquake sometime in the next 25 years. The overall probability of occurrence of a damaging earthquake is high.

Historical Occurrences and Impacts to Thurston PUD
There have been 3 large earthquakes since 1949. The one on February 28, 2001, a 6.8 magnitude deep earthquake was centered in the Nisqually Reach northeast of Olympia. It was the second worst earthquake in recent Washington history.

Summary Assessment
Though the example of the 2001 quake is not the largest earthquake event possible in the Puget Sound region, it is conceivable that a similar magnitude earthquake could emanate from a shallow crustal fault which would result in much greater damages. History does suggest a high probability of occurrence of another damaging earthquake sometime in the next 25 years. However, considering Thurston PUD’s history of not having any damages to wells, water lines or pump houses our vulnerability to the impact of earthquakes would be moderate, as would the overall risk.

Summary Risk Assessment for Earthquake for Thurston PUD

<table>
<thead>
<tr>
<th>Probability of Occurrence</th>
<th>Vulnerability</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
**Storms**

**Severity**
Destructive storms come in several varieties: wind, rain, ice, snow, and any combination. Nearly all destructive local storms occur from October through April when the jet stream is over the U.S. west coast and Pacific low-pressure systems are more frequent. The trajectory of these low pressure systems determines their effect locally. Southerly lows bring heavy rains; northerly lows bring cold air and potential for snow and ice. Winter storms can bring high winds, with speeds above 40 miles per hour causing widespread damage and those above 50 miles per hour causing possible disastrous damage. High winds of short duration can also be destructive though generally not as widespread.

**Impacts**
1. High winds can bring down trees, telephone and electrical lines, temporarily interrupting power to water system pump houses.
2. Ice storms create treacherous road conditions and often cause downed trees, telephone and electrical lines, temporarily interrupting power to water system pump houses.
3. Each of these, when in combination with any other or if accompanied by freezing temperatures, can exacerbate a storm's impact. High winds, heavy snows and heavy rains often result in increased power outages effecting the safety of drinking water.

**Probability of Occurrence**
Storms are frequent in Thurston, Lewis and Pierce Counties and history suggests a high probability of wind, rain, ice, snow, and any combination occurring.

**Historical Occurrences and Impacts to the Thurston PUD.**
The ice and windstorms of December 1996, caused large amounts of debris and damage to powerlines and pump houses.

**Summary Assessment**
Although examples of the December storms of 1996 and 2008 are not the most severe storm events possible in the Puget Sound region, future occurrences would have similar temporary impacts on Thurston PUD’s service area. History does suggest a high probability of occurrence of damaging storms. Impacts of storms would be moderate, as would the overall risk.

**Summary Risk Assessment for Storms for Thurston PUD**

<table>
<thead>
<tr>
<th>Probability of Occurrence</th>
<th>Vulnerability</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
Floods

Severity
Several factors determine the severity of floods, including rainfall intensity (or other water source) and duration. Four types of flooding occur in Thurston, Lewis and Pierce Counties: river or stream building floods, flash floods, tidal floods, and groundwater flooding.

Impacts
Impacts of flooding on surface water systems would likely be from pump houses getting flooded due to flash and groundwater flooding. Subsequent sanitation problems could arise from contaminated potable water supplies.

Probability of Occurrence
Historically, flooding occurs along one or more of the Thurston, Lewis and Pierce Counties waterways every year, suggesting a high probability of occurrence regionally. However, taking into consideration that Thurston PUD owns 18 water systems in the 100 year flood plain, the probability of occurrence within Thurston PUD’s service area is moderate.

Historical Occurrences and Impacts to Thurston PUD
There have been several floods since 1990. During the local flooding events of 1996, the water table rose and wells were contaminated with total coliforms which couldn’t be cleaned-up and now must be permanently chlorinated.

Summary Assessment
Although the history of flooding clearly demonstrates a high probability of future occurrence in Thurston, Lewis and Pierce Counties only a few of the District’s water systems are in a flood area and, so the probability would be moderate. The likelihood of the wellheads being flooded is low, so our vulnerability is low with and overall rating of low.

Summary Risk Assessment for Flood in Thurston PUD

<table>
<thead>
<tr>
<th>Probability of Occurrence</th>
<th>Vulnerability</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Low</td>
<td>Low</td>
</tr>
</tbody>
</table>
Landslides

Severity
Landslides are movement of rock, soil, or other debris, down a slope. The term landslide includes a wide range of ground movement, such as rock falls, deep failure of slopes, and shallow debris flows. Factors such as erosion, unstable slopes, earthquakes, volcanic eruptions, vibrations, increase of load, hydrologic factors, human activity, removal of lateral and underlying support, increase of lateral pressures and regional tilting will affect the severity of a landslide.

Impacts
Possible impacts of landslides would be damaged pump houses, wellheads, smaller reservoirs, the loss of power and the subsequent loss of clean running water. Landslides could also block or erode roadways, which could prevent the District’s staff from getting to some of our water systems.

Probability of Occurrence
Landslides tend to occur in isolated, sparsely developed areas threatening individual structures and remote sections of transportation, energy, and communications infrastructure. Thurston PUD owns 21 and manages 2 water systems that would be effected by landslides, therefore landslides would have a low probability of occurrence.

Historical Occurrences and Impacts to Thurston PUD
No significant history of landslide events has impacted Thurston PUD water systems.

Summary Assessment
Thurston PUD has some water systems located in an area with a 40% slope, with no significant history of landslide events. This leads to moderate vulnerability and low overall risk in those areas.

Summary Risk Assessment for Landslide in Thurston PUD

<table>
<thead>
<tr>
<th>Probability of Occurrence</th>
<th>Vulnerability</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moderate</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
Wildland Fires

Severity
Wildfires can begin unnoticed and spread quickly. Naturally occurring and non-native species of grasses, brush, and trees fuel wildfires. In Thurston, Lewis and Pierce Counties, wildfires are most likely to occur during the local dry season, mid-May through mid-October, or anytime during prolonged dry periods causing drought or near-drought conditions.

Impacts
Possible impacts of wildland fires on Thurston PUD owned water systems would be the spread of fire near pump houses, plastic reservoirs and powerlines. This could cause water contamination and flow issues for our customers.

Probability of Occurrence
According to FEMA, a low wildland fire risk area might be a developed portion of a city with few native trees and higher urban densities including commercial or industrial development. Thurston PUD owns 33 and manages 6 water systems in the wildland fire interface area, and therefore would have a high probability of occurrence.

Historical Occurrences and Impacts Specific to Thurston PUD
No significant history of wildfire events affected Thurston PUD water systems.

Summary Assessment
Numerous wildland fires will occur over the next 25 years, therefore the hazard received a high probability of occurrence rating. Because Thurston PUD has several water systems located in wildfire hazard areas, the PUD’s vulnerability would be moderate with a moderate overall risk.

Summary Risk Assessment for Wildland Fire in Thurston PUD

<table>
<thead>
<tr>
<th>Probability of Occurrence</th>
<th>Vulnerability</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>High</td>
<td>Moderate</td>
<td>Moderate</td>
</tr>
</tbody>
</table>
Volcanic Hazards

Severity
An eruption of Mount Rainier, an intermittently active local volcano, could create mud and debris flows called lahars. Lahars originate on volcano flanks and can surge tens or even hundreds of miles downstream from a volcano. Historically, lahars have been one of the most destructive volcanic hazards.

Impacts
Impacts of an eruption of Mount Rainier and subsequent lahar would be relegated to the Nisqually River valley, impacting nearby water system, disrupting power and destroying pump houses and reservoirs in this area.

Probability of Occurrence
There is evidence (dated to have occurred approximately 300 years ago) that lahars have buried forests near what are now the City of Yelm and the Nisqually Indian Reservation. This indicates a low probability of occurrence.

Historical Occurrences and Impacts Specific to Thurston PUD
The USGS provides the following short history of a major lahar event which originated from Mount Rainier and impacted the Nisqually River valley:


Thurston PUD owns 17 water system in the lahar inundation zone. In the event of a Nisqually Valley or Mt. Adams lahar, nearby roadways would be impacted disrupting or potentially cutting off service to those water systems.

Tephra or ash fall could block proper ventilation in the pump houses and clog air filters on the generators causing them to run poorly or not at all.

Summary Assessment
Due to the possible impact on nearby water systems and subsequent destruction and disruption of service to the water system, vulnerability would be high, but paired with a low probability of occurrence, the overall risk would be low.

Summary Risk Assessment for Volcanic Events in Thurston PUD

<table>
<thead>
<tr>
<th>Probability of Occurrence</th>
<th>Vulnerability</th>
<th>Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>High</td>
<td>Low</td>
</tr>
</tbody>
</table>
Thurston Public Utilities District

- Class B: Up to 15 Connect
- Class A: 15 to 100 Connect
- Class A: 100 to 1,000 Connect
- Class A: 1,000+ Connect

Thurston County

Jefferson County

Kitsap County

King County

Mason County

Pierce County

Lewis County

Cowlitz County

Skamania County

Document Path: P:\Regional\Thurston\PLUGINS\Maps_Images\ThurstonPUD_Systems2018-8x11.mxd
Thurston Public Utilities District
Liquefaction Hazards

Liquefaction Hazards

very low
low
low to moderate
moderate to high
high
bedrock
peat
water
CLASS A: 1,000+ Connect
CLASS A: 100 to 1,000 Connect
CLASS A: 15 to 100 Connect
CLASS B: Up to 15 Connect
Managed Water Systems

Liquefaction Data Source: Washington State Dept. of Natural Resources

1 in = 4.37 miles
Thurston Public Utilities District
Flood Hazards

- CLASS A: 1,000+ Connect
- CLASS A: 100 to 1,000 Connect
- CLASS A: 15 to 100 Connect
- CLASS B: Up to 15 Connect
- Managed Water Systems

1 in = 4.37 miles

* Source: FEMA DFIRM (Digital Flood Insurance Rate Map)
** High Ground Water Flooding Area Includes a 300 Foot Buffer. Source: Thurston GeoData Center

DECLARATION: This map is for general planning purposes only. Thurston Regional Planning Council makes no representations as to accuracy or fitness of this information for a particular purpose.

Document Path: P:\ThurstonCounty\Hazard_Mgt\2014-2015\Maps_Images\ChapterMaps\FloodMaps\Flood_PUD_Bx11.mxd
Thurston Public Utilities District
Steep Slopes

- WADNR Mapped Landslides
- Slopes of 40% or Greater
- CLASS A: 1,000+ Connect
- CLASS A: 100 to 1,000 Connect
- CLASS A: 15 to 100 Connect
- CLASS B: Up to 15 Connect
- Managed Water Systems

1 in = 4.37 miles
Thurston Public Utilities District
High Risk Wildland Urban Interface Areas

* Source: DNR, USFS, and National Fire Protection Association determined these high risk areas through a process of evaluation that considered behavior potential, fire protection capability, and risk to social, cultural and community resources.

1 in = 4.37 miles

DISCLAIMER: This map is for general planning purposes only. Thurston Regional Planning Council makes no representations as to accuracy or fitness of this information for any specific purpose.
Pierce County, Washington
Lewis County, Washington 2015 Multi-jurisdictional Hazard Mitigation Plan

Flood Hazards

[Map of Lewis County showing flood hazards, including 100-year flood zone, 500-year flood zone, rivers & lakes, state highways, city limits, and dam inundation areas.]
Lewis County, Washington 2015 Multi-jurisdictional Hazard Mitigation Plan

Earthquake Hazards

Peak Ground Accel. (%g) with 2% Probability of Exceedance in 50 Years
- 30-40
- 40-50
- 50-60

Liquefaction Potential
- Mod to High

(Risk of shaking from Earthquake increases from southeast to northwest)
Lewis County, Washington 2015 Multi-jurisdictional Hazard Mitigation Plan

Volcanic Hazards
Thurston PUD Mitigation Initiatives

The adopted mitigation initiatives are the Thurston PUD’s specific actions for mitigating losses and protecting life and property. They were identified during the development of the *Hazards Mitigation Plan for the Thurston Region* looking at all of Thurston PUD’s service area in Thurston County. The Thurston PUD development team prepared the initiatives.

<table>
<thead>
<tr>
<th>Priority</th>
<th>ID Number</th>
<th>Category</th>
<th>Action</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 of 11</td>
<td>TPUD-MH-1</td>
<td>Hazard Preparedness</td>
<td>Create a public education service to offer tips and information to customers for hazard proofing their homes and emergency preparedness information.</td>
<td>New</td>
</tr>
<tr>
<td>2 of 11</td>
<td>TPUD-WS-1</td>
<td>Hazard Preparedness</td>
<td>Develop a disaster debris management strategy. (Thurston County initiative CW-SH-1)</td>
<td>New</td>
</tr>
<tr>
<td>3 of 11</td>
<td>TPUD-EQ-4</td>
<td>Critical Facilities Replace / Retrofit</td>
<td>Replace all storage tanks in liquefaction zones.</td>
<td>New</td>
</tr>
<tr>
<td>4 of 11</td>
<td>TPUD-MH-3</td>
<td>Critical Facilities Replace / Retrofit</td>
<td>Retrofit offices to make them earthquake and storm resistant.</td>
<td>New</td>
</tr>
<tr>
<td>5 of 11</td>
<td>TPUD-LH-1</td>
<td>Hazard Preparedness</td>
<td>Join early notification system and provide evacuation maps to field staff and customers.</td>
<td>New</td>
</tr>
<tr>
<td>6 of 11</td>
<td>TPUD-MH-4</td>
<td>Hazard Preparedness</td>
<td>Strengthen interjurisdictional asset management capabilities. (Thurston County initiative CW-MH-7)</td>
<td>New</td>
</tr>
<tr>
<td>7 of 11</td>
<td>TPUD-MH-2</td>
<td>Hazard Damage Reduction</td>
<td>Outfit pump houses with generators to maintain service to customers during power outages.</td>
<td>New</td>
</tr>
<tr>
<td>8 of 11</td>
<td>TPUD-EQ-2</td>
<td>Hazard Damage Reduction</td>
<td>Replace all mains in liquefaction zones with Kubota GENEX ductile iron pipe and stabilize soil around these liquefaction vulnerable areas.</td>
<td>New</td>
</tr>
<tr>
<td>9 of 11</td>
<td>TPUD-EQ-1</td>
<td>Hazard Damage Reduction</td>
<td>Replace the asbestos cement water main in the Tanglewilde – Thompson Place System to prevent water loss during an earthquake.</td>
<td>New</td>
</tr>
<tr>
<td>10 of 11</td>
<td>TPUD-WF-1</td>
<td>Critical Facilities Replace / Retro</td>
<td>Retrofit at-risk pump houses with ignition-resistant materials. Create 100-foot defensible zone.</td>
<td>New</td>
</tr>
<tr>
<td>11 of 11</td>
<td>TPUD-MH-5</td>
<td>Hazard Preparedness</td>
<td>Install radio repeaters for improved distance for radio communication.</td>
<td>New</td>
</tr>
</tbody>
</table>

Hazard Category Codes are as follows: EH=Earthquake Hazard; FH=Flood Hazard; LH=Landslide Hazard; MH=Multi Hazard; SH=Storm Hazard; WH=Wildland Fire Hazard; and VH=Volcanic Hazard.
**Priority:** 1 of 11  
**Status:** New

**TPUD-MH-1:** Create a public education service to offer tips and information to customers for hazard proofing their homes and emergency preparedness information. This information will be published twice a year to ensure information is current.

**Hazard Addressed:** Multi-Hazard

**Category:** Hazard Damage Reduction

**Rationale:** Thurston PUD customers may experience temporary disruption to services due to hazard events. Public education outreach efforts can assist customers in hazard proofing their home water connections and learn how to become more disaster resilient.

**Relates to Plan Goal(s) and Objectives** 9A, 6B

**Implementer:** Thurston PUD

**Estimated Cost:** $12,000 per year

**Time Period:** Start the Project in 2019

**Funding Source:** Unknown

**Source and Date:** N/A

**Adopted Plan Number:** TPUD-MH 1

**Reference Page:** N/A

**Initiative and Implementation Status:** New
**Priority:** 2 of 11  
**Status:** New

**TPUD-WS-1:** Develop a disaster debris management strategy.

**Hazard Addressed:** Winds storms

**Category:** Hazard Preparedness

**Rationale:** Wind storms are a problem throughout the county. High winds can knock down powerlines, shutting down our pumps in systems that don’t have backup generators. High winds can also knock down trees which can fall and rupture pipes underground or pull pipes up if their roots are wrapped around the line. Timely and focused response to these potential disasters will help prioritize and streamline repair efforts.

**Relates to Plan Goal(s) and Objectives:** 5A, 8A

**Implemenoter:** Thurston PUD Operations

**Estimated Cost:** $10,000

**Time Period:** Complete by end of 2020.

**Funding Source:** Unknown.

**Source and Date:** N/A

**Adopted Plan Number:** TPUD-WS-1

**Reference Page:** N/A

**Initiative and Implementation Status:** New.
**Priority:** 3 of 11

**Status:** New

**TPUD-EQ-4:** Replace all storage tanks in liquefaction zones. There are 7 water systems in Thurston County with reservoir’s in liquefaction zones: Countrywood Estates, Deschutes Glen, East Olympia, Keanland Park, Longhorn Country Estates, Palermo, and The Vineyards.

**Hazard Addressed:** Earthquake / Liquefaction

**Category:** Critical Facilities Replacement / Retrofit

**Rationale:** Securing our storage tanks will aid in fire-fighting during an earthquake and allow us to more efficiently bring damaged systems back on-line.

**Relates to Plan Goal(s) and Objectives:** 2B, 2D

**Implementer:** Thurston PUD Operations

**Estimated Cost:** $1,385,859.17

**Time Period:** Unknown.

**Funding Source:** Unknown.

**Source and Date:** Hazards Mitigation Plan for the Thurston Region, 3rd Edition, April 2017

**Adopted Plan Number:** TPUD-EQ-4

**Reference Page:** N/A

**Initiative and Implementation Status:** New.
**Priority:** 4 of 11  
**Status:** New

**TPUD-MH-3:** Retrofit our main office and satellite office to make them earthquake and storm resistant. An inspection must be done first to determine the cost of retrofitting our offices at 1230 Ruddell Rd, 1240 Ruddell Rd, and 8421 Old Highway 99.

**Hazard Addressed:** Multi-hazard. Liquefaction and storms.

**Category:** Critical Facilities Replacement/Retrofit

**Rationale:** Securing our main office and satellite (field) office from these hazards allows Thurston PUD to have a command center and safe location for our staff during any emergency. This helps speed up the recovery process and allows for streamlined communication and emergency response.

**Relates to Plan Goal(s) and Objectives:** 2A, 2D, 8A

**Implementer:** Thurston PUD Operations

**Estimated Cost:** $15,000 for three inspections.

**Time Period:** Unknown.

**Funding Source:** Unknown.

**Source and Date:** N/A

**Adopted Plan Number:** TPUD-MH-3

**Reference Page:** N/A.

**Initiative and Implementation Status:** New.
**Priority:** 5 of 11  
**Status:** New

**TPUD-LH-1:** Join the USGS and Pierce County early warning notification system and provide all customers and field staff with evacuation route maps. Enslow 1-3 and Nisqually Vista are the four water systems in the lahar flow zone.

**Hazard Addressed:** Lahar

**Category:** Hazard Preparedness

**Rationale:** Timely evacuation is the most effective way to keep field staff and customers safe during a lahar.

**Relates to Plan Goal(s) and Objectives:** 1A, 1C, 8A

**Implementer:** Thurston PUD Operations

**Estimated Cost:** $12,000.

**Time Period:** Unknown.

**Funding Source:** Unknown.

**Source and Date:** N/A

**Adopted Plan Number:** TPUD-LH-1

**Reference Page:** N/A.

**Initiative and Implementation Status:** New.
Priority: 6 of 11    

Status: New

TPUD-MH-4: Strengthen interjurisdictional asset management capabilities. (Thurston County initiative CW-MH-7)

Hazard Addressed: Multi-Hazard

Category: Hazard Preparedness

Rationale: Having small and rural water systems spread throughout Thurston County, it’s important for us to communicate and plan with all available regional stakeholders.

Relates to Plan Goal(s) and Objectives: 1D, 5C

Implementer: Thurston PUD Operations

Estimated Cost: $10,000.

Time Period: Unknown.

Funding Source: Unknown.

Source and Date: Summary of Countywide Mitigation Initiatives

Adopted Plan Number: TPUD-MH-4

Reference Page: N/A

Initiative and Implementation Status: New.
Priority: 7 of 11  
Status: New

TPUD-MH-2: Outfit pump houses with generators to maintain service to customers during power outages. As of April 2019, there are 58 Group A water systems that don’t have generators currently installed.

Hazard Addressed: Multi-Hazard

Category: Hazard Preparedness

Rationale: Water service is critical for the safety and health of Thurston PUD’s customers. Backup generator systems will provide supplemental power to operate the water systems in the event of a power disruption.

Relates to Plan Goal(s) and Objectives: 2B, 2D

Implementer: Thurston PUD Operations

Estimated Cost: The estimated cost for 58 generators installed at an average of $40,000 each is $2,320,000.

Time Period: 2020 - 2021

Funding Source: Pre-disaster Mitigation Grant and other funding sources

Source and Date: N/A

Adopted Plan Number: TPUD-MH-2

Reference Page: N/A

Initiative and Implementation Status: New
Priority: 8 of 11  
Status: New

TPUD-LQ-2: Replace all water mains for water systems in liquefaction zones with Kubota GENEX DIP and stabilize soil around these liquefaction vulnerable areas. There are 18 water systems in Thurston County that are at risk.

Hazard Addressed: Earthquake

Category: Critical Facilities Replacement/Retrofit

Rationale: Installing these flexible pipes can prevent breaks and ruptures during earthquakes even where the ground opens up and separates.

Relates to Plan Goal(s) and Objectives: 2A, 2D, 8A

Implementer: Thurston PUD Operations

Estimated Cost: $4,480,964.27

Time Period: Unknown

Funding Source: Capital Improvement Plan.

Source and Date: Hazards Mitigation Plan for the Thurston Region, 3rd Edition, April 2017

Adopted Plan Number: TPUD-LQ-2

Reference Page: N/A

Initiative and Implementation Status: New.
Priority: 9 of 11

Status: New

TPUD-EQ-1: Replace the asbestos cement water main in the Tanglewilde – Thompson Place System to prevent water loss during an earthquake.

Hazard Addressed: Earthquake Hazard

Category: Hazard Damage Reduction

Rationale: The Tanglewilde – Thompson Place community is in a seismic hazard area and has over 1700 connection with an estimation of 4,460 people. The existing asbestos cement water main is moderately vulnerable for fracture or rupture during an earthquake. Upgrading the water main with steel pipe will reduce its vulnerability to catastrophic failure.

Relates to Plan Goal(s) and Objectives 2B, 2D

Implementer: Thurston PUD

Estimated Cost: Estimated at $17 million

Time Period: Start the Project in 2018

Funding Source: Combination of state or federal grants and locally generated funds

Source and Date: N/A

Adopted Plan Number: TPUD-EQ-1

Reference Page: N/A

Initiative and Implementation Status: New
Priority: 10 of 11 Status: New

TPUD-WF-1: Retrofit at-risk pump houses with ignition-resistant materials and strategies. This includes installing ignition-resistant roof coverings, creating a 100-foot defensible zone, and installing ember-resilient vents that comply with strict California Building Codes. In Thurston County, there are 24 pump houses within wildfire hazard zones.

Hazard Addressed: Wildfire

Category: Critical Facilities Replacement/Retrofit

Rationale: Creating pump house environments that are fire resistant helps ensure critical water will be available to our customers and fire fighters during a wildfire.

Relates to Plan Goal(s) and Objectives: 2B, 2D, 8A

Implementer: Thurston PUD Operations

Estimated Cost: $192,000.

Time Period: Unknown.

Funding Source: Unknown.

Source and Date: Hazards Mitigation Plan for the Thurston Region, 3rd Edition, April 2017

Adopted Plan Number: TPUD-WF-1

Reference Page: N/A

Initiative and Implementation Status: New.
**Priority:** 11 of 11  

**Status:** New

**TPUD-MH-5:** Install re-transmission stations to upgrade radio capabilities. Install radios in all trucks and base stations at the main and satellite office.

**Hazard Addressed:** Multi-Hazard

**Category:** Hazard Preparedness

**Rationale:** During a disaster that knocks out “modern” forms of communications such as cell phones or email, being able to communicate will help streamline our response efforts.

**Relates to Plan Goal(s) and Objectives:** 1A

**Implementer:** Thurston PUD Operations

**Estimated Cost:** $60,197.85

**Time Period:** 2019 - 2020

**Funding Source:** Unknown.

**Source and Date:** N/A

**Adopted Plan Number:** TPUD-MH-5

**Reference Page:** N/A

**Initiative and Implementation Status:** New.