Are there really earthquakes in Oregon?
## NW Earthquake Activity

<table>
<thead>
<tr>
<th>Source</th>
<th>Magnitude</th>
<th>Frequency</th>
<th>Latest Occurrence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Crustal</td>
<td>$M &lt; 5.5$</td>
<td>Every 15–20 years</td>
<td>Annually</td>
</tr>
<tr>
<td></td>
<td>$M \geq 5.5$</td>
<td>???</td>
<td>1993: Scotts Mills &amp; Klamath-Falls</td>
</tr>
<tr>
<td>CSZ*</td>
<td>$M \geq 8.0$</td>
<td>Every 350–500 years</td>
<td>January, 1700</td>
</tr>
<tr>
<td>Intraplate</td>
<td>$M = 4–7$</td>
<td>Every 30–50 years</td>
<td>Feb., 2009 M4.1, Grants Pass, OR</td>
</tr>
</tbody>
</table>

Note: $M9.0 = 1000 \times 2014$ Napa EQ

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**Known Oregon EQ Faults**

**NW Earthquakes > M3.5 since 1965**

**Multnomah County**
Earthquakes are not the only vulnerability

System Vulnerability Assessment, 2000

• Identify the risk of system damages and failure relative to all likely hazards
• Risks considered included 38 natural and human caused hazards
• Reduced water supply due to drought not included
• Intended to evaluate facilities based on existing data and studies
• Provide a comprehensive risk reduction list of ranked or prioritized risks/measures
Earthquakes are not the only Vulnerability

System Vulnerability Assessment, 2000

- System has been subjected to significant hazard events in its 100-year history
- 1964 Watershed Floods
- November 1995 Headworks Landslide
- February 1996 Watershed turbidity
Portland Water Bureau Statistical Information

2 Dams
100+ miles of large pipe
2,300+ miles of Smaller dia. pipe
66 Tanks and Reservoirs

14,000+ hydrants
50,000+ valves
180,000 meters
41 pump stations
- Specifies likely impacts of a magnitude 9.0 Cascadia earthquake.
- Defines target states of recovery goals to be met within 50 years.
- Recommends changes in practice and policy.

Target States of Recovery (ORP)

<table>
<thead>
<tr>
<th>Desired time to restore component</th>
<th>0-24 hours</th>
<th>1-5 days</th>
<th>1-2 weeks</th>
<th>2-5 weeks</th>
<th>5-8 weeks</th>
<th>8-10 years</th>
<th>1-5 years</th>
<th>5-10 years</th>
</tr>
</thead>
<tbody>
<tr>
<td>80-90% operational</td>
<td>G</td>
<td>Y</td>
<td>R</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-60% operational</td>
<td>G</td>
<td>Y</td>
<td>R</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20-30% operational</td>
<td>G</td>
<td>Y</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Current state (90% operational)</td>
<td>G</td>
<td>Y</td>
<td>R</td>
<td>X</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Key to the Table:
- G: Desired time to restore component to 80–90% operational
- Y: Desired time to restore component to 50–60% operational
- R: Desired time to restore component to 20–30% operational
- X: Current state (90% operational)
Tasks

- Task 1 – Assess liquefaction and lateral spreading
  - Produce hazard maps to assist in PWB’s emergency response
  - Produce high-resolution data of Permanent Ground Deformation (PGD) that can be utilized in determining risk (damage)

- Task 2 – Assess & Model backbone system performance

- Task 3 – Assess distribution system performance

- Task 4 – Evaluate emergency preparedness for response and recovery

- Task 5 – Develop & prioritize mitigation measures
Improvements

- **Long Term Approach**
  - $600 M over the last 20 years
  - 50 year plan to reach Oregon Resilience Plan Goals

- **Funding**
  - Rates
  - Revenue Bonds
  - Grants
Sandy River Crossing
Sandy River Crossing
Diack’s Conduit Trestles
Diack’s Conduit Trestles
Groundwater Earthquake Reliability
Groundwater Earthquake Reliability
Earthquake Resistant Pipe
Willamette Crossing - Potential Alignment
Geologic Cross Section

- Proposed alignment beneath liquefiable soils.
- Deep enough to eliminate impact on Willamette River.
Interstate Operations Facility

1973

1925

1992

Early 1920’s

Mid 1920’s

2005

Early 1920’s
Interstate Operations Facility
Lessons Learned

- Take a long term approach.
- Start where you are.
- Take advantage of opportunities.
Questions?

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