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## Estimation of time to restore services in the Valley

- Electricity  
    1 to 3 months
- Police and Fire Stations  
    2 to 4 months
- Top Priority Highways (partial)  
    6 to 12 months
- Healthcare Facilities  
    18 months
- Water and wastewater  
    1 month to 1 year

**The Oregon Resilience Plan  
Executive Summary**  
Reducing Risk and Improving Recovery  
for the Next Cascadia Earthquake and Tsunami  
Report to the 27th Legislative Assembly  
Hazard Mitigation Working Group  
Policy Advisory Committee (OSAPAC)  
Vaino, Oregon  
February 2013

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August 1, 2016

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## Personal Lessons from 2010 Chile Earthquake

The map illustrates the global tectonic plate system. The Nazca Plate is highlighted with a red circle, and an arrow points to the Chile rise, indicating the location of the 2010 Chile earthquake. Other labeled plates include Eurasia, Pacific, North America, South America, Nazca, Australia, and Antarctic. Boundaries shown include trenches (Kuril, Japan, Mariana, New Hebrides, Kermadec-Tonga), ridges (Mid-Atlantic, Carlsberg, Pacific-Antarctic, East Pacific, Macquarie, Atlantic-Indian), and rises (Chile, South East Indian).



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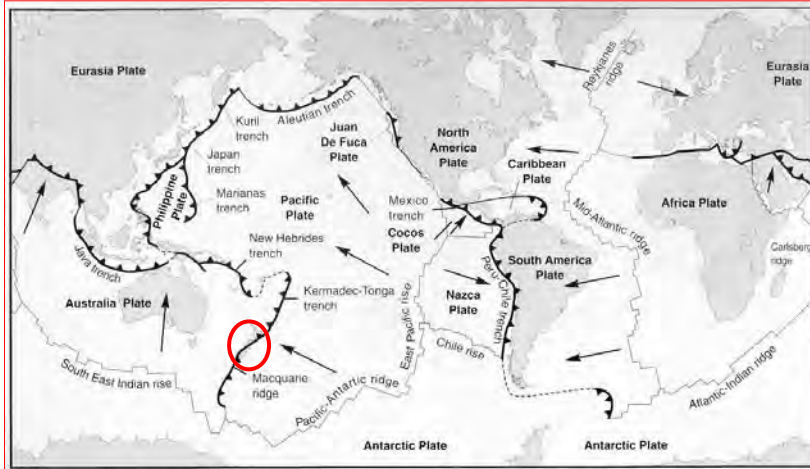
### Interviews from 2013, three years after

- Reinaldo, Rural Water Distribution
  - Biggest problem was delay in restoring electricity
    - Focus was restoration to cities, not rural communities
    - Couldn't even see a problem until power was restored
- Jose, ESSBIO
  - Need flexibility and redundancy in system
    - Add second water source at end of network
  - One week of planned effort took 3 weeks to execute
  - Soil type was critical in predicting pipe breaks
- Milo, Flood and Irrigation Control
  - Drinking water first, irrigation second, waste water third
  - Planning completed over a weekend, still two weeks to get crews out

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### 2010-2011 Christchurch Earthquakes





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### Interviews from 2013, two years after

- David, Lifelines Expert
  - Must find way to get records and equipment out of damaged buildings
  - Strong communities rebuilt must faster
  - Gravity sewers were the biggest persistent problem
- David, Local Water District
  - Years worth of repairs in 6 days
  - Hindsight, would have done more temporary fixes
    - Aftershocks and settlement resulted in too many re-repairs
- Tony, National Lifelines Program
  - Real work occurs at the regional level
  - Network redundancy is the key

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### 2011 Japan Earthquake

The map displays the global tectonic plate system. Key features include:

- Plates:** Eurasia Plate, Pacific Plate, North America Plate, South America Plate, Nazca Plate, Australia Plate, Africa Plate, and Antarctic Plate.
- Trenches:** Kuril trench, Japan trench, Aleutian trench, Mariana trench, New Hebrides trench, Kermadec-Tonga trench, and Chile rise.
- Ridges:** Mid-Atlantic ridge, Pacific-Antarctic ridge, East Pacific rise, and South East Indian rise.
- Other features:** Juan De Fuca Plate, Cocos Plate, Caribbean Plate, and the Izu Bonin and Ryukyu arcs.

The Philippine Plate is highlighted with a red circle, showing its position relative to the Pacific Plate and the Japan trench.







## Interviews from 2011 and 2013

- Local Resident, Suburb North of Tokyo
  - “They say we have water, but we don’t have sewer. If we don’t have sewer, we really don’t have water”
- Yasuko, Water/Wastewater Researcher
  - Restoration was delayed in liquefaction due to indecision
  - Insurance did not pay for temporary fixes
  - Use areal approach for distribution systems based on soil type
    - Location of shut-off valves
- Fumio, Tsunami Expert
  - 2m inundation depth is tipping point for repairs
  - Evacuation plans based on “wetted area,” less than an inch deep



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## Cascadia Lifelines Program at OSU

A targeted research consortium aimed at improving Oregon's resilience in a cost- and value-informed manner









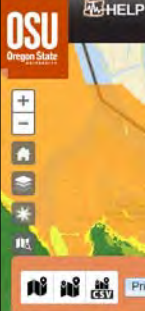
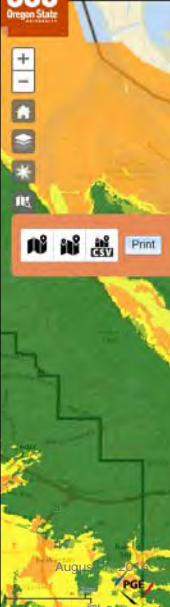








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### O-HELP HAZARD REPORT

**Section I**

Site Name:

Latitude: 45.5882

Longitude: -122.5913

Date: 7/13/2016

Comments:

Vicinity Map  
Under Development

**Section II: General site Information**

Elevation (Meter): 4.9

Slope (Degree): 0.0

NEHRP Site Class: C

Site Geologic Unit: sediments

Site Geology Description: Alluvium

Site Geology Symbol: Qal

Age of Site Geologic unit: Quaternary

Distance to nearest mapped active faults (Km): 10

**Section III: Seismic parameters -M9.0 CSZ Earthquake**

Modified Mercalli Scale: VII

Peak Ground Acceleration (g): 0.18


Peak Ground Velocity (cm/sec): 22.4

Short Period Spectral Response (g): 0.36

One Second Spectral Response (g): 0.24

**Section IV: Hazard Rating -M9.0 CSZ Earthquake**




	Unit	Very Low	Low	Medium	High	Very High
Deterministic Hazard		0				
Landslide Probability:	%	0				
Landslide Displacement:	cm	0				
Luqefaction Probability:	%			10		
Lateral Spreading:	cm				30	



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### EWEBS Legacy Power Pole Project

- Materials characterization – before loading
  - Corrosion potential
  - External damage assessment
- Materials characterization – after loading
  - Mechanical properties
  - Microstructural analysis
- Structural testing
  - Deformation response
  - Soil-structure interactions
  - Structural capacity



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### Affordable retrofit of unreinforced masonry structures project



Non-retrofitted specimen Retrofitted specimen

# Thank you!