Themes

Building Code – life safety

- City code – rules that provide life safety, protect health, address typical circumstances or hazards
- City policy – direction from City leaders, can provide resilience against unusual hazards or events
Themes

Funding Sources

- Need to move from rewarding restoration after event
- To support more resilient building practices
New Perspectives on Building Resilience into Infrastructure Systems

- Disaster Hits
- Normal Condition
- High Resilience (Chile, Japan)
- Low Resilience (Oregon, Washington)
- Improved Services
- 3 weeks to restore pre-disaster service levels
- 3 days to restore emergency services
- 3 years to improve infrastructure to a new norm
Oregon Resilience Plan (ORP)

- 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.

Deliverables

- Worked with Oregon Dept of Geology & Mineral Industries (DOGAMI) and 1000s of bore logs
- Four (4) PDF Maps along with four new ArcGIS layers in the City’s GIS mapping system
  - Liquefaction Hazard
  - Lateral Spread
  - Ground Settlement
  - Landslide Deformation
Pipeline Failures

- **TGD**
  - 1 failure every 16 miles (1 break every 80 miles and 1 leak every 20 miles)

- **PGD**
  - 12 to 16 failures each mile
Seismic Study Recommendations

- CIP Improvements
  - Supply (Conduits, Groundwater)
  - Backbone (river crossings, terminal storage)
  - Distribution (liquefaction-susceptible piping)
  - Pump Stations (seismic retrofits)
  - Storage (tank anchorage, flexible piping connections)
Seismic Study Recommendations

- Non-CIP projects
  - Pressure zone isolation plan to limit system leakage
  - Mutual aid agreements and on-call contracts
  - Additional seismic evaluation of Conduit bridges
  - Stockpile repair resources
  - Assess need for additional portable generators
  - Develop and maintain hard copy utility maps
  - Anchorage for electrical, mechanical, and communication equipment
Next Steps

- Develop an implementation plan
- Implement recommendations
  Examples:
  - Specific size and location for new pipelines
  - When to use alternate materials for small pipelines
  - How to keep backbone system in service
  - Alternatives analysis for CIP projects
- Budget for future projects
Risk-Based Decision Making for Sustainable and Resilient Infrastructure Systems

Figure 1-2. A schematic of the impact of a disaster on a regional economy, from Perry et al. (2008).
Figure 3-1. Los Angeles Water System service restorations following the 1994 Northridge earthquake (Davis et al, 2012).
Figure 4 Analysis of fire following earthquake (TCLEE, 2005)
- How to address unreinforced masonry structures in Portland