Overview of WTD's Resiliency Program

Presented to Metropolitan Water Pollution Abatement Advisory Committee

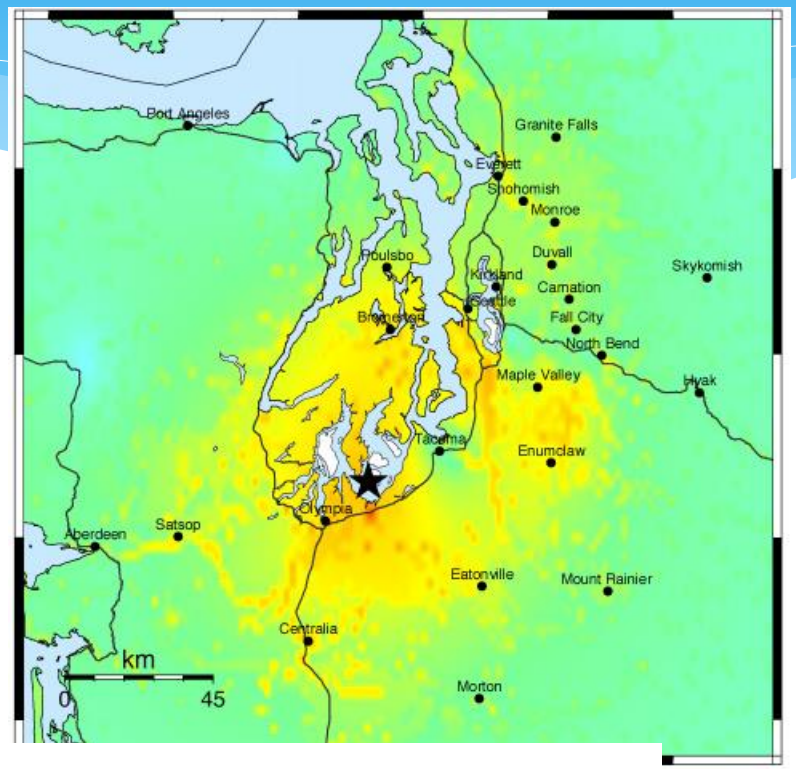
October 22, 2014

Our Region is at Risk from Three Types of Earthquakes

* Deep Quakes – like the Nisqually Quake
* Crustal Quakes – shallow quakes
* Subduction Quakes – off the coast

Nisqually was a Deep Quake

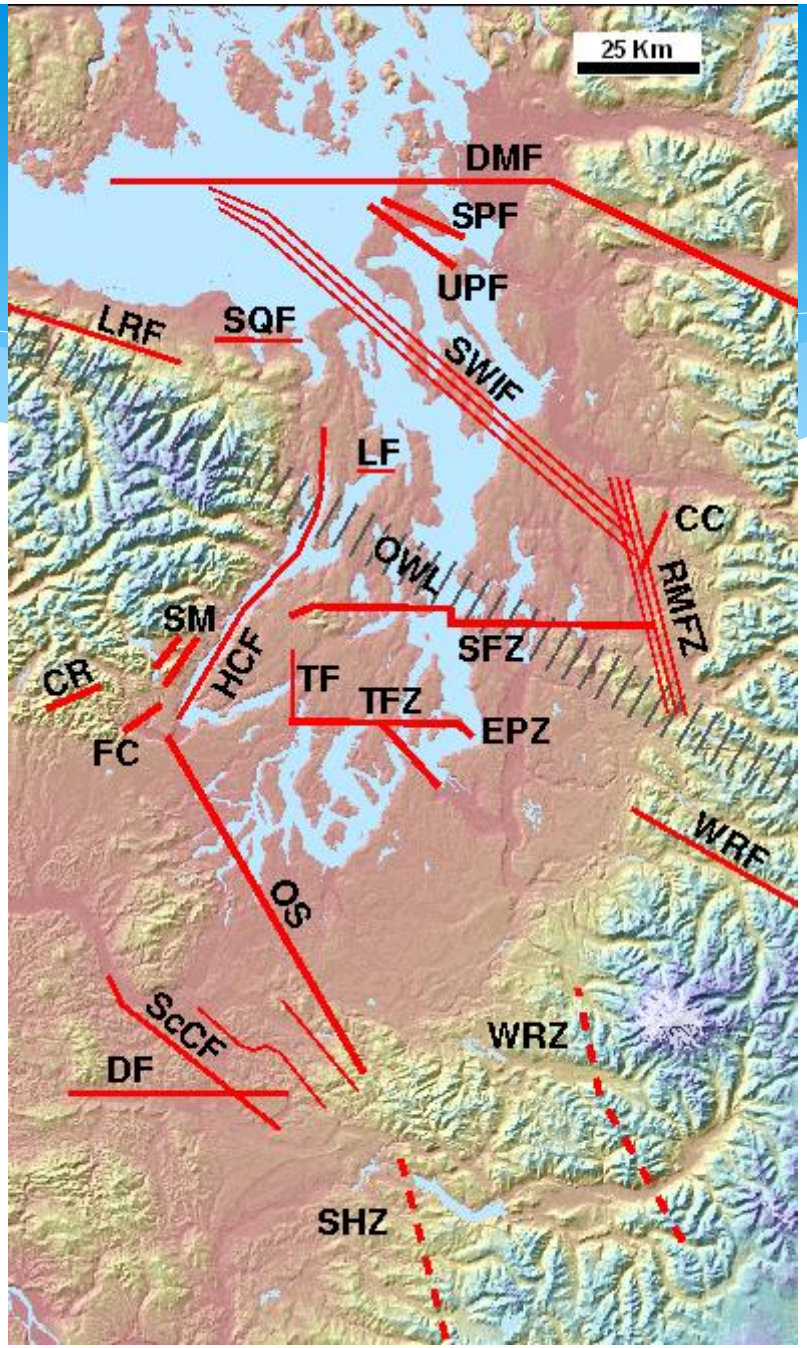
* 33 miles deep
* 6.8 on Richter Scale
* Average ground motion was < 10% of a G
* King Street Center was 20% of a G



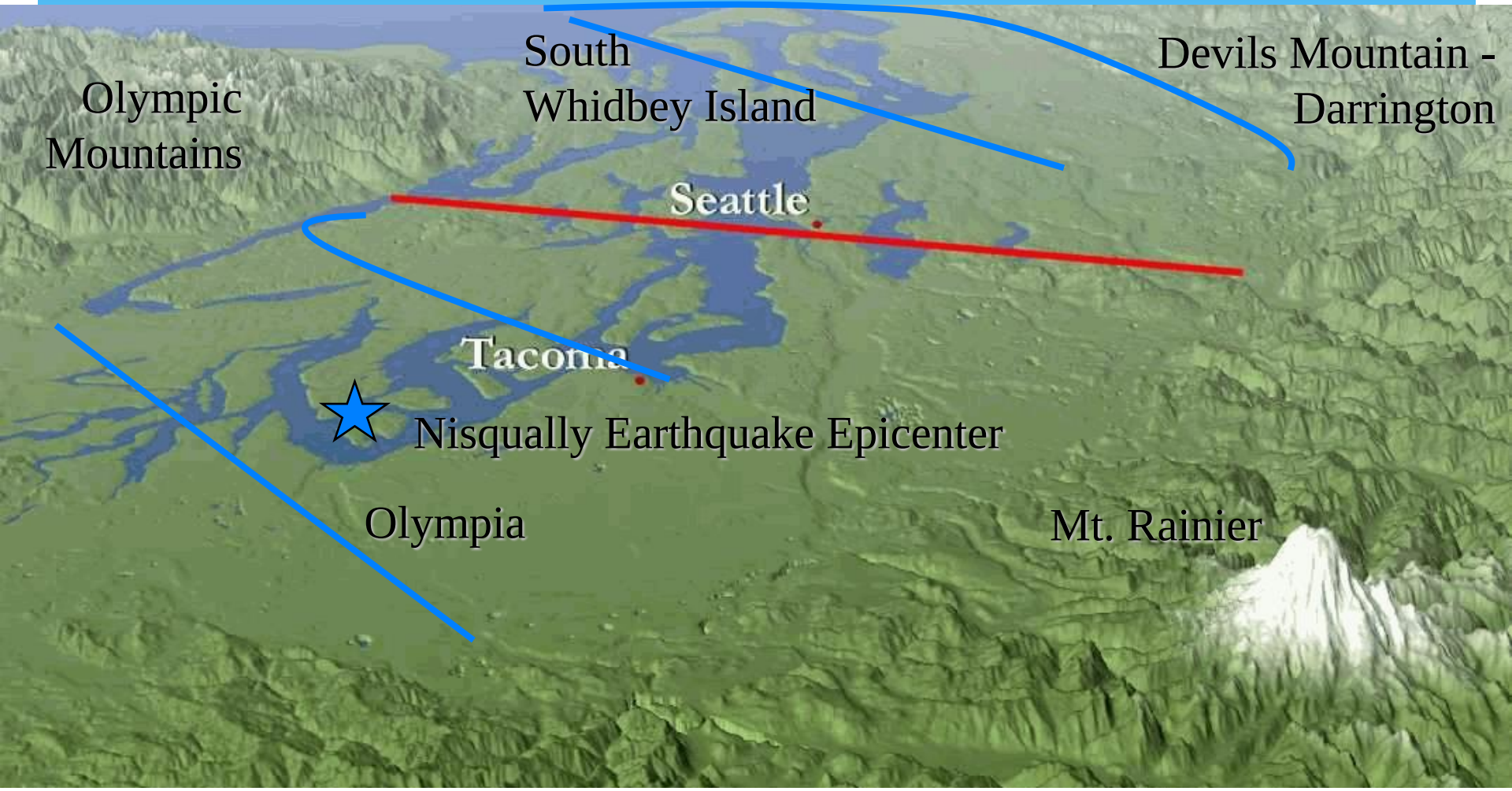
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	*<.17*	*.17-1.4*	*1.4-3.9*	*3.9-9.2*	*9.2-18*	18-34	34-65	65-124	>124
PEAK VEL. (cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	*16-31*	*31-60*	*60-116*	*>116*
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Crustal Quakes

* Greater concern
* 10-22 miles deep
* Produce much more ground motion than deep quakes
* We are surrounded by shallow faults



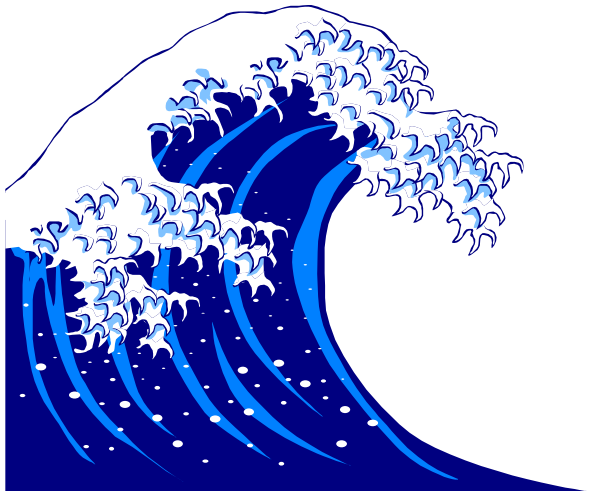
Local Faults of Concern



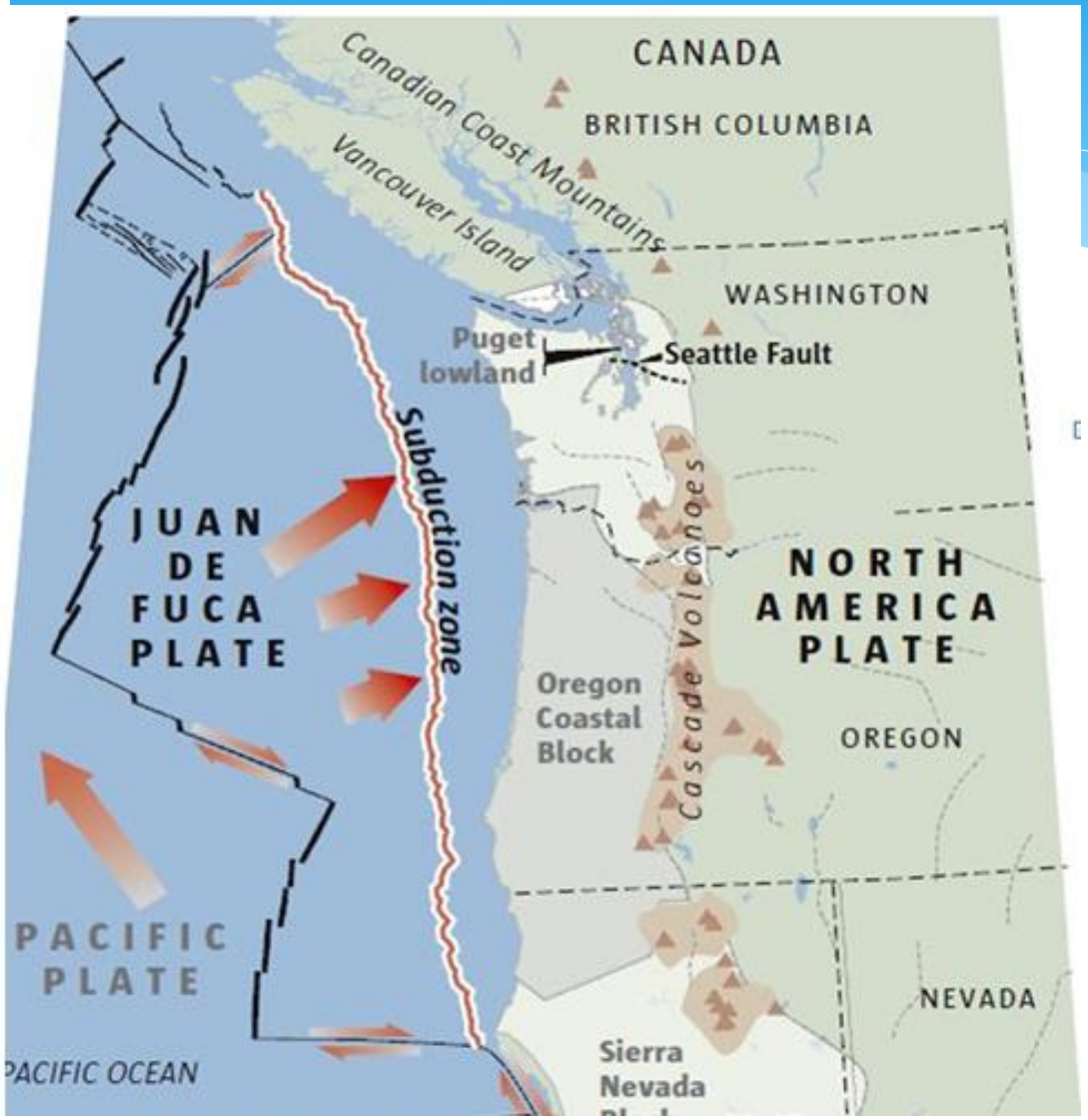
Seattle Fault

North American Subduction Zone Mega Quakes

* Alaska M9.2 1964
* Cascadia M9.0 Jan 26, 1700
* Dated by the destruction of two Japanese villages by a rogue Tsunami

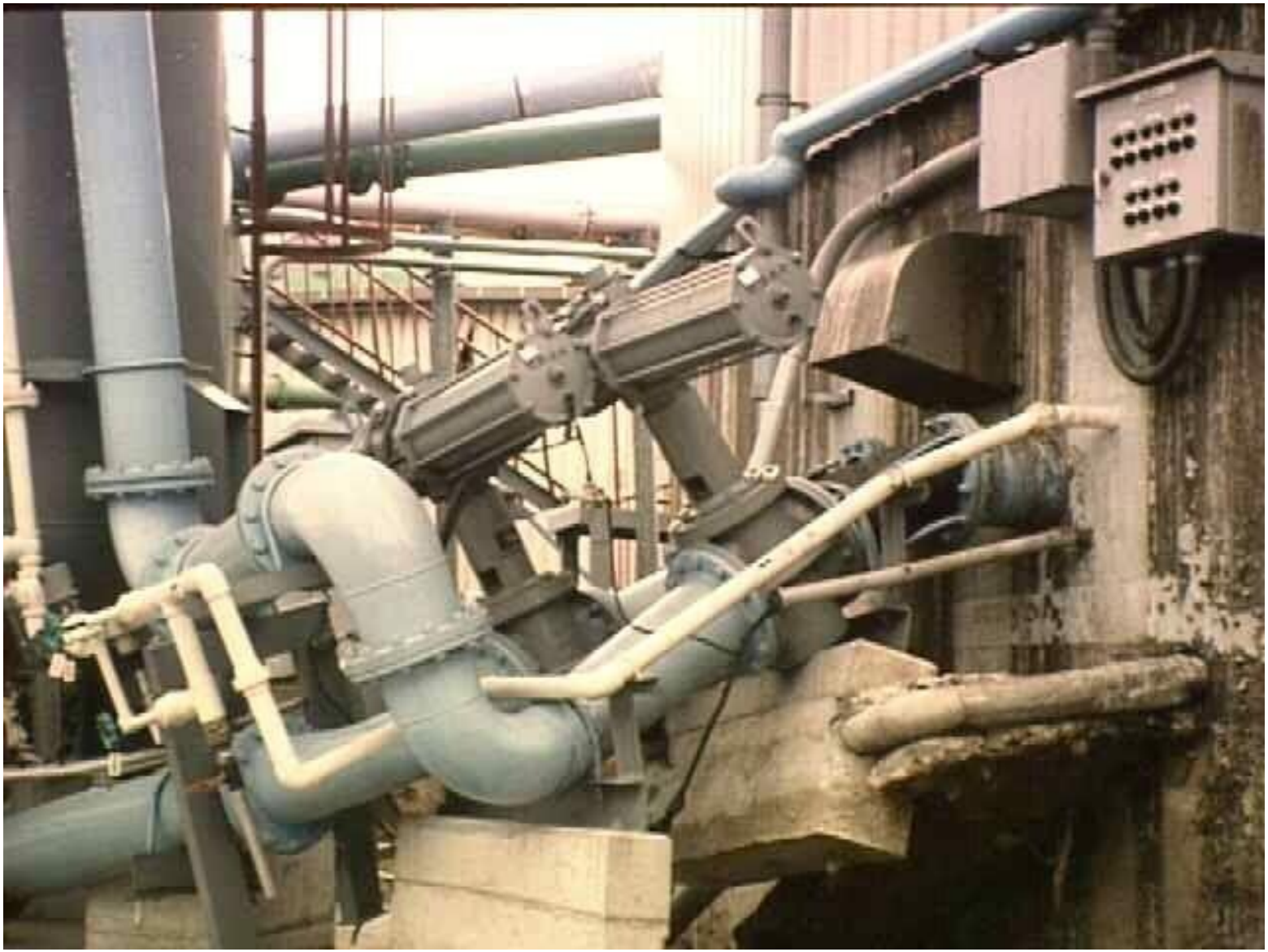


Cascadia Subduction Zone



* Vancouver Island to Northern California
* 6 minutes of shaking
* Up to 30% of G in Seattle
* Reoccurs every 200-1,000 years

This pipeline floated approx. 4-feet in Kobe, Japan

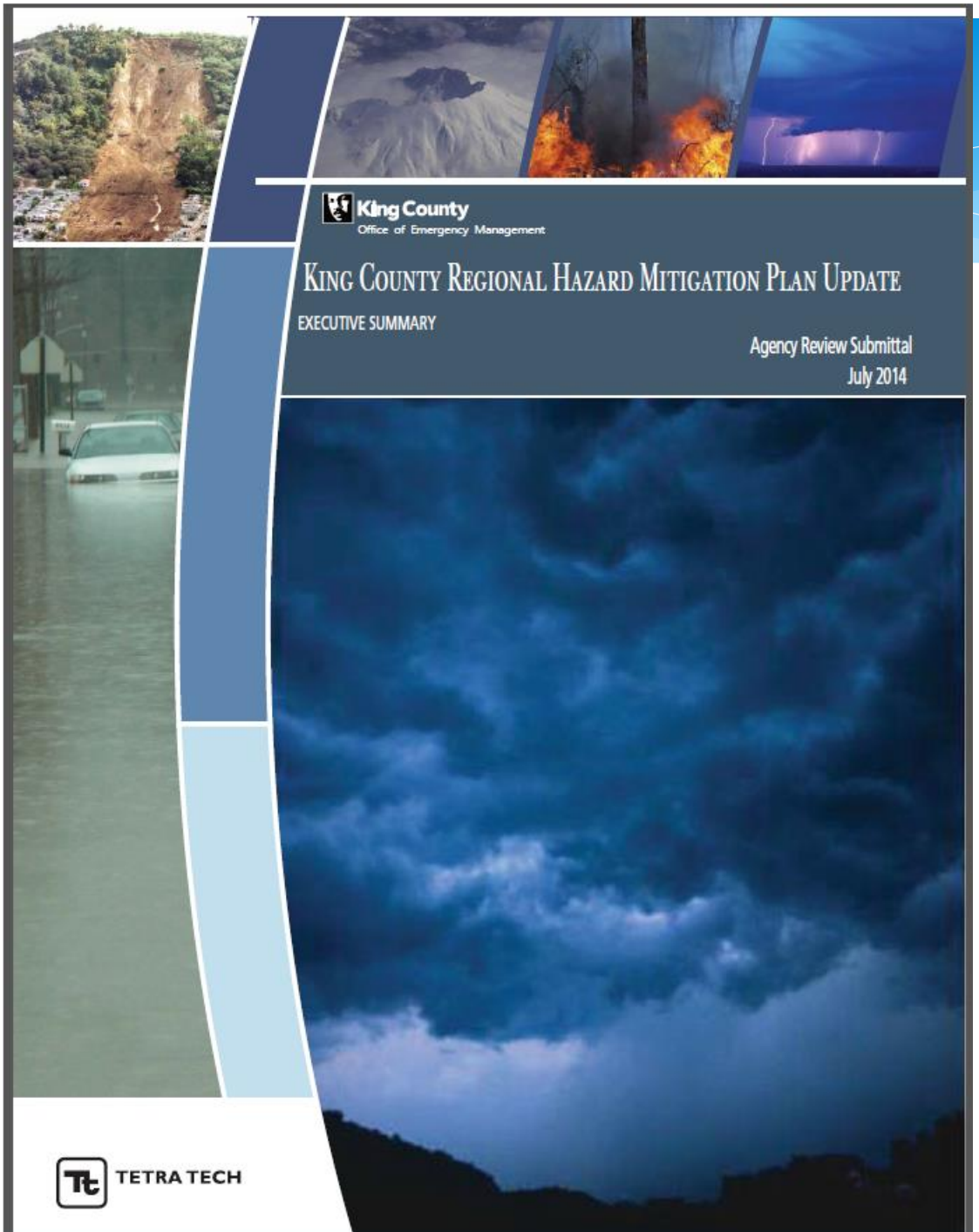


Wastewater Treatment Plant - Kobe, Japan

Kobe Sewer Performance

- Pipelines collapsed in 284 locations
- 25,000 repairs were required
- Siphons collapsed
- 4.5 km of trunk sewers damaged

King County's Hazard Mitigation Plan


King County
Office of Emergency Management
KING COUNTY REGIONAL HAZARD MITIGATION PLAN UPDATE
EXECUTIVE SUMMARY
Agency Review Submittal
July 2014
TETRA TECH

WTD Goals

* Conduct a Seismic Vulnerability Assessment; and

* Based on the findings of the Vulnerability Assessment, make modifications to existing facilities

Phased Mitigation Program Approach

* Size and inherent vulnerability of wastewater systems require close scrutiny of short-term response versus larger repairs
* Identify the backbone system to protect the community from health hazards and minimize the environmental impacts associated with raw sewage while larger repairs are underway

Inherent Seismic Vulnerabilities

Systems tend to be:

- Large & complex with numerous potential points of failure
- Highly dependent on other resources to remain operational and complete needed repairs
- Financially dependent on consistent revenue streams to fund ongoing operations & maintenance

Inherent Seismic Vulnerabilities continued

- Critical wastewater structures were designed and constructed before the adoption of current seismic design standards
- Pipeline networks include extensive use of non-ductile (inflexible) materials which tend to fail during strong ground motion
- Pipelines are especially vulnerable to joint failure from permanent ground deformation (resulting from liquefaction and landslides)

Inherent Seismic Vulnerabilities continued

- Pipelines tend to be prone to failure at connections to aboveground structures
- Breaks in water pipelines will cause collateral damage to wastewater systems
- Performance of gravity sanitation and storm sewers depends on accurate grades and slopes, which are disrupted by ground displacement
- Failures of storm sewers can contribute to localized flooding during even minor rain events, resulting in collateral damage

Steps to Improve Resiliency in Wastewater System

* Identification of the areas of concern and potential interceptor replacement materials is part of the scope of this project

* Incorporating seismic resilience objectives will be incorporated into future capital improvement projects

WTD Seismic Hazard Mitigation

Capital Projects
Objectives

* Prevention of injury or loss of life during an earthquake and in the response and recovery
* Minimization of public health risks
* Improve speed of restoration of service
* Reduction in the expected cost of recovery by reducing vulnerabilities before an event
* Long-term survivability of WTD facilities

Capital Projects
Resiliency and Recovery Program

Scope:

* Review and consolidate previous seismic vulnerability studies of our facilities and conveyance systems
* Perform a Seismic Risk Hazard Analysis
* Identify retrofits to improve the reliability and continued operation of facilities
* Develop cost estimates for retrofits
* Implement identified retrofits (highest risks first)
* Review and improve design standards to build in resilience

Capital Projects

Resiliency and Recovery Program

6-Year Capital Budget

* 2015 - $0.8M
* 2016 - $2.4M
* 2017 - $8.2M
* 2018 - $8.4M
* 2019 - $8.7M
* 2020 - $8.9M

Next Steps/Schedule

1. Conduct Vulnerability assessments
2. Modification to existing facilities (seismic retrofits)
3. Review seismic design standards

Questions?