San Francisco Public Utilities Commission Water System Improvement Program and Its Seismic Requirements

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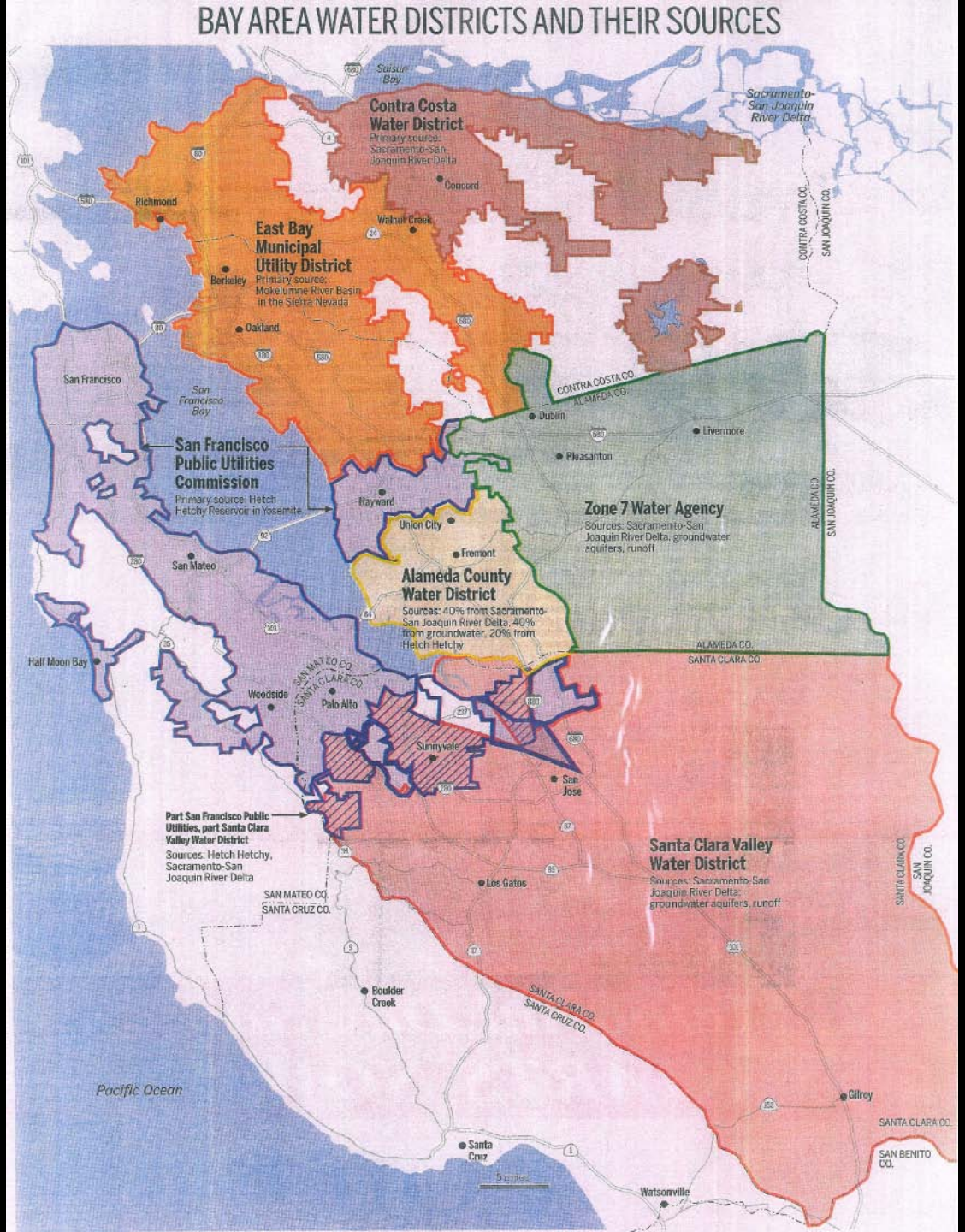
Sixth Taiwan-US-Japan Workshop on Water System Seismic Practices

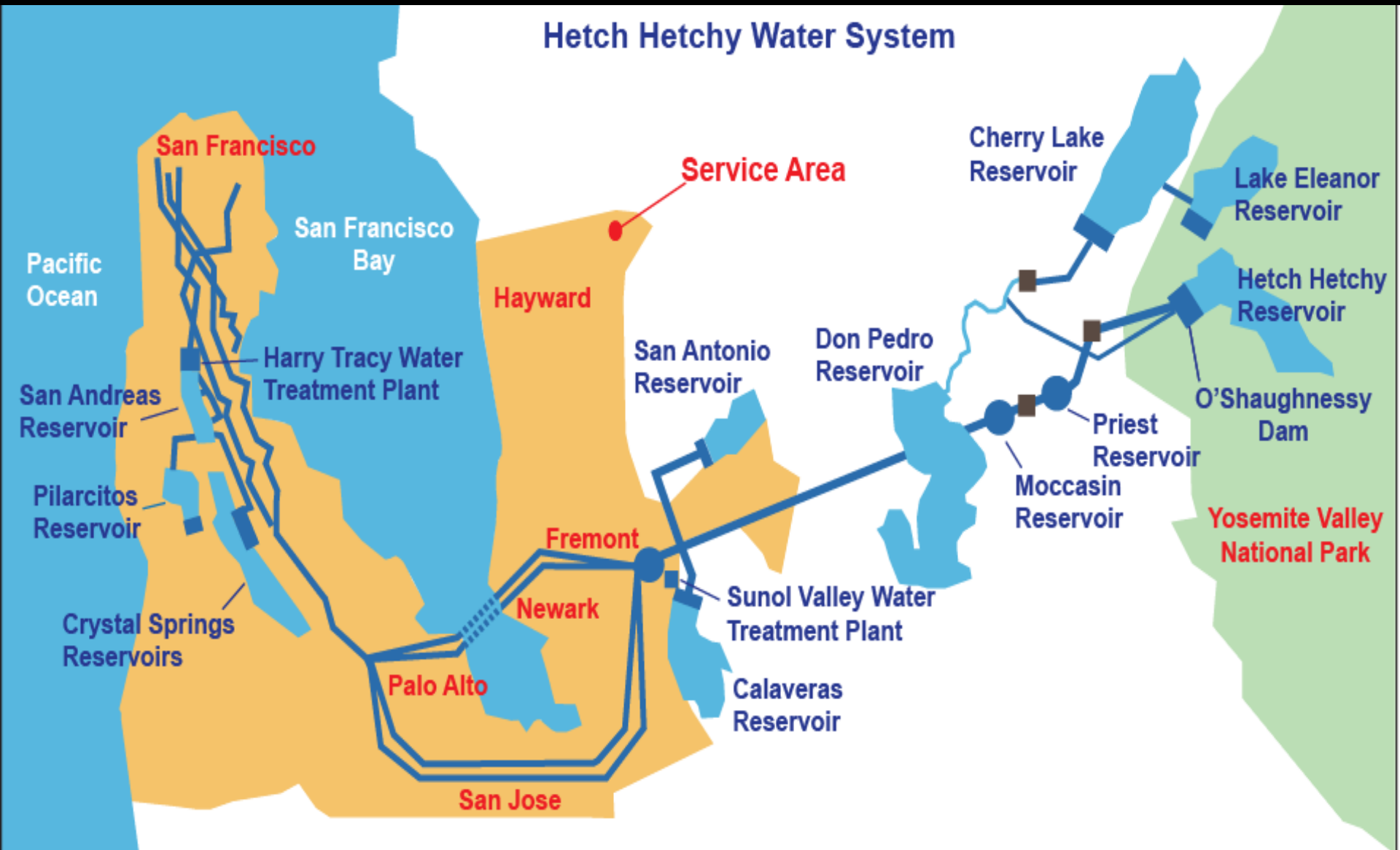
Outline

- Hetch Hetchy Water System
- Water System Improvement Program (WSIP)
- Seismic Requirements
- Current Status
- Summary

Bay Area Water Districts



SFPUC System & Service Area



Hetch Hetchy Water System

260 million gallons

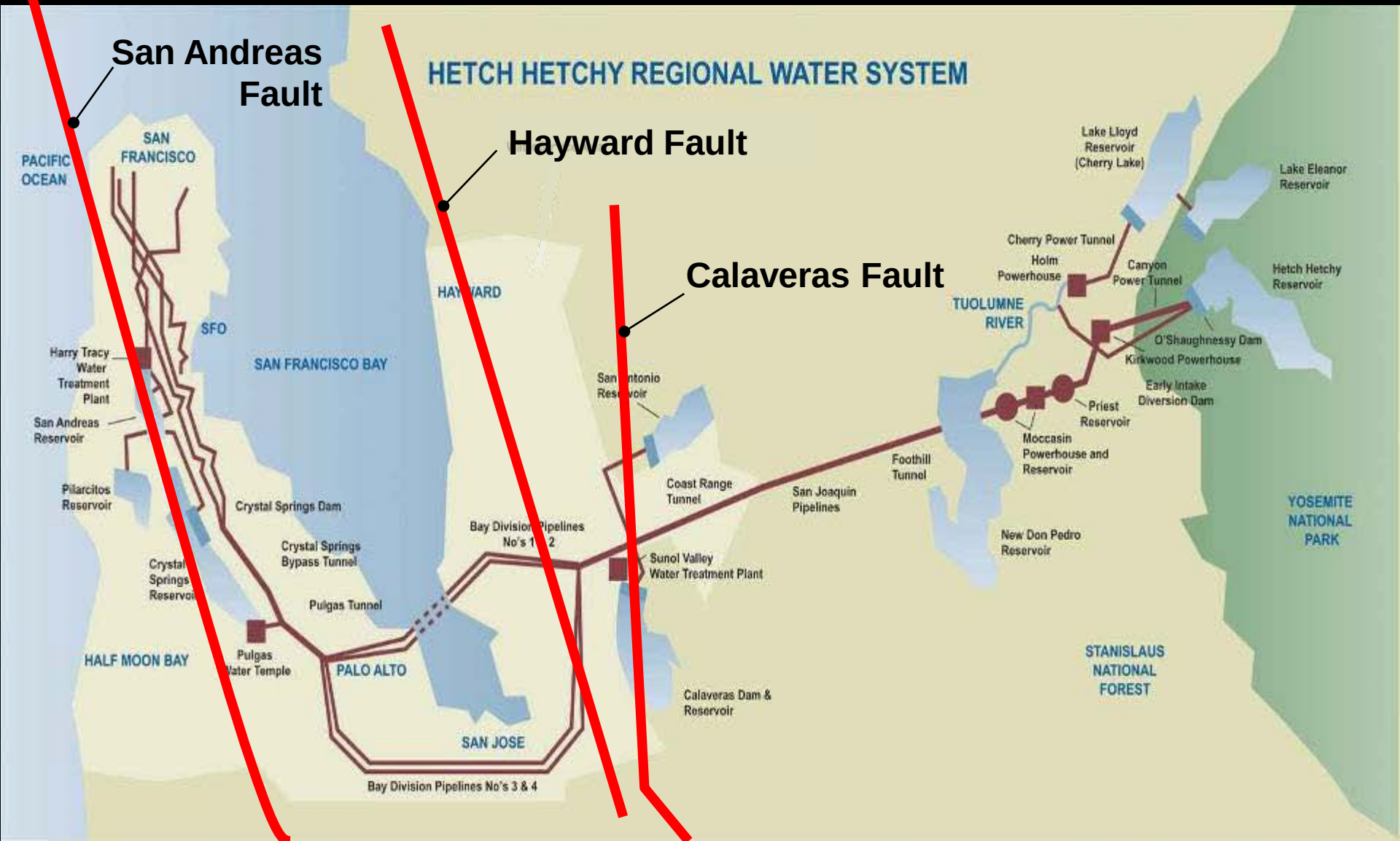
167 miles

2.6 million people

A Regional System

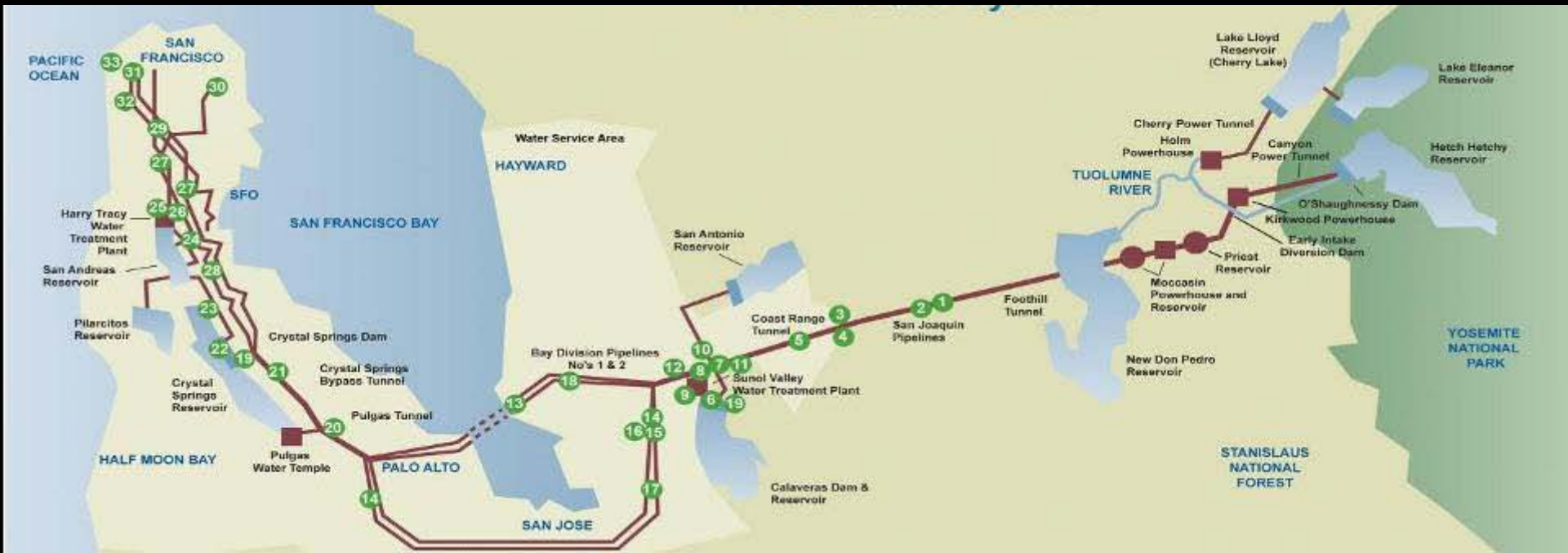
280 miles of pipelines, 60+ miles of tunnels, 11 reservoirs, 5 pump stations and 2 water treatment plants

3 Major Earthquake Faults



Water System Improvement Program

- Voter approved November 2002
- $4.4 Billion
- 80+ projects in 7 counties
- Completion late 2014



Seismic Requirements

- Goals
- Seismic Hazards
- Seismic Criteria

Delivery Goals

24 hours after major EQ

30 days after major EQ

Major EQs

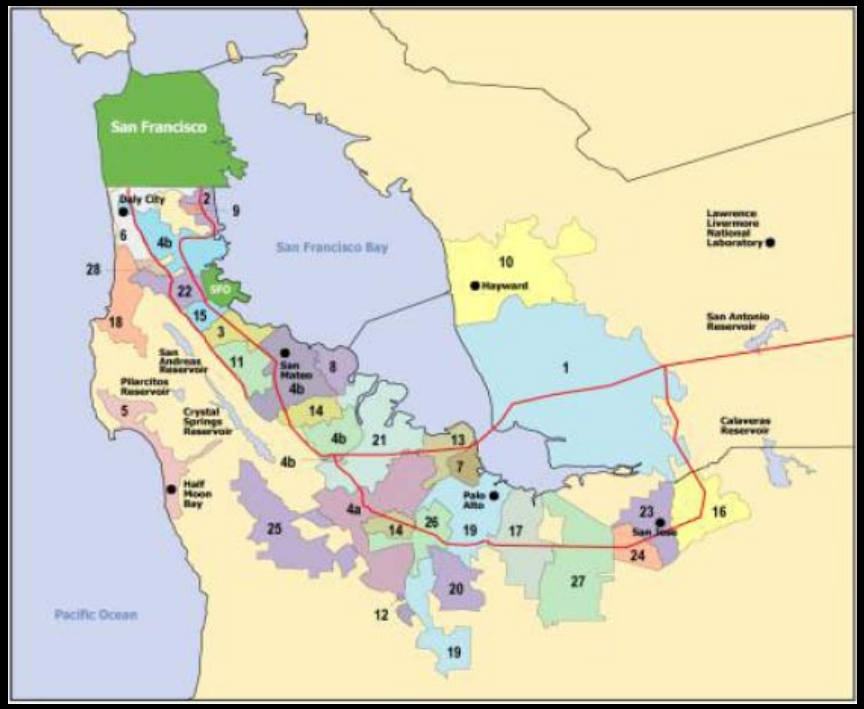
- M7.8 San Andreas
- M7.1 Hayward
- M6.8 Calaveras

Delivery Goals After a Major EQ

- Deliver 229 MGD (winter demand) within 24 hours after a major EQ
- 70% of turnouts within each customer group will receive the water
- 90% reliability

Customer Groups

- Santa Clara/Alameda/South San Mateo County
- Northern San Mateo County
- City of San Francisco



Post-EQ Recovery Goals

- Deliver 300 MGD (average day demand) within 30 days after the earthquake
- Assume resources and infrastructure are available

Seismic Hazards

- Fault Rupture
  - Magnitude
  - Locations
- Ground Motions
  - Design earthquakes
- Slope Instability
- Liquefaction

Seismic Criteria

- Buildings & Building-like Structures
- Non-building Structures
- Non-structural Elements
- Tanks
- Covered Reservoirs
- Pipelines
- Dams
- Tunnels
- Special Structures

Buildings & Building-like Structures

- International Building Code (IBC)
- California Building Code (CBC)
- ASCE/SEI-7

Non-building Structures

- International Building Code (IBC)
- California Building Code (CBC)
- ASCE/SEI-7

Non-structural Elements

- International Building Code (IBC)
- California Building Code (CBC)
- ASCE/SEI-7
- ASCE Standards, i.e. *Guide to Improved Earthquake Performance of Electric Power Systems*

Tanks

- International Building Code (IBC)
- California Building Code (CBC)
- ASCE/SEI-7
- AWWA D100

Covered Reservoirs

- International Building Code (IBC)
- California Building Code (CBC)
- ASCE/SEI-7
- ACI350 & ACI350.3

Pipelines

- ALA, *Seismic Guidelines for Water Pipelines*
- Standards/Manuals by ASCE, ASME, AWWA, API etc.

Dams

- Guidelines by
  - California Department of Water Resources' Division of Safety of Dams (DSOD)
  - United States Society of Dams (USSD)

Tunnels

- 2-D or 3-D soil-structure interaction (SSI) analysis depending on the structural layout and dimensions.
- Methods proposed by
  - Y.M.L Hashash *et al.*, 2001
  - J. Penzien, 2000
  - Jaw-Nah Wang, 1993
  - Ostadan and Penzien, 2001

Special Structures

- Reservoir Outlet Towers
  - USACE Manuals, i.e. *Structural Design and Evaluation of Outlet Works*
- Bridges
  - California Department of Transportation (Caltrans) Bridge Design Specifications

Status of WSIP Regional Projects

As of July 1, 2009

Active Phase	No. Projects
Planning	2
Design	11
Bid & Award/Construction	11
Multiple Phases	11
Closeout/Completed	10

Regional Program Performance

As of July 1, 2009

	All Improvements	
Project Phase	Percent Planned	Percent Actual
All Phases	16.7%	16.6%
Planning	97.3%	96.4%
Design	75.8%	74.6%
Construction	6.1%	6.2%
Close-Out	23.4%	21.8%

Summary

- SFPUC WSIP is one of the largest water infrastructure programs in the US.
- The Program's seismic requirements incorporate the latest seismic codes and standards.
- As of July 2009, overall, program performance is very close to as planned.

Thank You