



## East Bay Municipal Utility District: Seismic Improvement Program

### Full Mitigation Best Practice Story

#### *Multiple Counties, California*



**East Bay, CA** - The East Bay Municipal Utility District (EBMUD) provides water service to 1.2 million people along the east side of San Francisco Bay. Three major, active faults create a high seismic risk to EBMUD's water supply facilities. The Hayward Fault, which bisects the service area, poses the greatest threat of a major earthquake within 30 years and is one of the most active faults in the State of California.

Following the Loma Prieta Earthquake in 1989, EBMUD performed an in-depth evaluation of the seismic vulnerability of its water treatment plants, reservoirs, buildings, pipelines, tunnels, pumping plants and communication facilities. Using state-of-the-art computer models, damage estimates were made and post earthquake system performance was studied.

The results showed that in the event of a magnitude 7 earthquake on the Hayward Fault, 63% of their customers would be out of water, one-third of the reservoirs and two-thirds of the pumping plants would be out of service, 5,500 pipes could break, and four out of six water treatment plants would be out of service. It would take approximately six months to restore partial service, and the costs to repair damage to facilities were estimated at \$245 million dollars.

The EBMUD Board of Directors decided to take action in 1994 by approving an aggressive, ten-year, \$189 million capital improvement program to minimize damage to the water system, improve fire-fighting capability, and protect customers from long, disruptive water outages following a catastrophic seismic event. The Seismic Improvement Program (SIP) reduces long term risks to EBMUD facilities, people, property owners and the local economy. The four goals of the SIP are: (1) Life Safety -- to minimize the loss of life due to failure of any EBMUD structure; (2) Water Quality and Public Health -- to ensure that all water introduced into the treatment system is fully treated; (3) Fire Service -- to enable water availability in all areas, especially high fire danger zones; and (4) Customer Service -- restore minimum water service to 70% of customers within 10 days.

The SIP is now finishing its fourth year of implementation. During the next 6 years, the individual facility upgrades will continue, and three large projects within the SIP will begin design. EBMUD uses the latest seismic strengthening techniques to retrofit structures cost effectively. To date, the District has completed seismic upgrades for 21 reservoirs. EBMUD has installed shut-off valves and emergency hose connections at nine locations where water mains that cross earthquake faults are particularly vulnerable. These upgrades will either prevent pipe rupture or provide a bypass system to reroute water around broken pipes to protect life safety and property, and to preserve the water supply for post-earthquake uses, including fighting fires.

The Building and Structural Upgrades Subprogram seismically retrofits EBMUD buildings to meet life safety performance goals. Upgrades to 5 of 6 water treatment plants are complete and ensure they will be available and functioning after a seismic event. The Environmental Impact Report for the Southern Loop Pipeline project has been certified. This is an 11-mile proposed pipeline system to enable the District to meet its service restoration goal should pipelines and tunnels be damaged. In addition, EBMUD started preparing for the retrofit of the Claremont Tunnel, which was constructed in the 1920s to deliver water. Strengthening this tunnel will secure a water supply for 50% of the District's customers.

The District also educates the public about seismic risks in the Bay Area, and maintains public support for the SIP with an extensive community outreach program. The District has been internationally recognized for application of new technologies and actively participating in international technology exchange in the field of seismic mitigation.

The avoided losses due to fire, economic costs to rebuild the District system, lost revenue and economic impacts to businesses in the region, and inundation losses amount to \$1.2 billion. SIP capital costs amount to \$189 million, resulting in a cost-effectiveness ratio of 6 to 1.

EBMUD has reached out to the community to solicit input prior to program implementation. It routinely conducts outreach during project implementation for the SIP, which has resulted in the strong support of the public and local elected officials.

Additionally, the SIP Team has partnered with other agencies and state and local Offices of Emergency Services to develop a single message on how to store emergency water supplies.

EBMUD won the Partners in Preparedness Award from the International Emergency Managers Association for developing the "Waterlines are Lifelines" brochure and video.

#### Activity/Project Location

Geographical Area: **Multiple Counties in a State**

FEMA Region: **Region IX**

State: **California**

County: **Alameda County; Contra Costa County**

#### Key Activity/Project Information

Sector: **Public**

Hazard Type: **Earthquake**

Activity/Project Type: **Retrofitting, Non-structural; Education/Outreach/Public Awareness**

Activity/Project Start Date: **07/1995**

Activity/Project End Date: **Ongoing**

Funding Source: **Local Sources**

Funding Recipient: **Lifelines - Water/Sewer**

Funding Recipient Name: **EBMUD**

#### Activity/Project Economic Analysis

Cost: **\$189,000,000.00 (Estimated)**

#### Activity/Project Disaster Information

Mitigation Resulted From Federal  
Disaster? **Unknown**

Value Tested By Disaster? **Unknown**

Repetitive Loss Property? **No**

#### Reference URLs

Reference URL 1: **<http://www.ebmud.com>**

Reference URL 2: **<http://neic.usgs.gov/>**

## Main Points

- Following the Loma Prieta Earthquake in 1989, EBMUD performed an in-depth evaluation of the seismic vulnerability of its water treatment plants, reservoirs, buildings, pipelines, tunnels, pumping plants and communication facilities.
- Results of the evaluation showed that a moderate seismic event would severely impact service delivery, approximately six months to restore partial service, and the costs to repair damage to facilities were estimated at \$245 million dollars.
- An aggressive multi-million dollar Seismic Improvement Plan was developed and implemented over 10 years.
- The avoided losses due to fire, economic costs to rebuild the District system, lost revenue and economic impacts to businesses in the region, and inundation losses amount to \$1.2 billion. SIP capital costs amount to \$189 million, resulting in a cost-effectiveness ratio of 6 to 1.
- EBMUD won the Partners in Preparedness Award from the International Emergency Managers Association for developing the "Waterlines are Lifelines" brochure and video.