

Incident Action Checklist – Earthquake

The actions in this checklist are divided up into three “rip & run” sections and are examples of activities that water and wastewater utilities can take to: prepare for, respond to and recover from an earthquake. For on-the-go convenience, you can also populate the “My Contacts” section with critical information that your utility may need during an incident.

Earthquake Impacts on Water and Wastewater Utilities

An earthquake is caused by the shifting of tectonic plates beneath the Earth’s surface. Ground shaking from moving geologic plates collapses buildings and bridges, and sometimes triggers landslides, avalanches, flash floods, fires and tsunamis. The strong ground motion of earthquakes has the potential to cause a great deal of damage to drinking water and wastewater utilities, particularly since most utility components are constructed from inflexible materials (e.g., concrete, metal pipes). Earthquakes create many cascading and secondary impacts that may include, but are not limited to:

- Structural damage to facility infrastructure and equipment
- Water tank damage or collapse
- Water source transmission line realignment or damage
- Damage to distribution lines due to shifting ground and soil liquefaction, resulting in potential water loss, water service interruptions, low pressure, contamination and sinkholes and/or large pools of water throughout the service area
- Loss of power and communication infrastructure
- Restricted access to facilities due to debris and damage to roadways



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The following sections outline actions water and wastewater utilities can take to prepare for, respond to and recover from an earthquake.

Example of Water Sector Impacts and Response to an Earthquake

East Bay Municipal Utility District Mitigates Earthquake Impacts

Following the 1989 Loma Prieta earthquake, the East Bay Municipal Utility District (EBMUD) in Oakland, California, began developing a comprehensive seismic program to increase their ability to recover from earthquake impacts and reduce water and wastewater service interruptions. Taking a proactive approach, EBMUD was the first US water utility to comprehensively retrofit its service area facilities to address seismic weaknesses.

The utility began by assessing its entire water distribution network to determine areas of improvement. Upgrades included installation of flexible joints and hoses to minimize pipe ruptures and to facilitate rerouting of water around broken pipes. The utility also created alternative transmission routes for pipes that cross fault zones.

EBMUD did a great deal of work to reinforce aqueducts to make them more resilient to earthquake impacts, including strengthening levees at aqueduct crossings and pipe foundations at river crossings, reinforcing pipe joints on buried portions of pipe, and strengthening pipe support structures on elevated portions of the aqueduct. The utility is also designing aqueduct interconnections to create bypasses around damaged segments after a levee failure or earthquake. These bypasses allow the utility to continue providing service to customers while permanent repairs are being made.

Since 1989, EBMUD has invested more than \$350 million in their seismic program, which has been primarily funded by bonds that are being repaid through a seismic surcharge on customers’ water bill of just over one dollar per month for single-family residential homes.

Source: EBMUD’s 2011 “Earthquake Readiness: Protecting Life Safety and Public Health.”

My Contacts and Resources



CONTACT NAME	UTILITY/ORGANIZATION NAME	PHONE NUMBER
	Local EMA	
	State EMA	
	State Primacy Agency	
	WARN Chair	
	Power Utility	

Planning

- Incident monitoring:
 - [USGS recent earthquake activity map](#) (U.S. Geological Survey [USGS])
 - [NOAA National Weather Service tsunami alerts](#) (National Oceanic and Atmospheric Administration [NOAA])
- [Earthquake Hazard Mitigation Handbook](#) (Federal Emergency Management Agency [FEMA])
- [Earthquake Hazards Program](#) (USGS)
- [Earthquake Shaking Maps and Information for California Residents](#) (Association of Bay Area Governments)
- [Recent Earthquakes: Implications for U.S. Water Utilities](#) (Water Research Foundation)
- [Planning for an Emergency Drinking Water Supply](#) (EPA)
- [All-Hazard Consequence Management Planning for the Water Sector](#) (Water Sector Emergency Response Critical Infrastructure Partnership Advisory Council [CIPAC] Workgroup)
- [Vulnerability Self Assessment Tool \(VSAT\)](#) (EPA)
- [Tabletop Exercise Tool for Water Systems: Emergency Preparedness, Response, and Climate Resiliency](#) (EPA)
- [How to Develop a Multi-Year Training and Exercise \(T&E\) Plan](#) (EPA)
- [Make a Plan](#) (FEMA)

Coordination

- [Water/Wastewater Agency Response Network \(WARN\)](#) (EPA)
- [Community Based Water Resiliency](#) (EPA)

Facility and Service Area

- [Oregon Earthquake Resiliency Plan](#) (see Chapter 8: Water and Wastewater Systems) (Oregon Seismic Safety Policy Advisory Commission)
- [Seismic Guidelines for Water Pipelines](#) (American Lifelines Alliance)

Power, Energy and Fuel

- [EPA Region 1 Water/Wastewater System Generator Preparedness Brochure](#) (EPA)

Documentation and Reporting

- [Federal Funding for Utilities In National Disasters \(Fed FUNDS\)](#) (EPA)

Mitigation

- [Earthquake Publications: Building Designers, Managers and Regulators](#) (FEMA)
- [IS-323: Earthquake Mitigation Basics for Mitigation Staff](#) (FEMA)
- [HAZUS: FEMA's Methodology for Estimating Potential Losses from Disasters](#) (FEMA)
- [Earthquake Hazard Mitigation for Utility Lifeline Systems](#) (FEMA)

Actions to Prepare for an Earthquake



Planning

- Review and update your utility's emergency response plan (ERP), and ensure all emergency contacts are current.
- Conduct briefings, training and exercises to ensure utility staff is aware of all preparedness, response and recovery procedures.
- Identify priority water customers (e.g., hospitals), obtain their contact information, map their locations and develop a plan to restore those customers first.
- Develop an emergency drinking water supply plan and establish contacts (potentially through your local emergency management agency [EMA] or mutual aid network) to discuss procedures, which may include bulk water hauling, mobile treatment units or temporary supply lines, as well as storage and distribution.
- Conduct a hazard vulnerability analysis in which you review historical records to understand the past frequency and intensity of earthquakes and how your utility may have been impacted. Consider taking actions to mitigate seismic impacts to the utility, including those provided in the "Actions to Recover from an Earthquake: Mitigation" section.
- Complete pre-disaster activities to help apply for federal disaster funding (e.g., contact state/local officials with connections to funding, set up a system to document damage and costs, take photographs of the facility for comparison to post-damage photographs).

Coordination

- Join your state's Water/Wastewater Agency Response Network (WARN) or other local mutual aid network.

- Coordinate with WARN members and other neighboring utilities to discuss:
 - Outlining response activities, roles and responsibilities and mutual aid procedures (e.g., how to request and offer assistance)
 - Conducting joint tabletop or full-scale exercises
 - Obtaining resources and assistance, such as equipment, personnel, technical support or water
 - Establishing interconnections between systems and agreements with necessary approvals to activate this alternate source. Equipment, pumping rates and demand on the water sources need to be considered and addressed in the design and operations
 - Establishing communication protocols and equipment to reduce misunderstandings during the incident
- Coordinate with other key response partners, such as your local EMA, to discuss:
 - How restoring system operations may have higher priority than establishing an alternative water source
 - Potential points of distribution for the delivery of emergency water supply (e.g., bottled water) to the public, as well as who is responsible for distributing the water
- Understand how the local and utility emergency operations center (EOC) will be activated and what your utility may be called on to do, as well as how local emergency responders and the local EOC can support your utility during a response. If your utility has assets outside of the county EMA's jurisdiction, consider coordination or preparedness efforts that should be done in those areas.
- Ensure credentials to allow access will be valid during an incident by checking with local law enforcement.

Actions to Prepare for an Earthquake *(continued)*



Communication with Customers

- Develop outreach materials to provide your customers with information they will need after an earthquake (e.g., clarification about water advisories, instructions for private well and septic system maintenance and information about earthquake mitigation).
- Review public information protocols with local EMA and public health/primacy agencies. These protocols should include developing water advisory messages (e.g., boil water) and distributing them to customers using appropriate mechanisms, such as reverse 911.

Facility and Service Area

- Inventory and order extra equipment and supplies, as needed:
 - Motors
 - Fuses
 - Chemicals (ensure at least a two week supply)
 - Cellular phones or other wireless communications device
 - Emergency Supplies
 - Tarps/tape/rope
 - Cots/blankets
 - First aid kits
 - Foul weather gear
 - Plywood
 - Flashlights/flares
 - Sandbags (often, sand must be ordered as well)
 - Bottled water
 - Batteries
 - Non-perishable food

- Ensure communication equipment (e.g., radios, satellite phones) works and is fully charged.
- Develop a GIS map of all system components and prepare a list of coordinates for each facility.
- Document pumping requirements and storage capabilities, as well as critical treatment components and parameters.
- Establish a seismically hardened or offsite facility to store essential records and equipment.
- Inspect utility for structural stability and consider implementing actions to improve the utility's ability to withstand damage from earthquakes, such as:
 - Secure fixtures, shelves and equipment
 - Anchor or stabilize utility equipment to withstand earthquake forces and movements
 - Reinforce, secure or improve utility transmission lines and connections to withstand earthquake forces, soil movements and differential settlements
 - Anchor or improve tank structures to withstand earthquake forces and movements

Personnel

- Identify essential personnel and ensure they are trained to perform critical duties in an emergency (and possibly without communication), including the shut down and start up of the system.
- Establish communication procedures with essential and non-essential personnel. Ensure all personnel are familiar with emergency evacuation and shelter in place procedures.
- Pre-identify emergency operations and clean-up crews. Establish alternative transportation strategies if roads are impassable.

Actions to Prepare for an Earthquake *(continued)*



- Consider how evacuations or limited staffing due to transportation issues (potentially all utility personnel) will impact your response procedures.
- Identify possible staging areas for mutual aid crews if needed in the response, and the availability of local facilities to house the crews.
- Encourage personnel, especially those that may be on duty for extended periods of time, to develop family emergency plans.

Power, Energy and Fuel

- Evaluate condition of electrical panels to accept generators; inspect connections and switches.
- Document power requirements of the facility; options for doing this may include:
 - Placing a request with the US Army Corps of Engineers 249th Engineer Battalion (Prime Power): <http://www.usace.army.mil/249thEngineerBattalion.aspx>
 - Using the US Army Corps of Engineers on-line Emergency Power Facility Assessment Tool (EPFAT): <http://epfat.swf.usace.army.mil/>

- Confirm and document generator connection type, capacity load and fuel consumption. Test regularly, exercise under load and service backup generators.
- Contact fuel vendors and inform them of estimated fuel volumes needed if utility is impacted. Determine your ability to establish emergency contract provisions with vendors and your ability to transport fuel if re-fueling contractors are not available. Develop a backup fueling plan and a prioritization list of which generators to fuel in case of a fuel shortage.
- Collaborate with your local power provider and EOC to ensure that your water utility is on the critical facilities list for priority electrical power restoration, generators and emergency fuel.



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Notes:

Actions to Respond to an Earthquake



Planning

- For coastal communities with an increased risk for tsunami activity following an earthquake; review the Tsunami Incident Action Checklist for more information.

Coordination

- Notify your local EMA and state regulatory/primacy agency of system status.
- If needed, request or offer assistance (e.g., water buffalos, water sampling teams, generators) through mutual aid networks, such as WARN.
- Assign a representative of the utility to the incident command post or the community's EOC.

Communication with Customers

- Notify customers of any water advisories and consider collaborating with local media (television, radio, newspaper, etc.) to distribute the message. If emergency water is being supplied, provide information on the distribution locations.

Facility and Service Area

Overall

- Conduct damage assessments of the utility to prioritize repairs and other actions.

- Check that back-up equipment and facility systems, such as controls and pumps, are in working order, and ensure that chemical containers and feeders are intact.

Drinking Water Utilities

- Inspect the utility and service area for damage. Identify facility components (e.g., valve boxes) and fire hydrants that have been buried, are inaccessible or have been destroyed.
- Investigate drinking water wells for damage caused by liquefaction. This could result in the loss of storage for groundwater or ground subsidence.
- Ensure pressure is maintained throughout the system and isolate those sections where it is not.
- Isolate and control leaks in water transmission and distribution piping.
- Turn off water meters at destroyed homes and buildings.
- Monitor water quality, develop a sampling plan and adjust treatment as necessary.
- Notify regulatory/primacy agency if operations and/or water quality or quantity are affected.
- Utilize pre-established emergency connections or setup temporary connections to nearby communities, as needed. Alternatively, implement plans to draw emergency water from pre-determined tanks or hydrants. Notify employees of the activated sites.

Notes:



Wastewater Utilities

- Inspect the utility and service area, including lift stations, for damage, downed trees, and power availability. Inspect the sewer system for debris and assess the operational status of the mechanical bar screen. If necessary, run system in manual operation.
- Notify regulatory/primacy agency of any changes to the operations or required testing parameters.

Documentation and Reporting

- Document all damage assessments, mutual aid requests, emergency repair work, equipment used, purchases made, staff hours worked and contractors used during the response to assist in requesting reimbursement and applying for federal disaster funds. When possible, take photographs of damage at each work site (with time and date stamp). Proper documentation is critical to requesting reimbursement.
- Work with your local EMA on the required paperwork for public assistance requests.

Personnel

- Account for all personnel and provide emergency care, if needed. Caution personnel about known hazards resulting from earthquakes.
- Deploy emergency operations and clean-up crews (e.g., securing heavy equipment). Identify key access points and roads for employees to enter the utility and critical infrastructure; coordinate the need for debris clearance with local emergency management or prioritize it for employee operations.

Power, Energy and Fuel

- Use backup generators, as needed, to supply power to system components.
- Monitor and plan for additional fuel needs in advance; coordinate fuel deliveries to the generators.
- Maintain contact with electric provider for power outage duration estimates.

Notes:

Actions to Recover from an Earthquake



Coordination

- Continue work with response partners to obtain funding, equipment, etc.

Communication with Customers

- Assign a utility representative to continue to communicate with customers concerning a timeline for recovery and other pertinent information.

Facility and Service Area

- Complete damage assessments.
- Complete permanent repairs, replace depleted supplies and return to normal service.



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Documentation and Reporting

- Compile damage assessment forms and cost documentation into a single report to facilitate the sharing of information and the completion of state and federal funding applications. Visit EPA's web-based tool, Federal Funding for Utilities—Water/Wastewater—in National Disasters (Fed FUNDS), for tailored information and application forms for various federal disaster funding programs: <http://water.epa.gov/infrastructure/watersecurity/funding/fedfunds/>
- Develop a lessons learned document and/or an after action report to keep a record of your response activities. Update your vulnerability assessment, ERP and contingency plans.
- Revise budget and asset management plans to address increased costs from response-related activities.

Mitigation

- Identify mitigation and long-term adaptation measures that can prevent damage and increase utility resilience. Consider impacts related to earthquakes when planning for system upgrades (e.g., replacing pipes, wellheads and water tanks to address seismic weaknesses).

Notes: