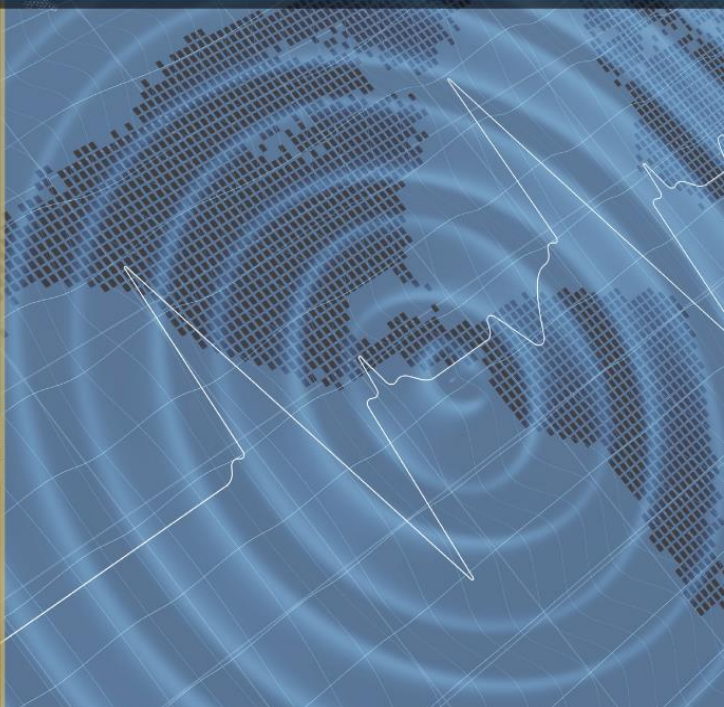




EARTHQUAKE WARNING CALIFORNIA LEGISLATIVE REPORT



EEW Legislative Report

REQUIREMENT

On or before March 1, 2023, Cal OES shall submit a report to the budget committees of the Legislature, the Assembly Committee on Emergency Management, the Senate Committee on Governmental Organization, Joint Emergency Management Committee, and the Legislative Analyst's Office that includes the following information:

- a. The steps taken to date to identify non-General Fund sources and investments in support of the California Earthquake Early Warning System.
- b. The potential fund sources and investments that have been or are being considered, including, but not limited to, federal funds and investments derived from entities potentially benefiting from the system.
- c. For each fund source identified in (b), the report shall detail:
 1. The potential level of funds available from the fund source.
 2. The potential benefits and challenges with obtaining funds from the source.
 3. The steps that have been or will be taken, if any, to obtain funds from the source.
 4. Any steps that must be taken by entities other than the Governor's Office of Emergency Service to obtain funds from the fund source.
 5. If the fund source is not considered viable, the justification for that conclusion.

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INTRODUCTION

California's unique landscape makes it prone to many natural hazards that could threaten people, property, economy, and the environment. California experiences over 100 earthquakes every day. With over 15,700 identified faults and over 200 considered very dangerous based on their slip rates in recent geological time (the last 10,000 years), California is at significant risk of a devastating earthquake. In addition, more than 70 percent of the state's 40 million people reside within 30 miles of a known fault where strong ground shaking could occur at any time.

Earthquakes represent the state's most destructive source of hazard, risk, and vulnerability, both in terms of history and the probability of future high impact events. The California Governor's Office of Emergency Services (Cal OES) addresses this through earthquake planning, preparedness, and mitigation, including the California Earthquake Early Warning System (CEEWS).

As the designated lead agency for CEEWS, pursuant to Government Code section 8587.8, Cal OES has engaged with key partners and stakeholders, including the California Geological Survey (CGS), the University of California (UC), the California Institute of Technology (CalTech), the United States Geological Survey (USGS), and the Seismic Safety Commission (SSC), to build out a comprehensive network of seismic stations across the state. The California EEW System uses state-of-the-art ground motion sensors, rapid data transmittal through redundant telemetry pathways, and a variety of alerting methods to deliver warnings to people and industry before the strongest shaking arrives.

Recent strong earthquakes around the Bay Area and along the coast in Northern California have successfully demonstrated CEEWS. More than 5.5 million people received Earthquake Early Warning (EEW) notifications through smartphones during the last four (4) major earthquake events¹. Feedback from EEW recipients indicate that many had crucial seconds of warning before strong shaking began to take protective actions.

For more information about CEEWS, visit www.CalOES.ca.gov².

¹ Santa Rosa – Magnitude 4.4 which occurred September 13, 2022, at approx. 6:39pm.
San Jose – Magnitude 5.1 which occurred October 25, 2022, at approx. 11:42am.
Ferndale – Magnitude 6.4 which occurred December 20, 2022, at approx. 2:34am.
Tres Pinos – Magnitude 4.4 which occurred April 4, 2023, at approx. 3:23pm.

² <https://www.caloes.ca.gov/office-of-the-director/operations/planning-preparedness-prevention/seismic-hazards/california-earthquake-early-warning-program/>, see Business Plan located under the "Finance" section.

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INVESTMENT IN EARTHQUAKE EARLY WARNING

Steps Taken to Realize EEW in California

The Loma Prieta Earthquake (1989) provided an opportunity to advance seismic monitoring as most seismic technology in northern California at the time was outdated. The seismic network lacked the ability to continue operating during local power disruption. Communication links and power failed at several sites, resulting in loss of data and information to assist emergency response operators. There was a need for more advancement in seismic research to develop early warning technology that could deliver mass alerts to the public, ensure critical sectors could remain operational, and prevent damage due to secondary impacts.

In 2000, the California Integrated Seismic Network (CISN) was established when CGS, CalTech, the UC, USGS, and Cal OES signed a Memorandum of Agreement to merge disparate efforts and form a single hub “for earthquake monitoring, research, archiving, and distribution of information for the benefit of public safety, emergency response, and loss mitigation.”³ Senate Bill 135 (Padilla, Chapter 342, Statutes of 2013) built on those efforts and required Cal OES to develop a comprehensive statewide EEW system through its public-private partnership with the CISN.

Senate Bill 438 (Hill, Chapter 803, Statutes of 2016) established the EEW Advisory Board under Cal OES with membership representing various critical sectors, including natural resources, health and human services, transportation, education, utilities, and business. The board advises Cal OES on implementation and system advancements through operations, research and development, finance and investment, and training and education. This breadth of support and partnership leverages multiple disciplines, groups, and individuals with expertise in how EEW can best be leveraged in California to improve earthquake safety.

In 2019, on the 30th anniversary of the Loma Prieta earthquake, Governor Newsom, announced the launch of the nation's first operational EEW system and the MyShake EEW mobile application, developed by UC Berkeley and available for free to all Californians.

³ <https://www.cisn.org/pages/about.html>

State Investment Background

In past years, CEEWS had been funded through one-time state General Fund appropriations. Beginning with an initial \$10 million in 2016-17, funds were allocated to contract for sensor installation, social science research, education and outreach efforts, and research to improve telemetry and mass alert distribution. Funds of varying amounts were received every year, except for 2017-18 because operation and maintenance funds were not yet needed. For 2020-21, Cal OES received a loan of \$17.3 million to the California Earthquake Safety Fund from the California School Land Bank Fund to support the California EEW System until a continuous funding stream could be established. In 2022-23 permanent state funding for EEW was approved and enacted into the state budget. CEEWS now receives ongoing funding to support the continued operation of the system, as well as education and outreach and research and development projects.

To leverage California's investment in EEW, Cal OES successfully advocated to amend Section 404 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) through the Disaster Recovery Reform Act (DRRA) of 2018. DRRA Section 1233 also added Section 404(g) to the Stafford Act, allowing recipients of federal hazard mitigation assistance to apply for funding to support building capability for EEW systems. Eligible activities include regional seismic networks, geodetic networks, and seismometers, Global Positioning System receivers, and associated infrastructure.

Cal OES has also secured investments in EEW through partnerships, including Bay Area Rapid Transit (BART) and Pacific Gas and Electric (PG&E). Since 2017, BART has incorporated EEW in its train operations and PG&E is among the first energy companies in California to begin investing in EEW technologies by implementing automated actions in various facilities, including the installation of hardware on elevators of their original downtown San Francisco headquarters to provide immediate elevator recall to the nearest floor when a warning is received.

In 2020, Cal OES partnered with Google to incorporate EEW technology into the Android operating system. EEW technology is now automatically included in Android phones, a major force multiplier for cell phone alerts that compliments the state MyShake app. This partnership greatly increased the number of end users receiving early earthquake warnings.

Non-State Investments

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A portion of the CEEWS annual spending plan goes to station build-out, maintenance, and operations conducted through its CISN partners. Those investments are amplified by other source funds contributed by these partners for personnel, equipment, public outreach, education, research into new and improved methods of detection, telemetry, and alert delivery technologies, and lastly, program administration.

In the **transportation sector**, BART uses EEW to slow and stop trains throughout the BART system. The Los Angeles Metropolitan Transit Authority (LA Metro) automated the delivery of alerts to public address systems in their Rail Operations Center in Watts and 25 additional Metro buildings, rail yards, and maintenance facilities throughout their service area. Southern California Regional Rail Authority (Metrolink) developed the Commuter Railway Seismic Interface (CRSI) which integrates EEW with Metrolink's Positive Train Control (PTC) system to deliver alerts to a Metrolink train crew and to slow and stop trains along seven segments of its passenger rail lines.

Also, with support from a grant from the City of Los Angeles, Los Angeles World Airports (LAWA) is investigating the possibility of automatically shutting down the LAX fuel hydrant system to help to prevent jet fuel from flowing during an anticipated earthquake and the automatic alerting of passengers in terminals.

In the **utilities sector**, PG&E EEW pilot programs include installing ground sensor stations at select PG&E Bay Area facilities to provide audio alerts to employees when a quake has occurred, and shaking is imminent and desktop alerts to employees connected to PG&E's intranet.

PG&E is exploring feasibility of integrating EEW with its Supervisory Control and Data Acquisition (SCADA) network to actuate electric switches and gas valves to de-energize susceptible electric lines and depressurize gas lines that may be in harm's way.

In **telecommunications**, Google partnered with Cal OES and USGS in 2020 to deliver earthquake early warnings via the Android Earthquake Alerts System. Since it launched, Android has delivered more than 15M+ alerts. A global team of engineers and designers is working to continually update and improve the alerting algorithms and systems to better protect users.

In the **healthcare sector**, EEW alerts are being delivered to public address systems at Cedars Sinai Hospital in Los Angeles.

In the **education sector**, schools have automated public address systems to instruct students to Drop, Cover, and Hold On, and implemented sirens, at [Santa Monica College](#), [Biola University](#), [Polytechnic School](#) in Pasadena, schools in the [Porterville School District](#), [the Lindsay Unified School District](#), and in the [Los Angeles Unified School District](#).

In the **public safety sector**, EEW automations alert firefighter personnel and automatically open firehouse doors and turn off gas appliances at the [Menlo Park Fire District](#) and [Los Angeles Fire Station 51 at Universal Studios](#).

Local governments are using grant funds and existing budgets to protect their communities with lifesaving EEW technology. For example:

- **San Diego County** has integrated EEW into its emergency alerts app.
- The **City of Hermosa Beach** is incorporating an EEW siren system along with a corresponding public education program into its public safety toolchest.
- Automated alerts are delivered by PA systems in public buildings such as at **Los Angeles City Hall**.

All the above represent investments in the system that are independent but coordinated within the state funds.

POTENTIAL FUNDING SOURCES EXPLORED/UTILIZED

In addition to state funding allocated to the program annually and the non-state investments discussed above, this section describes additional non-General Fund sources explored to support the development of CEEWS.

Federal Hazard Mitigation Assistance

The Federal Emergency Management Agency's (FEMA) Hazard Mitigation Assistance (HMA) Grants Program includes the Section 404 Hazard Mitigation Grant Program (HMGP) and the Building Resilient Infrastructure and Communities (BRIC) Program.

Potential level of funds available. HMGP helps to rebuild communities in a way that mitigates future disaster losses by reducing potential damage and increasing understanding of potential hazard vulnerability and threats. HMGP is granted to states and tribes following a Presidentially Declared Disaster. States

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such as California, which have an Enhanced State Hazard Mitigation Plan, receive 20 percent of the eligible costs of damage for HMGP. Due to the number of and severity of Presidentially Declared Disasters in recent years, California receives millions of HMGP dollars to invest in risk reduction, including earthquakes. BRIC is distributing up to \$2.295 billion nationally to fund hazard mitigation projects and reduce the risks communities face from disasters. In the first few years of the BRIC program, California has received on average 25 percent of the total national competitive funds for each year; more than any other state. In the FY2021 BRIC program, there were 53 projects selected for “further review” totaling \$795.9 million in federal share. Of those, nine belonged to California for a total of \$180.2 million.

Potential benefits and challenges with obtaining funds. Per the Disaster Recovery Reform Act, FEMA will now consider proposals to fund the purchase and installation of seismometers, Global Positioning System (GPS) receivers, and the associated infrastructure (i.e., telemetry and signal processing) to enhance capability of existing EEW systems that are part of the Advanced National Seismic System (ANSS). The Bipartisan Infrastructure Bill increased the award ceiling and overall funding for BRIC. A traditional benefit-cost analysis is not needed for projects that build additional EEW capability through BRIC and HMGP.

There are some limitations associated with HMGP and BRIC. Under the DRRR Section 1233, FEMA will not fund operations or maintenance costs for support of a network or EEW system operations. Also, these funds do not cover ongoing maintenance or subscription fees past the initial cost. Private sector owns and operates most critical infrastructure but is ineligible to apply for BRIC and HMGP funds. This limits use of federal funds for projects where EEW could be most beneficial. Lastly, applicants for FEMA funds must have the resources to provide the non-FEMA cost share.

Steps that have been or will be taken, if any, to obtain funds. Within Cal OES, staff supporting CEEWS are working closely with Hazard Mitigation fund managers to support the implementation of EEW across critical sectors in California and identify eligible projects. This includes assessing locations of high seismic risk, location of community lifelines, areas of social vulnerability, high population density, and disadvantaged communities, as well as economic factors that would lend to successful applications.

Steps that must be taken by entities other than Cal OES to obtain funds. Eligible applicants must submit their project applications to Cal OES HMA for inclusion in [Earthquake Early Warning Legislative Report](#)

the State's HMGP and BRIC applications. Some HMGP projects have been submitted and approved for EEW. One example is a \$454,558 project that will fund the installation of an automated EEW system within Long Beach schools and the City of Long Beach's water treatment facility.

Cal OES is currently working with BART on a potential application to improve their existing EEW operations.

USGS Annual EEW Budget Allocation

Although it is not an open funding source, USGS supports the California EEW System through their direct investments in EEW. USGS receives an annual budget allocation for ShakeAlert (the signal that generates EEW). USGS investment is primarily for research, development, central operations, and administration of the three-state system. USGS funds both the Pacific Northwest Seismic Network (PNSN) and the CISEN. USGS spends approximately two-thirds of their EEW allocation in California, because two-thirds of the EEW sensor network is located here. In FFY2021, USGS contributed \$17.5 million to EEW in California.

The USGS contribution to CEEWS roughly doubles the financial investment annually and leverages staff and expertise. Also, USGS and Cal OES collaborate on EEW spending plans to maximize the joint contributions. However, there are also some challenges associated with the USGS investment. There is a three-state system, so USGS policies and administration tend to be a "one size fits all." Also, states do not have visibility on the ShakeAlert License to Operate (LTO) process whereby commercial vendors, private businesses, and public services can apply to create ShakeAlert powered products or receive the ShakeAlert signal. Cal OES is embarking on a pilot project to "shadow" an entity going through the LTO process.

Non-viable Funding Sources

Cal OES has researched the following federal fund sources but found EEW to be an ineligible use or the fund source is too small to support EEW projects.

National Earthquake Hazards Reduction Program (NEHRP) and FEMA Individual State Earthquake Assistance (ISEA)

The FEMA NEHRP Earthquake State Assistance Grant Program was created to increase and enhance the effective implementation of earthquake risk

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reduction at the local level, prioritizing goals that improve understanding of earthquake processes and impacts; develop cost-effective measures to reduce earthquake impacts on individuals, the built environment, and society-at-large; and improve the earthquake resilience of communities nationwide.

NEHRP ISEA distributes funds to mitigate earthquake losses through basic and directed research and implementation activities in the fields of earthquake science and engineering. It also supports the establishment of earthquake hazards reduction programming and the implementation of earthquake safety, mitigation, and resilience activities at the state and local level.

These funds are not viable as they do not cover the cost of EEW systems and equipment or construction and renovation costs. Additionally, the small amount of funding available to California is not conducive to most EEW projects. However, as NEHRP supports the establishment of earthquake hazards reduction programming and the implementation of earthquake safety, mitigation, and resilience activities at the state and local level, the program is already being leveraged, when possible, for education and outreach for earthquake early warning.

CONCLUSION

With the near completion of the seismic station buildout, Cal OES is actively implementing EEW projects that will reduce earthquake risks. Current focus includes integration and adoption of automated actions in communities, local and state agencies, and private-sectors and industries. Where possible, Cal OES will seek federal grant funding for these projects.

Cal OES recognizes that the private sector and industry serve as key partners in earthquake preparedness, response, and long-term recovery. As a major effort in 2023, Cal OES is leveraging its existing connections in these sectors and the EEW Advisory Board to secure new investments in EEW.

Based on the strong foundation established by the state, private entities will continue to contribute to the system via many types of investments. Whether it be automated alerts to the general public, critical infrastructure and systems controls, or rapid resumption of public services, EEW in California is a first in the nation new tool to protect people, communities, and the economy from the impacts of earthquakes.

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