

**CALIFORNIA EARTHQUAKE EARLY WARNING SYSTEM**

*Project*

# **CHARTER**

**For the Development of an Implementation Plan**

**February 21, 2014**

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# Charter

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*California Earthquake Early Warning System*  
**Charter**

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# Charter

## I. PURPOSE

This document shall serve as a blueprint for developing an implementation plan for a California Earthquake Early Warning System (CEEWS).

California state law (Government Code Section 8587.8) states that the California Governor's Office of Emergency Services (Cal OES) will, in collaboration with the California Institute of Technology (CalTech), the California Geological Survey (CGS), the University of California, the United States Geological Survey (USGS), the Alfred E. Alquist Seismic Safety Commission (CSSC), and other stakeholders, develop a comprehensive statewide earthquake early warning system in California through a public private partnership. In addition, Cal OES will identify funding sources for the earthquake early warning system which do not specify the state General Fund as a funding source.

## II. SCOPE

The Implementation Plan for a CEEWS will describe how the system will be developed, a time frame for implementation, an organization and management structure that clearly defines roles and responsibilities of public and private sector entities, conforms to performance standards that assure timeliness and accuracy of alerts, identifies and addresses user needs for training and education to effectively utilize alerts and provides a feasible and broadly consensual model for funding and maintaining the system.

The broader context in which an early warning system will operate is in extending the existing real-time seismic information stream into a new realm, the few seconds to tens of seconds after the nucleation of an earthquake and prior to the actual arrival of strong motion from a large potentially damaging earthquake. Advances in scientific understanding of earthquakes and technological developments have resulted in the capacity to rapidly analyze earthquakes, small and large and provide a suite of products that are vital to emergency management especially in situational assessment and awareness early in an earthquake emergency.

Existing real-time seismic information products include time, location and magnitude of all earthquakes in California in a time frame of 10-30 seconds. Ground motion parameters from the California Integrated Seismic Network (CISN) are automatically analyzed to produce a ground shaking map (ShakeMap) within 5-8 minutes after the occurrence of an earthquake and loss estimates from the Prompt Assessment of Global Earthquakes for Response and other software like *ShakeCast* use earthquake source data to predict casualties, damage and potential economic disruption.

To these existing seismic information products, earthquake early warning offers a critical time window to implement life safety responses and trigger automated mitigation measures in many institutional sectors. The implementation Plan that will

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be articulated at the end of this project will constitute a detailed pathway to secure the goal of improving public safety and reducing the damage caused by large California earthquakes.

## A. Development Phases

The project conceptualized in this document is part of a six phase process:

1. Form a Collaborative Planning Team
2. Understand the Situation
3. Draft Goals and Objectives
4. Develop an Implementation Plan and Identify Funding
5. Approve and Socialize the Plan
6. Implement and Evaluate the Plan

### Phase I: Form a Collaborative Planning Team

This phase was initiated in January of 2013, when Cal OES Director Mark S. Ghilarducci convened a working group comprised of public and private sector stakeholders in the development and operation of an earthquake early warning system that could be implemented for California.

During the meetings, which took place between March and July of 2013, many aspects of earthquake early warning were discussed including possible roles to be played by government agencies and private sector organizations, how the system would be organized and managed, how users would come to understand how to use early warnings and the costs associated with a start-up and for ongoing maintenance and operations.

During this same period, California State Senator Alex Padilla introduced Senate Bill 135 mandating that an earthquake early warning system for California be implemented as a public/private partnership and tasked Cal OES, in collaboration with several institutional stakeholders in further articulating the details of a system and identifying funding sources that do not include the state's General Fund. The bill passed and was signed by the Governor as California Government Code 8587.8.

The working group subsequently endorsed a set of recommendations that are consistent with the government code mandate.

1. **Recommendation 1:** The state shall develop an early warning model that represents a public/private partnership, and a cost effective and reliable system.
2. **Recommendation 2:** The state shall formalize an early warning organization structure that incorporates existing roles and responsibilities, such as the CISN.

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3. **Recommendation 3:** The state shall have an approval mechanism to ensure appropriateness of early warning standards, how they apply to various early warning components, compliance and participation criteria.
4. **Recommendation 4:** Cal OES shall convene a group of subject experts and stakeholders to develop and implement California's early warning education and training.
5. **Recommendation 5:** Cal OES will develop a distributed funding model.

## **Phase 2: Understand the Situation**

In this phase, the stakeholders begin work to develop a system description that clearly defines the project scope, intent, desired capabilities, interoperability and constraints. Each stakeholder has a vision of what the system should resemble. It is incumbent upon the representatives to achieve consensus on the system description, so that objectives can be developed, tasks can be defined, funding estimates can be generated, approval can be obtained, personnel and resources can be allocated and the project can begin.

## **Phase 3: Draft Goals and Objectives**

The goal of this charter is to develop an Implementation Plan for development of an earthquake early warning system for California that conforms to the mandate of California Government Code Section 8587.8. In order to meet the intent of the government code, the previously-established working group recommendations shall now be defined as objectives to be achieved during system development and implementation.

Based upon the mandate of Government Code Section 8587.8, this charter incorporates working group recommendations as objectives to be achieved as part of an implementation plan.

## **Phase 4: Develop an Implementation Plan and Identify Funding**

Cal OES will carry out the mandate of the legislation by convening the committees necessary to achieve charter objectives, develop an implementation plan and identify funding sources to address the CEEWS.

The product of these committees as assembled by the Project Managers will be a well-articulated and detailed document that describes an earthquake early warning system for California that meets the mandate of California Government Code 8587.8, that is, a comprehensive plan for the an operational earthquake early warning system that is a public/private partnership, with organizational responsibilities and management structure clearly articulated, that includes a

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well-articulated education and training program, conforms to the highest scientific and technical standards of performance and has a rational and feasible funding strategy that is independent of the state General Fund.

The committees will be comprised of public and private stakeholders and subject matter experts as deemed appropriate by the Project Managers.

1. **CEEWS Implementation Steering Committee:** Review and provide advice on the progress of the other project committees as they work toward meeting the objectives. The Steering Committee will be comprised of the chairs of the five committees and chaired by an executive level member of Cal OES.
2. **Stakeholder Liaison Group:** Provide information regarding the development of the CEEWS to external stakeholders and potential users of an earthquake early warning system during CEEWS development. This committee will also serve an advocacy function as well as identify and recommend workshops, focus groups and other outreach to specific target groups for CEEWS implementation.
3. **Funding Options Committee:** Identify costs and options for system funding that do not identify the state General Fund as one of those sources.
4. **Standards Committee:** Establish a mechanism to assure that the system operates in a timely, reliable and efficient manner.
5. **Model Committee:** Develop a model that represents a public/private partnership that will operate in a cost effective and reliable manner.
6. **Management Committee:** Formalize an organizational structure that incorporates existing roles and responsibilities for seismic monitoring in California.
7. **Education and Training Committee:** Develop a comprehensive training and education program that addresses the needs of all potential users of an earthquake early warning system.

## Phase 5: Approve and Socialize the Plan

Once the committee work is complete and the implementation plan is drafted, it will be presented to the appropriate bodies for review and comment. These bodies include:

1. CEEWS Implementation Steering Committee
2. Cal OES Executives

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3. CISN Steering and Advisory Committees
4. Seismic Safety Commission
5. SEMS Advisory Board and Mutual Aid Regional Advisory Committees
6. Other bodies as identified.

The final draft of the implementation plan will be formally approved by Cal OES Executive Office.

Socialization includes both education about the system and outreach to individuals, organizations, and agencies that have a stake in earthquake early warning.

### **Phase 6: Implement and Evaluate the Plan**

In this phase, the scientific institutions will purchase and deploy equipment and acquire hardware, software, telecommunications and other technology needed to rapidly capture and analyze an evolving seismic sequence.

A management structure will be established, staff hired and memoranda of agreement will be established between cooperating entities, both public and private.

A well-articulated education and training program will be initiated to provide both individual and organizational users the information they will need to maximize the value of earthquake alerts.

These steps will be taken based on an adequate level of funding to support both the build-up necessary for a robust and reliable system and for ongoing maintenance and improvements in the system.

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## II. GOALS AND OBJECTIVES

| Goal                                                                                                                                                         | Objectives                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>Develop an Implementation Plan for development of an earthquake early warning system for California that conforms to the mandate CA Gov. Code 8587.8.</p> | <p><b>Objective 1</b> (Recommendation 1 - CEEWS Model): The state shall develop a CEEWS model that represents a public/private partnership and a cost effective and reliable system.</p> <p><b>Objective 2</b> (Recommendation 2 - Management): The state shall formalize a CEEWS organization structure that incorporates existing roles and responsibilities, such as the CISN.</p> <p><b>Objective 3</b> (Recommendation 3 – Standards): The state shall have an approval mechanism to ensure appropriateness of CEEWS standards, how they apply to various CEEWS components, compliance and participation criteria.</p> <p><b>Objective 4</b> (Recommendation 4 - Education and Training): Cal OES shall convene a group of subject experts and stakeholders to develop and implement California’s CEEWS education and training program.</p> <p><b>Objective 5</b> (Recommendation 5 – Funding): Cal OES will develop a distributed funding model, considering options such as:</p> <ul style="list-style-type: none"> <li>• Federal and State government sources</li> <li>• Assessments/Fees</li> <li>• Private financing, sponsorship, incentives</li> <li>• Research institution, in-kind or contributions</li> <li>• Code requirements</li> <li>• Subscription service</li> </ul> <p><b>Objective 6 – Steering Committee:</b> Cal OES will establish a Steering Committee to oversee and review the other committees’ activities by providing policy and direction and supervise the development of an Implementation Plan for the Introduction of Earthquake Early Warning in California.</p> |

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|  |                                                                                                                                                                                                                                                                                                                                                                   |
|--|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | <p><b>Objective 7-Stakeholder Liaison Group:</b> Cal OES will establish a committee designed to be the public face of the effort to develop a working CEEWS. This committee will communicate with external stakeholders regarding the CEEWS, identify the needs of specific target groups and serve as an advocate for earthquake early warning in the state.</p> |
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## III. PROJECT TEAM

The table below describes the initial composition of the Steering Committee, standing committees and stakeholder liaison group. A chairperson pro tem has been appointed to facilitate the first meeting of the standing committees. The chairperson will schedule an initial committee meeting among the selected subject matter experts and appoint a committee chair. Each committee membership will be expanded as the roles of the public and private sector, including industry, investors and others become better understood.

Once the chair is appointed, the committee should review the Project Charter, goals, objectives and deliverables and begin completing the tasks necessary to complete the project. The Steering Committee will schedule periodic meetings to coordinate open issues, obtain updates and assure that deliverables are consistent with the scope of the project.

| Committees                              | Proposed Committee Members                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Responsibilities |
|-----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------|
| CEEWS Implementation Steering Committee | Mark S. Ghilarducci, Cal OES, (Chair)<br>Tina Curry, Cal OES (Alternate)<br>Brendan Murphy, Cal OES<br>Doug Given, USGS<br>Egill Hauksson, CalTech<br>George Dixon, SWS<br>John Parrish, CGS<br>Kate Long, Cal OES<br>Richard McCarthy, CSSC<br>Stakeholder Liaison Group Rep.<br>Jeff Lusk, FEMA<br>Mark R. Johnson, Project Charter Mgr.                                                                                                                                                                                                                                                                                                   | See Description  |
| Stakeholder Liaison Group               | Chairperson TBD - CSSC Appointee<br>Association of Bay Area Governments<br>CA Emergency Utilities Association<br>California Fire Chiefs Association<br>California High Speed Rail Authority<br>California Hospital Association<br>California Operational Area Coalition<br>California Police Chiefs Association<br>California State Association of Counties<br>California State Sheriffs Association<br>California Transit Association<br>Cal OES EQTSU Program Staff<br>Cal OES Fire Branch<br>Cal OES Law Enforcement Branch<br>League of California Cities<br>So. CA Association of Governments<br>Other Interested Public / Private Reps | See Description  |

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|                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                        |
|----------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
| <p>Funding Options Committee</p> | <p>Brendan Murphy, Cal OES (Chair-Pro Tem)<br/>         Association of Bay Area Governments<br/>         CA Dept. of Business Oversight<br/>         CA Dept. of Finance<br/>         CA Dept. of Insurance<br/>         CA Seismic Safety Commission<br/>         CA State Association of Counties<br/>         CA State Treasurer<br/>         California Earthquake Authority<br/>         Cal OES EQTSU Program Staff<br/>         Govs Office of Business and Econ Dev<br/>         House Rep. Adam Schiff Staff Rep<br/>         League of California Cities<br/>         Senator Alex Padilla Staff Rep<br/>         Senator Diane Feinstein Staff Rep<br/>         So. CA Association of Governments<br/>         The California Endowment<br/>         U.S. Dept. of Interior (USGS invitee)<br/>         Others as recommended</p> | <p>See Description</p> |
| <p>Model Committee</p>           | <p>Doug Given, USGS (Chair Pro-Tem)<br/>         California Institute of Technology<br/>         UC Berkeley<br/>         CA Geological Survey<br/>         Seismic Warning Systems, Inc.<br/>         Kinemetrics, Inc<br/>         Trimble / RefTek<br/>         Everbridge, Inc.<br/>         Assemblyman Ken Cooley Staff Rep<br/>         National Oceanic Atmospheric Admin.<br/>         Advanced National Seismic Systems<br/>         FEMA RIX Earthquake Program Staff<br/>         Cal OES Legal Counsel<br/>         Cal OES EQTSU Program Staff<br/>         Others as recommended</p>                                                                                                                                                                                                                                          | <p>See Description</p> |
| <p>Standards Committee</p>       | <p>Egill Hauksson, Caltech Chair Pro-Tem<br/>         Advanced National Seismic Systems<br/>         CA Dept. of Transportation<br/>         CA Emergency Utilities Association<br/>         CA Geological Survey<br/>         CA Seismic Safety Commission<br/>         CA State Warning Center<br/>         California Public Utilities Commission<br/>         Cal OES EQTSU Program Staff<br/>         Cal OES Public Safety<br/>         Communications</p>                                                                                                                                                                                                                                                                                                                                                                             | <p>See Description</p> |

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|                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                        |
|-----------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------|
|                                         | <p>Pacific Gas and Electric Co.<br/>                 Seismic Warning Systems, Inc.<br/>                 UC Berkeley<br/>                 US Dept. of Commerce<br/>                 US Geological Survey<br/>                 Others as recommended</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                        |
| <p>Management Committee</p>             | <p>John Parrish, CGS (Chair Pro-tem)<br/>                 US Geological Survey<br/>                 Southern California Earthquake Center<br/>                 Earthquake Engineering Research Inst.<br/>                 California State Association of Counties<br/>                 Association of Bay Area Governments<br/>                 So. CA Association of Governments<br/>                 League of California Cities<br/>                 Degenkolb Engineers<br/>                 FEMA RIX<br/>                 Cal OES Legal Counsel<br/>                 Cal OES EQTSU Program Staff<br/>                 Others as recommended</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <p>See Description</p> |
| <p>Education and Training Committee</p> | <p>Kate Long, Cal OES (Chair Pro-Tem)<br/>                 Mark R. Johnson, Cal-OES<br/>                 American Red Cross<br/>                 Art Center College of Design<br/>                 Association of Bay Area Governments<br/>                 CA Broadcasters Association<br/>                 CA Dept. of Education<br/>                 CA Seismic Safety Commission<br/>                 CA State Association of Counties<br/>                 Cal OES EQTSU Program Staff<br/>                 California Institute of Technology<br/>                 California State University<br/>                 Cal OES Access and Functional Needs<br/>                 Cal OES PIO<br/>                 Earthquake Country Alliance<br/>                 FEMA RIX<br/>                 League of California Cities<br/>                 Pearce Global Partners Rep<br/>                 SCEC Rep<br/>                 Southern California Earthquake Center<br/>                 UC Berkeley<br/>                 University of California<br/>                 University of Kentucky<br/>                 US Geological Survey<br/>                 Others as recommended</p> | <p>See Description</p> |

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## **IV. ROLES AND RESPONSIBILITIES**

### **A. CEEWS Implementation Steering Committee**

#### **1. Role**

- a. The Steering Committee will be comprised of the chairs of the five standing committees and chaired by an Cal OES Executive Staff member appointed by the Cal OES Director and staffed by a member of the Cal OES Earthquake and Tsunami Branch who will be assigned to prepare minutes of all committee meetings and distribute these minutes to all committee members.
- b. The committee will coordinate the work of the five other committees and ultimately supervise the development of the main product, an Implementation Plan for the Introduction of Earthquake Early Warning in California.
- c. The Steering Committee will be assisted by a Stakeholder Liaison Group and Support Staff. The group will share progress with, and offer input from, local government officials, public safety agencies and other external stakeholders. The Support Staff will assist with facilitating meetings and preparing the final Implementation Plan.

#### **2. Responsibilities**

- a. Work with the five standing committees to assist them in coordinating their work, including recommendations, with the other committees to assure integration.
- b. Based on the deliberations of all five committees oversee the preparation of the final report, an implementation plan for the Introduction and Operation of an Earthquake Early Warning System for California.
- c. Ensure project transparency and broad representation during system development via actions and communication through the Stakeholder Liaison Group.

#### **3. Tasks**

##### **a. General**

- i. Schedule an initial committee meeting among the selected subject matter experts.
- ii. Select a CEEWS Steering Committee Chairperson.

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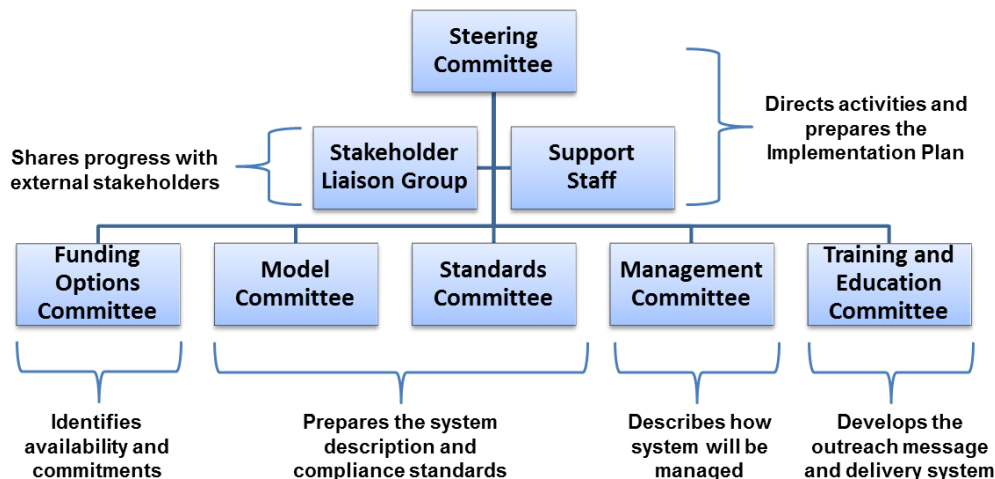
- iii. Identify staff to take minutes for each meeting. Cal OES staff can assist.
- iv. Review the project charter, goals, objectives and deliverables.
- v. Identify who else should be represented on the committee and arrange for their representation.
- vi. Determine a meeting schedule.
- vii. Obtain updates from the other committees on a regular basis.

### **b. Specific**

- i. Collaborate with the other committees to assure that deliverables are consistent with the scope of the system.
- ii. Assess the need for, and provide guidance in, development of MOUs, contracts and other necessary agreements to accomplish project goals and objectives.
- iii. Work with the five standing committees to assist them in coordinating their work, including recommendations, with the other committees to assure integration.
- iv. Arrange for a formal review of the Standards Committee deliverable and assure that any changes recommended by CEPEC/NEPEC are implemented and resubmitted to CEPEC/NEPEC for approval.
- v. Based on the deliberations of all five committees oversee the preparation of the final report, an implementation plan for the introduction and operation of an earthquake early warning system for California.
- vi. Brief the appropriate agency representatives regarding the key deliverables.
- vii. Submit the implementation plan for final approval.

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## 4. CEEWS Implementation Steering Committee Organization



### B. Stakeholder Liaison Group

#### 1. Role

- a. Inform external parties of progress in the development of CEEWS, assist in funding research and serve as a conduit for conducting external workshops to support the development of CEEWS.
- b. Serve as a clearinghouse for information about CEEWS and earthquake early warning in general
- c. Coordinate with and maintain close contact with the Education and Training Committee to keep abreast of developments in CEEWS user outreach strategies.

#### 2. Responsibilities

- a. To the extent possible, assure that all constituencies likely to use the CEEWS are addressed by the Education and Training Committee including persons with disabilities.
- b. Provide recommendations regarding possible funding options and advise the Steering Committee on strategies for workshops and target groups for outreach.
- c. Coordinate with the Steering Committee on activities and remain in contact with the work of all other committees, particularly the Education and Training Committee.

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## 3. Tasks

### a. General

- i. Receive a briefing and additional guidance from the Steering Committee.
- ii. Schedule an initial committee meeting among the selected subject matter experts.
- iii. Select a committee chair.
- iv. Identify staff to take minutes for each meeting. Cal OES staff can assist.
- v. Identify who else should be represented on the committee and arrange for their representation.
- vi. Determine a meeting schedule.
- vii. Review the project charter, goals, objectives and deliverables.
- viii. Committee chairs meet regularly with the Steering Committee to coordinate on issues.
- ix. Obtain updates from the other committees as appropriate to support meeting this objective.
- x. Prepare a report to the Steering Committee that includes, committee findings, conclusions, recommendations, members, chairperson, meeting schedule and minutes.
- xi. Brief the Steering Committee regarding the deliverables.
- xii. Submit the report for subsequent incorporation into the Implementation Plan.

### b. Specific

- i. Coordinate closely with the Steering Committee and the Education and Training Committees.
- ii. Provide stakeholder feedback to all relevant committees.
- iii. Identify specific target groups for outreach and propose workshops, focus groups, or other means of securing feedback from all potential users of CEEWS.
- iv. Make regular reports to the Steering Committee on activities and recommended actions.

## C. Funding Options Committee

### 1. Role

- a. In following the mandate of Government Code 8587.8 the Funding Options Committee must consider the costs of initial investment in the early warning hardware and software, the costs of ongoing maintenance and system operations as well as the source of funding for the system, which cannot include the state General Fund.

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- b. Other sources of funding, as identified in legislation include single or multiple revenue sources such as federal funds, funds from revenue bonds, local funds and private grants.
- c. Based on discussions of the Cal OES Working Group in Phase 1, the level of funding for the system will significantly determine the systems geographic coverage, its reliability, the timeliness of alerts and overall performance.
- d. Initial cost estimates vary from \$12 to \$23 million and annual maintenance costs range from \$2 to \$12 million. The Model Committee and the Standards Committee will shape the system description, which will in turn refine the cost estimate. The Funding Options Committee must work in close collaboration with the other committees to assure that recommended funding and maintenance levels are consistent with the scope of the system envisioned by other committees. Conversely, the level of available funding for the system will significantly determine the systems geographic coverage, its reliability, the timeliness of alerts and overall performance.

## **2. Responsibilities**

- a. Hold an initial meeting to select a chair and determine a meeting schedule for the 12 months following the first meeting and address all the issues included in “committee role” above.
- b. Prepare with the assistance of Cal OES staff and the Steering Committee, a document which incorporates all decisions made on funding options.

## **3. Tasks**

### **a. General**

- i. Receive a briefing and additional guidance from the Steering Committee.
- ii. Schedule an initial committee meeting among the selected subject matter experts.
- iii. Select a committee chair.
- iv. Identify staff to take minutes for each meeting. Cal OES staff can assist.
- v. Identify who else should be represented on the committee and arrange for their representation.
- vi. Determine a meeting schedule.
- vii. Review the project charter, goals, objectives and deliverables.

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- viii. Committee chairs meet regularly with the Steering Committee to coordinate on issues.
- ix. Obtain updates from the other committees as appropriate to support meeting this objective.
- x. Prepare a report to the Steering Committee that includes, committee findings, conclusions, recommendations, members, chairperson, meeting schedule and minutes.
- xi. Brief the Steering Committee regarding the deliverables.
- xii. Submit the report for subsequent incorporation into the Implementation Plan.

### b. Specific

- i. Receive a report from the other committees regarding:
  - Initial investment in the early warning hardware and software. Preliminary estimates range from \$12 to \$23 million.
  - Ongoing maintenance and system operations. Preliminary estimates range from \$2 to \$16 million.
- ii. Collaborate with the other committees to assure that recommended funding and maintenance levels are consistent with the scope of the system.
- iii. Consider the source of funding for the system. Include sustainable single or multiple revenue sources:
  - Research availability of federal funds.
  - Research availability of funds from revenue bonds.
  - Research availability of local funds.
  - Research availability of sustainable private grants.
- iv. Research funding sources and revenue streams, identify organizational responsibility for policy decisions and financial administration, how funding will be distributed and strategies for maintaining ongoing funding and investment.

### D. Model Committee

#### 1. Role

- a. The CEEWS Working Group established in January 2013 began work on a vision for a CEEWS model that represents a public/private partnership and a cost effective and reliable system, and is consistent with legislative mandates, organizational relationships, division of labor between agencies and the private sector and funding

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recommendations as determined by other committees. The Model Committee will further this effort by formulating a framework of the key stakeholders and requirements for a robust early warning system which will include a system description (how the system will build upon existing efforts like ShakeAlert), operational components, cost estimates, the interaction between public and private sectors, criteria for participation and any needed policy recommendations

- b. For example, there is broad consensus that the USGS would have lead responsibility for the operation of an earthquake early warning system but the USGS has a responsibility for seismic monitoring for the nation as a whole and the Survey's Technical Implementation Plan calls for a West Coast early warning system that includes the states of Washington and Oregon, but the mandate of 8587.8 identifies only California as a the recipient of early warnings. This issue may have implications for how the system is ultimately configured and funded. The USGS role in earthquake early warning is not well defined by existing statutes and the U.S. Department of the Interior may require additional authorities before it accepts a lead role in earthquake early warning.
- c. The Model Committee will also have responsibility for considering the level of reliability and robustness of the system that can be built given potential funding constraints. Further, this committee will identify and describe a research component that will be an ongoing part of the CEEWS system.

## **2. Responsibilities**

- a. Hold an initial meeting to select a chair and determine a meeting schedule for the 12 months following the first meeting and address all the issues included in "committee role" above.
- b. Prepare with the assistance of Cal OES staff and the Steering Committee, a document which incorporates all decisions made on the model to be followed.
- c. USGS has lead responsibility for national seismic monitoring. However, USGS may require additional authorities before it accepts a lead role in earthquake early warning. The USGS Technical Implementation Plan calls for a West Coast early warning system that includes the states of Washington and Oregon. This issue may have implications for how the California system is ultimately configured and funded.

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## 3. Tasks

### a. General

- i. Receive a briefing and additional guidance from the Steering Committee.
- ii. Schedule an initial committee meeting among the selected subject matter experts.
- iii. Select a committee chair.
- iv. Identify staff to take minutes for each meeting. Cal OES staff can assist.
- v. Identify who else should be represented on the committee and arrange for their representation.
- vi. Determine a meeting schedule.
- vii. Review the project charter, goals, objectives and deliverables.
- viii. Committee chairs meet regularly with the Steering Committee to coordinate on issues.
- ix. Obtain updates from the other committees as appropriate to support meeting this objective.
- x. Prepare a report to the Steering Committee that includes, committee findings, conclusions, recommendations, members, chairperson, meeting schedule and minutes.
- xi. Brief the Steering Committee regarding the deliverables.
- xii. Submit the report for subsequent incorporation into the Implementation Plan.

### b. Specific

- i. Review any considerations such as:
  - California Government Code Section 8587.8 for any modeling requirements.
  - Reliability and robustness of the system that can be built given potential funding constraints.
- ii. Collaborate with the other committees to assure that deliverables are consistent with legislative mandates, organizational relationships, division of labor between agencies and the private sector and funding recommendations as determined by other committees.
- iii. Develop a research component as part of the CEEWS.
- iv. The committee will also consider CEEWS “roll out” scenarios and strategies based on factors such as costs, seismic risk and other factors.

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- v. Provide details of how the modeled system will be built out (from demonstration project to regional to full statewide implementation) and provide a new cost estimate (both initial and ongoing) that reflects a more accurate assessment of system development and maintenance.
- vi. Investigate potential legal liabilities associated with system operation as well as responsibilities and immunities.

## **E. Standards Committee**

### **1. Role**

- a. The standards committee will consider all of the following issues and identify structures through which these issues will be addressed in the CEEWS system.
- b. In general, the scientific work will conform to the Department of Interior Secretary's Order # 3305 regarding scientific quality and integrity; as part of the Advanced National Seismic System, the CEEWS will conform to national standards for management, system performance, data quality and completeness, sharing seismic data and validation of methods for the creation and distribution of public earthquake information.
- c. More specifically, the committee will address the following issues specific to earthquake early warning: minimum and optimum seismic and geodetic station spacing; sensor and data types that are useful to the system; maximum allowable telemetry latency; system security; acceptable level of "false alarms" or "missed events"; acceptable levels of reliability for release of alerts to user groups; the length, content and means of delivering alert messages: software coding, testing, and certification standards; development and use of synthetic wave forms to test newly developed code to test for very large events than are available in existing datasets; test algorithms and maintain results in a database for future troubleshooting and integrate methods and tools developed to evaluate performance into the ANSS Quake Monitoring System (AQMS). The committee will also identify an organizational component that will provide ongoing monitoring of performance and recommend changes that will improve system performance, including the incorporation of the results of new research and development.
- d. The resulting decisions of the committee will be submitted to the California Earthquake Prediction Evaluation Council (CEPEC) and National Earthquake Prediction Evaluation Council (NEPEC) for a joint

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review to evaluate the standards from scientific and technical standpoints.

## **2. Responsibilities**

- a. Hold an initial meeting to select a chair and determine a meeting schedule for the 12 months following the first meeting and address all the issues included in “committee role” above.
- b. Prepare with the assistance of the Cal OES staff person, a document which incorporates all decisions made on performance standards.
- c. Submit this document with recommended performance standards to CEPEC/NEPEC for a scientific evaluation of the proposed standards.

## **3. Tasks**

### **a. General**

- i. Receive a briefing and additional guidance from the Steering Committee.
- ii. Schedule an initial committee meeting among the selected subject matter experts.
- iii. Select a committee chair.
- iv. Identify staff to take minutes for each meeting. Cal OES staff can assist.
- v. Identify who else should be represented on the committee and arrange for their representation.
- vi. Determine a meeting schedule.
- vii. Review the project charter, goals, objectives and deliverables.
- viii. Committee chairs meet regularly with the Steering Committee to coordinate on issues.
- ix. Obtain updates from the other committees as appropriate to support meeting this objective.
- x. Collaborate with the other committees to assure that deliverables are consistent with the scope of the system.
- xi. Prepare a report to the Steering Committee that includes, committee findings, conclusions, recommendations, members, chairperson, meeting schedule and minutes.
- xii. Brief the Steering Committee regarding the deliverables.
- xiii. Submit the report for subsequent incorporation into the Implementation Plan.

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## b. Specific

- i. Review any considerations such as:
  - Ongoing structures through which standards-related issues will be addressed in the system.
  - The scientific work will need to conform to the Department of Interior Secretary's Order # 3305 regarding scientific quality and integrity.
  - As part of the Advanced National Seismic System, the CEEWS will need to conform to existing national standards for management, system performance, data quality and completeness, sharing seismic data and validation of methods for the creation and distribution of public earthquake information.
  - Minimum and optimum seismic and geodetic station spacing.
  - Sensor and data types must be useful to the system.
  - Maximum allowable telemetry latency.
  - System security; acceptable level of "false alarms" or "missed events" and how to reduce the frequency and impact of errors.
  - Acceptable levels of reliability for release of alerts to user groups.
  - The length, content and means of delivering alert messages: software coding, testing, and certification standards.
  - Development and use of synthetic wave forms to test newly developed code to test for very large events than are available in existing datasets.
  - Test algorithms and maintain results in a database for future troubleshooting and integrate methods and tools developed to evaluate performance into the ANSS Quake Monitoring System (AQMS).
- ii. The resulting decisions of the committee will need to be submitted to a joint CEPEC/NEPEC review to evaluate the standards from scientific and technical standpoints.
- iii. Prepare a system description report that concisely defines the scope and parameters for CEEWS.

## F. Management Committee

### 1. Role

- a. The management committee will identify the roles and responsibilities of organizations which will operate an earthquake early warning

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system or have important secondary or supporting roles in the system. For some organizations, roles and responsibilities are defined in statute or existing roles and responsibilities may be extended to the earthquake early warning system.

- b. The roles of FEMA and Cal OES in an operational earthquake early warning system are yet to be fully articulated.
- c. Given that the system will be a public/private partnership, the roles to be played by the private sector are also ill defined and must be articulated by the Management Committee. These roles may include provision of source data to CISN from privately operated seismic networks (e.g. Southern California Edison, PG&E, Caltrans), communicating alerts via private telecommunications networks and Internet services, and the potential market created for sophisticated application of early warnings to specialized institutional sectors.
- d. Organizations involved in the operation of an earthquake early warning system may interact with other entities in new ways requiring cooperative agreements or MOAs and the Management Committee may identify areas in which these agreements are needed. Legal guidelines addressing the interaction between public and private partners need to be defined and agreements arranged. The guidelines should address the development, implementation and enforcement of legal terms and conditions such as non-disclosure agreements.

## **2. Responsibilities**

- a. Hold an initial meeting to select a chair and determine a meeting schedule for the 12 months following the first meeting and address all the issues included in “committee role” above.
- b. Prepare with the assistance of Cal OES staff and the Steering Committee, a document which incorporates all decisions made on organization and management issues.

## **3. Tasks**

### **a. General**

- i. Receive a briefing and additional guidance from the Steering Committee.
- ii. Schedule an initial committee meeting among the selected subject matter experts.
- iii. Select a committee chair.

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- iv. Identify staff to take minutes for each meeting. Cal OES staff can assist.
- v. Identify who else should be represented on the committee and arrange for their representation.
- vi. Determine a meeting schedule.
- vii. Review the project charter, goals, objectives and deliverables.
- viii. Committee chairs meet regularly with the Steering Committee to coordinate on issues.
- ix. Obtain updates from the other committees as appropriate to support meeting this objective.
- x. Collaborate with the other committees to assure that deliverables are consistent with the scope of the system.
- xi. Prepare a report to the Steering Committee that includes, committee findings, conclusions, recommendations, members, chairperson, meeting schedule and minutes.
- xii. Brief the Steering Committee regarding the deliverables.
- xiii. Submit the report for subsequent incorporation into the Implementation Plan.

### b. Specific

- i. Review any considerations such as:
  - Roles and responsibilities of organizations that will operate an earthquake early warning system or have important secondary or supporting roles in the system. For some organizations, roles and responsibilities are defined in statute or existing roles and responsibilities may be extended to the earthquake early warning system.
  - The legal authorities for collecting, obtaining, analyzing and issuing warnings for seismic hazards are unclear and involve several stakeholder groups. There is a need for greater clarity on the legal authorities defining the responsibilities within this emerging industry.
  - The ANSS regional seismic networks role is to provide the seismic data in support of an early warning system.
  - The FEMA and Cal OES role requires additional definition.
  - The private sector role is also ill defined and must be articulated by the Management Committee. Legal guidelines addressing the interaction between public and private partners need to be defined and agreements arranged. The guidelines should address the development, implementation and enforcement of legal terms and conditions such as non-disclosure agreements.
  - The role of privately operated seismic networks (e.g. Southern California Edison, PG&E, Caltrans) should be

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clearly outlined. Organizations involved in the operation of an earthquake early warning system may interact with other entities in new ways requiring cooperative agreements or MOAs and the Management Committee may identify areas in which these agreements are needed.

- Define how ongoing operations will be sustained, including cost estimates.

### **G. Education and Training Committee**

#### **1. Role**

- a. The education and training committee will facilitate development of a comprehensive education and training program for both individual and institutional users of an earthquake early warning system. This program must be comprehensive in scope, illustration and graphics rich in its presentation, informed by social science research in its formulation and broad in its application.
- b. In addition to very simple, specific and contextual instructions for individual users, the program must include institution-specific recommendations for the financial, health care, utility and lifeline, emergency management, education and other sectors.
- c. Beyond response and mitigation actions, the program must include training in the limitations of the system, the minimum and maximum length of warnings users will receive, the possibility that technical failures could result in false alarms or missed events and that in some areas or for some earthquakes, there could be no warning at all. In addition to education and training regarding the appropriate response to earthquake early warnings in various contexts and for various users, there must be instructions regarding how to receive warnings whether through applications on hand held devices, via radio or television, over public address systems at school or work or other means.
- d. One of the greatest challenges in developing an education and training program will be to identify rapidly executable mitigation actions for specific institutional sectors. In regard to both individual and institutional education and training, much can be learned through a close examination of training programs associated with the national earthquake early warning system which has been operating in Japan since October 2007.
- e. The Education and Training Committee will also be responsible for providing instructions on the use of CEEWS by persons with disabilities.

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## 2. Responsibilities

- a. Hold an initial meeting to select a chair and determine a meeting schedule for the 12 months following the first meeting and address all the issues included in “committee role” above.
- b. Prepare with the assistance of Cal OES staff and the Steering Committee, a document which incorporates all decisions made on an Education and Training Program.

## 3. Tasks

### a. General

- i. Receive a briefing and additional guidance from the Steering Committee.
- ii. Schedule an initial committee meeting among the selected subject matter experts.
- iii. Select a committee chair.
- iv. Identify staff to take minutes for each meeting. Cal OES staff can assist.
- v. Identify who else should be represented on the committee and arrange for their representation.
- vi. Determine a meeting schedule.
- vii. Review the project charter, goals, objectives and deliverables.
- viii. Committee chairs meet regularly with the Steering Committee to coordinate on issues.
- ix. Obtain updates from the other committees as appropriate to support meeting this objective.
- x. Collaborate with the other committees to assure that deliverables are consistent with the scope of the system.
- xi. Prepare a report to the Steering Committee that includes, committee findings, conclusions, recommendations, members, chairperson, meeting schedule and minutes.
- xii. Brief the Steering Committee regarding the deliverables.
- xiii. Submit the report for subsequent incorporation into the Implementation Plan.

### b. Specific

- i. Review any considerations such as:
  - A comprehensive education and training program will be needed for both individual and institutional users of an earthquake early warning system.

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- This program must be comprehensive in scope, illustration and graphics rich in its presentation, informed by social science research in its formulation and broad in its application.
- The program should provide simple, specific and contextual instructions for individual users.
- The program must include institution-specific recommendations for the financial, health care, utility and lifeline, emergency management, education and other sectors.
- Beyond response and mitigation actions, the program must include training in the limitations of the system, the minimum and maximum length of warnings users will receive, the possibility that technical failures could result in false alarms or missed events and that in some areas or for some earthquakes, there could be no warning at all.
- In addition to education and training regarding the appropriate response to earthquake early warnings in various contexts and for various users, there must be instructions regarding how to receive warnings whether through applications on hand held devices, via radio or television, over public address systems at school or work or other means.
- One of the greatest challenges in developing an education and training program will be to identify rapidly executable mitigation actions for specific institutional sectors.
- In regard to both individual and institutional education and training, much can be learned through a close examination of training programs associated with the National earthquake Early warning system which has been operating in Japan since October 2007.

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## V. DELIVERABLES AND DUE DATES

| Milestone                          | Deliverable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Due Date |
|------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Form a Collaborative Planning Team | <ol style="list-style-type: none"> <li>1. Working Group Initiates Project.</li> <li>2. CEEWS Committees formed to address objectives.</li> <li>3. Project Charter prepared and approved.</li> <li>4. Project Charter is maintained by the Cal OES Earthquake and Tsunami program staff.</li> </ol>                                                                                                                                                                                                                                                                                                                                                      | Jan 2014 |
| Draft Goals and Objectives         | <ol style="list-style-type: none"> <li>1. The CEEWS Working Group approves goal and objectives.</li> <li>2. Goals and objectives are included in the charter.</li> <li>3. The CEEWS Working Group establishes standing committees including a CEEWS Steering Committee to address the objectives in the charter.</li> <li>4. The CEEWS Working Group turns responsibility over to the CEEWS Steering Committee and dissolves.</li> </ol>                                                                                                                                                                                                                | Jan 2014 |
| Understand the Situation           | <ol style="list-style-type: none"> <li>1. The Steering Committee meets in July to consider the following activities:</li> <li>2. The priority for committee efforts will be for the Model Committee to develop the system description in coordination with the other committees. Other committees address tasks that are independent of the system description.</li> <li>3. The standing committees convene, select a chair and establish a meeting schedule that conforms to the project timeline.</li> <li>4. Committee report to Steering Committee with name of each committee chair, meeting schedule and minutes of the first meeting.</li> </ol> | Jul 2014 |

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| Milestone                                                  | Deliverable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Due Date        |
|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|
|                                                            | <ol style="list-style-type: none"> <li>5. This can be submitted to the CEEW Project Manager (mark.johnson@caloes.ca.gov).</li> <li>6. Committees meet 6-8 times with discussions and conclusions recorded by support staff.</li> <li>7. A draft system description report is prepared by the Model Committee in coordination with the Standards Committee.</li> <li>8. The draft system description report is submitted to CEPEC/NEPEC for formal review.</li> <li>9. The draft system description is revised based on CEPEC/NEPEC approval, rejection or revision of performance standards.</li> <li>10. The draft system description report is re-submitted to CEPEC/NEPEC for formal approval.</li> <li>11. The revised system description is submitted to the Steering Committee for approval.</li> </ol> |                 |
| <p>Develop an Implementation Plan and Identify Funding</p> | <ol style="list-style-type: none"> <li>1. The Steering Committee Meets in January to consider the following activities:</li> <li>2. Standing committees provide progress report to the Steering Committee for the previous period.</li> <li>3. The Standards Committee reports on progress on recommending standards for the system that will be included in the implementation plan.</li> <li>4. Model Committee reports on progress on the system description for inclusion in the Implementation Plan.</li> <li>5. The Funding Options Committee reports on progress on identifying the availability and commitments of funding to support both the build-up necessary for a robust and reliable</li> </ol>                                                                                                | <p>Jan 2015</p> |

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| Milestone                      | Deliverable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Due Date |
|--------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
|                                | <p>system and for ongoing maintenance and improvements in the system.</p> <ol style="list-style-type: none"> <li>6. The Management Committee reports on progress of establishing draft roles and responsibilities of organizations which will operate an earthquake early warning system or have important secondary or supporting roles in the system.</li> <li>7. The Education and Training Committee reports on progress on how individual and organizational users can maximize the value of earthquake alerts through education, outreach and training.</li> </ol> |          |
|                                | <ol style="list-style-type: none"> <li>1. The Steering Committee meets in July to consider the following activities:</li> <li>2. Committee chairs meet regularly with the Steering Committee to coordinate on issues.</li> <li>3. Committees complete work, prepare a report containing conclusions and recommendations for inclusion in the implementation plan.</li> <li>4. Steering Committee staff prepares the implementation plan based on the committee reports.</li> </ol>                                                                                       | Jul 2015 |
| Approve and Socialize the Plan | <ol style="list-style-type: none"> <li>1. The Steering Committee meets in September to consider the following activities:</li> <li>2. Implementation Plan reviewed by Steering Committee.</li> <li>3. Implementation plan is presented to the appropriate bodies for review and comment.</li> <li>4. Implementation plan is formally approved by Cal OES Executive Office and finalized for publication.</li> </ol>                                                                                                                                                      | Sep 2015 |

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| Milestone                       | Deliverable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Due Date |
|---------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| Implement and Evaluate the Plan | <ol style="list-style-type: none"> <li>1. The Steering Committee meets in January to consider the following activities:</li> <li>2. Funding commitments are documented.</li> <li>3. The scientific institutions procure and deploy equipment, hardware, software, telecommunications and other technology needed to rapidly capture and analyze an evolving seismic sequence.</li> <li>4. A management structure is established, staff hired and memoranda of agreement will be established between cooperating entities, both public and private.</li> <li>5. A well-articulated education and training program is initiated to provide both individual and organizational users the information they will need to maximize the value of earthquake alerts.</li> </ol> | Jan 2016 |

## VI. CONDITIONS

### A. Authorities

California Government Code Section 8587.8 (Earthquake Early Warning Act)

### B. Assumptions

1. The available funding will be sufficient to establish and maintain an adequately performing system that is robust, timely, and reliable and is able to minimize false alerts and missed events.
2. The funding mechanisms identified will be feasible and assure reliable support for the system in the long-term.
3. The alerts will be welcomed by users who will embrace the system as a socially responsible public service.
4. That upon completion of the work of the five committees and the implementation plan, administration and/or legislative action will result in establishment of an early warning system with stable funding.

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## C. Benefits

1. Implementation of an earthquake early warning system would be an important addition to existing earthquake preparedness and mitigation strategies
2. Successful effort in detailing an optimal earthquake early warning system would be a credit to Cal OES and to the State of California in developing the first application of early warning in the nation.
3. An earthquake early warning system has the potential to save lives and reduce property damage in a major earthquake as was demonstrated in the March 11, 2011 Great Tohoku Earthquake and Tsunami in Japan.

## D. Constraints

1. The inability to consider the State General Fund as a source of support is a limiting factor.
2. The ability to identify a stable source of ongoing operations and maintenance funding will be as major challenge at a time of budgetary austerity.
3. Some key stakeholders are experiencing a potential for reduction in current funding for the CISN. This presents challenges in continuing the current level of participation in the CEEWS initiative to enhance capabilities for advance notification.
4. The quality of the implementation plan is dependent upon the careful selection and the commitment of committee member.

## VII. PROJECT REFERENCES

Reference documents for consideration in developing the California Earthquake Early Warning System may be submitted to [mark.johnson@caloes.ca.gov](mailto:mark.johnson@caloes.ca.gov). Submitted documents that are in the public domain will be stored at <http://www.cisn.org/ceews/docs/>. FOUO documents will be placed in a secured folder.

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## VIII. APPROVALS

  
\_\_\_\_\_  
Cal OES Project Manager

2/21/2014  
Date

  
\_\_\_\_\_  
Cal OES Executive Sponsor

2/19/14  
Date

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## IX. APPENDICES

- A. Committee Reports (TBD)
- B. CEEWS System Description (TBD)
- C. CEEWS Implementation Plan (TBD)