



City and County of San Francisco Emergency Response Plan

AN ELEMENT OF THE CCSF EMERGENCY MANAGEMENT PROGRAM

Tsunami Response Annex



**TABLE OF CONTENTS****SECTION 1 - INTRODUCTION**

1.0 Introduction	4
1.1 Purpose	4
1.2 Background	4

SECTION 2 – CONCEPT OF OPERATIONS

2.0 General Concepts	5
2.1 Notification and Public Warning	6-9
2.2 Response	9-13
2.3 Evacuation.....	13-17
2.4 Public Education and Awareness	17

SECTION 3 – RECOVERY

3.0 Damage Assessment	18
3.1 Debris Removal	18-19
3.2 Public Outreach	19
3.3 Disaster Assistance Programs	19-20

SECTION 4 – TSUNAMI ANALYSIS

4.0 Definitions	21-23
4.1 Tsunami Warning Systems	23
4.2 Potential Impacts	23-24
4.3 Estimated Inundation Zone	24-25

SECTION 5 – PLANNING

5.0 Planning Assumptions	26
5.1 Planning and Mitigation	26
5.2 Public Information Campaign	26-27

SECTION 6 - PLAN CONSIDERATIONS

6.0 Relationship to Other Plans	28
6.1 After-Action Review	28
6.2 Plan Testing, Training and Exercises	28
6.3 Document Management and Distribution	28

ATTACHMENTS

Attachment A - Duty Officer Checklist	29
Attachment B – CCSF Coastal Tsunami Inundation Map	30
Attachment C – Notification Alert List	31
Attachment D – Equipment Staging Locations	32
Attachment E – Evacuation Routes – Traffic Plan	33-35
Attachment F – Evacuation Assembly Sites	36
Attachment G – Care and Shelter Activation Procedures	37
Attachment H – Declaration of Local Emergency	38
Attachment I – Prepare to Evacuate Notification – EAS Release	39
Attachment J – Evacuation Notification – EAS Release	40
Attachment K – Glossary of Key Terms and Terminology	41-43
Attachment L – Acronyms	44



ATTACHMENTS

Attachment A	DEM/DES Duty Officer Tsunami Checklist – Watch or Warning
Attachment B	City & County of San Francisco Tsunami Inundation Map
Attachment C	Notification Alert List – By Department/Agency
Attachment D	Equipment Staging Locations
Attachment E	Emergency Evacuation Routes - Traffic Plan
Attachment F	Evacuation Assembly Sites
Attachment G	Care and Shelter Activation Procedures
Attachment H	Declaration of Local Emergency
Attachment I	Prepare to Evacuate – Tsunami Watch – EAS Release
Attachment J	Evacuation Notification – Tsunami Warning – EAS Release
Attachment K	Glossary of Key Terms and Terminology
Attachment L	Acronyms



SECTION 1 – INTRODUCTION

1.0 INTRODUCTION

In accordance with the San Francisco's Emergency Response Plan (ERP), this Hazard Specific Annex was developed to focus on San Francisco's response actions to Tsunami related Advisories, Watches, Warnings or Events.

Although an emergency response to a Tsunami requires an all-hazards approach, a Tsunami would trigger specific response actions that are significantly different than those response actions triggered by other hazards. Responding to Tsunami threats are complex, as it can be caused by distant-source events resulting in waves taking hours to reach our coast, or it can be caused by a near-shore event that provides no lead or warning time.

1.1 PURPOSE

The purpose of this Annex is to provide an understanding of the operational concepts and coordinated actions of San Francisco Departments and Agencies, who may be involved in a Tsunami response. This Annex will also provide as a resource to establish guidelines under which San Francisco will operate, when notified of a Tsunami Advisory, Watch, Warning, or an actual Tsunami occurrence.

This Annex complies with the National Incident Management System (NIMS), in accordance with the National Response Framework (NRF), the California Standardized Emergency Management System (SEMS), the Incident Command System (ICS), and the California State Emergency Plan.

1.2 BACKGROUND

Since 1850, fifty-one Tsunamis have been recorded or observed in the San Francisco Bay. Nine of these Tsunamis originated in Alaska and were caused by an earthquake, earthquake and landslide, or volcano and earthquake. The 1906 earthquake generated a 4-inch wave "run-up", recorded at the Presidio gauge station shortly after the 1906 earthquake. The earthquake caused the down-dropping of the seafloor north of Lake Merced between overlapping segments of the San Andreas Fault and, as such, the earthquake inertia generated a Tsunami.

In the more recent years, it is probable that wave impact occurred in and around the Bay Area during 1946, 1960, and 1964. In 1946 an earthquake in the Aleutian Islands generated a Tsunami. In 1960 a Tsunami killed sixty-one people in Hawaii and damaged our coast. A 1964 Alaskan earthquake caused twelve deaths and 17 million dollars in damage in Crescent City. There are no known recorded deaths from Tsunami related events in San Francisco County.



SECTION 2 – CONCEPT OF OPERATIONS

2.0 GENERAL CONCEPTS

An emergency response during a citywide event will be a comprehensive effort that will require the City and County of San Francisco to work and coordinate effectively with many government, non-government, and private organizations. San Francisco departments must be prepared to activate and effectively respond to any unforeseeable emergency and to take appropriate actions, which may include requesting and providing resources.

This Section gives decision makers and plan users a representation of the sequence and scope of actions to take for a citywide response to a Tsunami. This Section describes notification and public warning actions; response operations, to include organizational roles and responsibilities; evacuation planning; and public education and awareness.

For information regarding general citywide emergency management concepts, organizational structures, and decision-making processes, reference the ERP. The ERP provides details for organizational roles and responsibilities; operational procedures during an emergency; the alignment of local emergency response operations with Federal systems; the functions of the citywide Emergency Operations Center (EOC), Department Operations Centers (DOCs); and describes how information flows from the incident level to other disaster response entities.

When the Department of Emergency Management (DEM) is notified of the issuance of a Tsunami Advisory, Watch, or Warning, DEM is responsible for coordinating citywide preparedness and response activities. DEM provides these activities by activating the EOC, providing alerts and notifications, providing resource coordination, and by fulfilling any other citywide needs for an emergency or disaster.

The following City Departments may play a major role in responding to a Tsunami event.

City Departments	
Department of Public Health (DPH)	Public Utilities Commission (PUC)
Department of Public Works (DPW)	San Francisco Fire Department (SFFD)
Department of Technology (DOT)	San Francisco Police Department (SFPD)
Human Services Agency (HSA)	San Francisco Sheriff's Department (SFSD)
Mayor's Office	San Francisco Unified School District
Municipal Transportation Agency (MTA) /Department of Parking & Traffic	

A brief description of their roles and responsibilities is defined in this Section.



2.1 NOTIFICATION AND PUBLIC WARNING

If a **Tsunami Information Statement, Advisory, Watch, or Warning** has been issued, the following actions will be implemented:

- **DEM/DEC** receives notification from the State NAWAS System.
 - DEM/DEC Bridge confirms receipt of message via telephone (recorded)
 - DEM/DEC contacts internal supervisors and DEM/DES Duty Officer.
- The **DEM/DES Duty Officer** will:
 - Confirm the details and content of the Tsunami Teletype through a verbal conversation with the DEC Bridge Supervisor.
 - The DEC supervisor will read and Fax the teletype to the Duty Officer.
 - The Duty Officer will contact the National Weather Service (NOAA) at 831-656-1717 for additional confirmation.
- The Duty Officer will brief the DEM Director or designee on the situation and determine Tsunami response actions, to include alerts and notifications, EOC activation level, possible evacuations of the inundation zones, etc.

As a crisis begins to develop or a **Tsunami Advisory/ Watch** has been issued, further actions may include, but are not limited to:

- **DEM Director** will brief the Mayor and members of the Policy Group
 - Evaluate the need to evacuate residents, schools, hotels, and people in care facilities in the potential inundation zones (*Attachment B*)
 - Evaluate the need to close the zoo, wharf, Marina areas, and beaches
- **DEM/DES Staff** will:
 - Activate the EOC (partial or full based on situation)
 - Review the Tsunami Plan for Equipment Staging Areas, Evacuation Site Locations, Care and Shelter Locations, Evacuation Routes, etc.
 - Notify critical CCSF Departments and support agencies (*Attachment C*)
Prepare them to open DOC's, make staff notifications, and review equipment and resource inventories.
 - Monitor the Tsunami threat status and modify response actions as the Tsunami Warning Center elevates, modifies, or cancels the Advisory/Watch.
 - Monitor tide levels through the National Weather Service Site <http://www.weather.gov/sanfrancisco> (refer to "tsunami info" on left tool bar).
- **DOT** will release a local Emergency Alert Message (*Attachment I*)

If a **Tsunami Watch** has been upgraded and a **Tsunami Warning** is issued, with confirmation of a Tsunami wave that has the potential to create "significant inundation" to the shoreline of San Francisco, the following additional actions will be implemented:

- **DOT** activates the Outdoor Public Warning System for the entire City of San Francisco and Treasure Island:
 - Sirens
 - Public Address System
 - Broadcast public safety messages through the media to the public using the Emergency Alert System (EAS) and Electronic Disaster Information System (EDIS) (*Attachments I and J for sample scripted messages*)
- **DEM/DES Staff** activates the EOC and makes the following notifications:
 - Notify critical Departments and agencies to open DOC's (*Attachment C*)
 - Issue "Recall Orders" for CCSF emergency response personnel



- Create EAS message for DOT to release
- Notify Fire, Police, Sheriff, Health, DPW, PUC, MTA/DPT and other critical response departments to:
 1. Evaluate available staffing and resources for deployment to the Equipment Staging Area, as requested. Identify and deploy additional staffing if needed and communicate personnel information to the EOC
 2. Notify MTA – MUNI to prepare to deploy LRV's and diesel buses to designated locations for evacuations from the inundation zones. MTA will also prepare to deploy DPT officers for traffic control at designated intersections (*Attachment E*).
 3. Notify USD to open 6 Evacuation Assembly Sites (*Attachment F*)
 4. Notify HSA to evaluate and prepare to open shelter locations throughout the city for displaced residents near the shoreline.
- Notify National Park Service to clear the beaches and land, within their jurisdiction, of pedestrians and vehicles.
- Notify the CHP to clear the roadways within their jurisdiction of pedestrians and vehicles.
- Notify Coast Guard activate their Planned Response to a Tsunami protocol
- Send out an Alert SF notification
- Place regional mutual aid requests for additional resources to support evacuations, street closures, shelter needs, family reunification, and other response activities, that may include the following types of resources:
 - a. Buses and drivers
 - b. Law enforcement personnel and vehicles
 - c. Water search & rescue teams
 - d. Medical personnel and ambulances to support evacuees
 - e. Fire personnel
 - f. Public works crews and street clearing equipment
 - g. Generators and lighting systems
 - h. Food, bottled water, and bulk water storage systems
 - i. Animal control support
- Once the ICP or Dept. DOC's have given DEM/DES, or the EOC, direction to receive Department /Agency resources, the EOC will:
 1. Relay the Emergency Evacuation Routes - Traffic Plan to responding agencies, especially noting the Ingress Routes for Emergency Response Vehicles and the Egress Routes for evacuees.
 2. Road closures
 3. Relay number of staff and resource types responding to Equipment Staging Locations (for the Sunset, Richmond, Zoo, Lake Merced, Bay Side and Potrero Districts).
- **SFFD**, designated as Incident Commander, will work collaboratively with other Departments/Agencies to implement the following:
 - a. Obtain continual situational awareness and intelligence gathered from the EOC, other Departments, NWS, etc.
 - b. Establish a Unified Command Post at SFFD Division of Training at 2300 Folsom Street (at 19th Street) (Phone 970-2000, METS 2280)
 - c. Set-up a Mobile Command Van as the FDOC
 - d. Position CCSF ambulances throughout the City in order to respond to calls.
 - e. Notify SFPD and National Park Service to close beaches and portions of San Francisco Bay and initiate evacuations in the inundation risk areas



- SFPD, SFSD, and NPS use emergency vehicles with PA systems and bullhorns to make roving announcements
- f. Notify SFPD, SFSD, MTA-DPT, DPW, CHP and National Park Service to implement road & street closures in the inundation zones and provide support (personnel and vehicles) for designated traffic control points (*Attachment E*)
- g. Notify DOC/EOC of road closures
- h. Notify HSA, DPH, ARC, ACC, SFSD and the EOC to activate identified Care and Shelter Locations (*Attachment H*), establish security and crowd control measures
- i. Identify, open, and establish command and control of the Equipment Staging Locations in the City.
 - The GSA or the Logistics Section of the EOC may assist in identifying Equipment Staging Locations for the SFFD

*Additional actions are outlined in Section 2.2

Tsunami Impact: During an immediate Tsunami Impact, emphasis is on saving lives, controlling the situation, and minimizing the effects of the disaster. Immediate response actions include, but are not limited to:

- Search and rescue operations (Coast Guard, SFFD, SFPD)
- Emergency medical treatment (SFFD and DPH EMS)
- Open Care and Shelter sites (HSA, DPH, ARC)
- Securing the damaged areas (SFPD, DBI, DPW, PUC)
- Responding to sewage spills, hazardous materials or other public health risks (SFFD, DPW, PUC, DPH)
- Clearing debris from roads and streets (DPW)

Sustained Efforts: Assistance is provided to victims and efforts are made to reduce additional damage. Local, Regional, State and Federal resources (e.g. USAR, DMAT or other response teams) may be provided or requested to assist with these efforts. Response support facilities may be established.

Public Information

The public may be notified/warned, of the potential threat of a Tsunami and recommended actions they should take, using the following methods:

- Outdoor Public Warning System (sirens and public address) (DOT, SFPD, SFSD, NPS, CHP, and Coast Guard)
- EAS and EDIS notifications to local media (DOT)
- Public Address systems (emergency personnel will be withdrawn from the inundation area at least 30 minutes before the predicted arrival of the first wave) (DEM/DEC, SFPD, SFFD, SFSD, and emergency personnel (in vehicles))
- "Alert SF" public notification system – DEM or EOC

The DEM Public Information Officer (PIO) will coordinate all public information activities from the Joint Information Center (JIC) and may include:

- Establish a JIC
- Utilize Tsunami response information messages (*Attachment I and J*)
- Coordinate with field PIO's (specifically SFFD and SFPD)
- Broadcast messages to the public that may include:
 1. Turn on your radio or TV to your local emergency broadcast station



2. Residents in or close to a known inundation risk area, prepare to walk to higher ground on short notice
3. Evacuate low-lying unprotected areas such as beaches, parks, sports fields, Zoo, coastal trails, paths and roads
4. All Clear: Once the impact/risk area has been deemed safe for reentry, the DEM Director, in coordination with the Mayor, will authorize an issuance for an "All Clear" public safety message that will contain guidelines for re-entry into the impact/risk area. The message will be issued through the EAS and EDIS. The State NAWAS System will issue an "All Clear" message to local agencies no sooner than 2 hours after the estimated time of a projected wave arrival.

2.2 RESPONSE

Operations

Tsunami response objectives are to protect life and property in San Francisco and on Treasure Island. Tsunami response operations include immediate protective actions as:

- Evacuations
- Providing basic services (i.e. shelter, food, water, medical) to people who have evacuated the risk areas
- The SFFD, in collaboration with the EOC, upon confirmation of a potentially damaging Tsunami, will coordinate:
 - Staging response resources in anticipation of responding to the impact of the incoming Tsunami waves
 - Resources for clearing roadways, responding to medical emergencies, mass casualty issues, performing search and rescue operations, handling HazMat, downed electrical lines, and other dangerous situations

Roles and Responsibilities

San Francisco will use multi-agency, multi-discipline coordination in its response to a Tsunami threat or event. The EOC may be activated to facilitate coordination among various agencies and disciplines with responsibility for the event. DOCs may be activated to support and coordinate Department-specific response actions.

The following departments, agencies, and organizations may take immediate actions to a Tsunami Advisory, Watch, Warning, or Impact. Below are brief descriptions of their roles and responsibilities:

American Red Cross:

- Assist with opening and maintaining shelter services that includes: feeding, first-aid, disaster welfare inquiry services for displaced residents and visitors, etc.

Animal Care and Control:

- Activate the Animal Rescue Team
- Support opening temporary pet facilities
- Coordinate animal rescue operations
- Open ACC DOC



California Highway Patrol:

- Provide law enforcement mutual aid
- Implement road and street closures in the inundation zone (*Attachment B*)
- Assist with establishing and securing traffic control points (*Attachment E*)
- Use emergency vehicles with PA systems to make roving announcements

Coast Guard:

- Provide Mutual aid to San Francisco and Treasure Island
- Support Search and Rescue Operations
- Launch Coast Guard Air Station according to policy
- Notify commercial vessels and applicable facilities of Tsunami warning
- Close port to all inbound vessel traffic and encourage vessels to move to a safe location
- Conduct patrols of waterways within the affected zone to ensure maritime security

Department of Emergency Management/Division of Emergency Communications:

- Receive and relay the Tsunami Advisory/Watch/Warning/Occurrence to the DEM/DES Duty Officer or alternate
- Confirm receipt of Advisory/Watch/Warning with State NAWAS System
- Monitor follow-up information from the State NAWAS System
- Advise 911 callers if an evacuation is occurring
- Relay 911 calls received from inside the Inundation Area to the Incident Commander

Department of Emergency Management/Division of Emergency Services:

- Receive and assess the threat Advisory, Watch, Warning, Impact
- Notify and advise the Mayor and other members of the Policy Group;
- Authorize the activation of the Outdoor Public Warning System and other public notification systems
- Send alert message to the Tsunami Notification Alert List (*Attachment C*)
- Activate and support the Emergency Operations Center (EOC)
- Coordinate response activities for San Francisco and Treasure Island
- Appoint the Operations, Planning, Logistics and Finance Section Coordinators, as well as EOC support staff.
- Advise County leadership of the issuance of a Declaration of Local Emergency
- Coordinate response activities with the State Office of Emergency Services and other Regional, State, and Federal agencies
- Activate the Joint Information Center and establish a system to handle incoming inquiries from the public and media
- Coordinate the "All Clear" issuance and public announcements, including notifying all agencies previously alerted

Fire Department:

- Serve as Incident Commander
- Establish a Unified Command Post
- Set-Up Equipment Staging Locations throughout the City for responding emergency personnel, equipment and resources
 - Designate a Staging Area Manager to oversee each location
 - Prepare to stage and track response resources
- Support the SFPD's efforts in evacuations along the shoreline, throughout the neighborhoods, at the schools, restaurants, hotels, etc in the inundation zone.
- Assist with evacuating critical care facilities of non-ambulatory persons



- Request the EOC Logistics Section procure 20 wheelchair vans and 20 ambulances from companies to transport non-ambulatory individuals out of the inundation zones.
- Support the establishment of traffic control points utilizing SFPD, SFSD, and DPT
- Request fire and medical mutual aid through their respective coordinators
- Provide fire suppression
- Assist with providing emergency medical treatment and transport for the injured
- Coordinate hazardous material responses
- Coordinate NERT activities
- Coordinate search and rescue operations

General Services Agency:

- Coordinate logistical support throughout San Francisco and Treasure Island
- Open GSA DOC
- Send a liaison or support staff to the Logistics Section of the EOC

Human Service Agency:

- Open HSA DOC
- Open Care and Shelter trailers and sites in specified areas of town as directed by the Incident Commander or EOC.
- Coordinate support at shelters
- In collaboration with DPH provide necessary resources to evacuees at shelters
- Check on the welfare status of the pre-identified vulnerable population

Mayor's Office:

- Receive a briefing from the DEM Director and/or SFFD Unified Command
- Issue a Declaration of Local Emergency if needed (*Attachment I*)
- Determine if a partial or full evacuation is required in San Francisco and Treasure Island
- Meet with the Policy Group at the EOC
- Procure assistance from State and Federal Agencies

Medical Examiner's Office:

- Open DOC
- Assist the SFFD and DPH

MTA – Department of Parking and Traffic:

- Open MTA – DPT DOC
- Enforce traffic control points as directed
- Direct Ingress of emergency vehicles
- Direct Egress of evacuees out of the inundation area
- Identify alternate routes of travel
- Assist SFFD, SFPD, SFSD, DPW and PUC with traffic enforcement as requested

MTA - MUNI:

- Open MTA – MUNI DOC
- Provide transportation support (buses, LRV's, cable cars) for evacuations
- Assist with enforcing traffic control points if needed (*Attachment E*)
- Re-route or discontinue transportation service into the inundation area

National Park Service – Golden Gate Recreation Area

- Evacuate beach and other low-lying areas within the Golden Gate Recreation Area



- Using bullhorns and/or public address systems on emergency vehicles, make roving announcements on Evacuation Routes and Evacuation Assembly Sites

Neighborhood Emergency Response Teams (NERT)

- Assemble NERT volunteers per SFFD policy

Police Department:

- Open DOC
- Conduct and coordinate evacuations by:
 1. Traveling in emergency vehicles at 5 m.p.h. up and down each street in the inundation area making notifications to individuals in hotels, homes, apartment complexes, restaurants, shops, beaches, etc.
 2. Use PA system in vehicles to announce Evacuation Routes of travel
 3. Announce intersections for evacuees to board MUNI buses and LRV's to Evacuation Assembly Sites
 4. Encourage evacuees to use their personal vehicles noting travel routes
 5. Coordinate with SFFD the movement of non-ambulatory
- Coordinate and enforce Evacuation Routes and Traffic Control Points (*Attachment E*) with the SFFD, DPT, CHP, and NERT Teams
- Request law enforcement mutual aid as needed
- Secure a safe perimeter from the inundation zone and manage crowd control issues
- Patrol neighborhoods in anticipation of increased crime in the evacuation areas
- FOB will contact police stations to be on alert for Tsunami type activity (sieches) on Treasure Island, areas of the Marina, Fisherman's Wharf, South of Market and Potrero

Public Health:

- Open DOC
- Collaborate with SFFD and public safety personnel, to ensure people listed on the Disaster Registry are notified and provided with evacuation assistance or shelter-in-place guidance, as appropriate
- Provide DPH-EMS assistance as needed
- Provide public health support at Care and Shelter Locations
- Coordinate evaluation of and response to environmental issues
- Coordinate the evaluation and response to public health threats
- Notify hospitals and clinics

Public Utilities Commission:

- Open DOC
- Coordinate efforts to prevent/minimize the impact of flooding
- Coordinate efforts to minimize the contamination of drinking water
- Provide drinking water through the portable bagging system
- Reroute Utility access

Public Works:

- Open DOC
- Coordinate efforts to prevent/minimize the impact of flooding
- Conduct damage assessments and reconnaissance of public infrastructure
- Assist with Evacuation Routes and Traffic Control Points (*Attachment E*)
- Coordinate public works related mutual aid requests
- Coordinate clearing debris from roads and over-all debris management



Recreation and Parks Department

- Open DOC
- Notify site managers in potential inundation areas: SF Zoo, Golden Gate Park, Marina Green, Lincoln Park, Lower Great Highway, and Lake Merced Park
- Evacuate RPD staff and the public from RPD facilities in inundation areas, once notified
- Contact Care and Shelter representative Joe Medina 210-6480 for possible set-up

Salvation Army:

- Support evacuation centers by providing food to designated locations

Sheriff's Department:

- Open DOC
- Provide mutual aid assistance to the SFFD as requested by the Incident Commander
- Provide mutual aid assistance to SFPD
 1. Assist with PA notifications to residents through roving vehicle patrols of neighborhoods
 2. Assist with securing Traffic Control Points (*Attachment E*) at designated intersections
- Coordinate facility security for shelters, if requested

Technology Department (DOT)

- Open DOC
- Activate the Outdoor Public Warning System and other public notification systems, when authorized
- Issue local EAS and EDIS messages for San Francisco and Treasure Island
- Release continual local Emergency Alert Messages
- Ensure telecommunications and data services are functional in EOC, DOC's and city

Unified School District:

- Evacuate students and staff as required
- Open designated school Evacuation Assembly Sites and assist in receiving evacuees

Zoo:

- Announce on the Public Address System the closure of the Zoo and evacuation route
- Secure the animals
- Clear all patrons from the zoo in an expeditious manner following designated routes of travel when leaving the zoo parking lots
- Request mutual aid assistance through the EOC

2.3 EVACUATION

Evacuation Plans

Evacuations are necessary when a Tsunami Warning is issued that affects San Francisco, and/or the State NAWAS System declares that "significant inundation" is predicted.

Evacuation Plans consider:

- Optimum evacuation routes away from the shoreline. The primary objective is to move up and inland.
- Evacuation Routes - Traffic Control Plans (*Attachment E*). Law enforcement agencies can use auxiliary and volunteers to staff Traffic Control Points.



- Evacuation Assembly Sites (*Attachment F*) should have the capacity to shelter evacuees. Landmarks include: schools or other well-known public facilities
- Simplified maps (*Attachment B*) depicting Tsunami Inundation Zones
- Notification and evacuation procedures for first responders and field personnel

Evacuation Authorization

A partial or full evacuation of the run-up area will be decided by the Mayor, with guidance from the DEM Director and/or the Policy Group (if the tsunami is a distant-source event that allows time for a consultation). Once approved, DEM or the EOC will initially send local EAS and EDIS messages ordering evacuations, until DOT is able.

When a near-source tsunami warning is issued, and there is not enough time for a full consultation, the following individuals or their designee can order an evacuation:

- Mayor
- DEM Director
- SFFD Fire Chief
- SFPD Police Chief
- DPH Director

Evacuation Priorities

The first priority is to clear people from:

- Ocean Beach and all beaches on the City's west shore (NPS and SFPD)
- San Francisco Zoo (RPD; Zoo staff utilizes their internal evacuation plan)
- Sidewalks and inundation area streets (SFPD, SFSD, SFFD, DPT, DPW)
- Lake Merced Park, Fort Point, Marina Green, Lincoln Park (SFPD and RPD)
- Soccer fields near the beach in Golden Gate Park (SFPD and RPD)
- Janet Pomroy Center (and any other facility that primarily serves people with disabilities) (SFFD)

SFPD, in conjunction with SFSD, DPT, and CHP will institute Traffic Control Points (*Attachment E*), to prevent people from entering the inundation area.

The second priority is to clear people residing in high risk areas should a Tsunami strike their area. The following are examples of people living in high risk areas:

- People living in older wood-frame or single story homes close to the beach
- People with medical conditions that are dependent on electricity or other utilities
- People in low lying areas that could be overtopped by waves (e.g. zoo);
- Motels, schools, care facilities, hospitals, and other high occupancy facilities.

Evacuation Instructions

- SFFD serves as the Incident Commander
- The primary communications method for warning people indoors will be through the
 1. Media: radio, internet, television, and EAS
 2. Roaming public address notifications from emergency vehicles, if time allows
 3. SF Alert
- All evacuations will be voluntary
- Evacuations will be coordinated by SFPD, in collaboration with the Fire Department



- NPS police will evacuate and secure beaches and other low-lying areas within the Golden Gate National Recreation Area
- Evacuation instructions, via public messaging, informs people to
 1. Use their personal vehicles or walk to higher ground:
 - a. In Richmond District above 47th Ave
 - b. In the Sunset District above 45th
 - c. Near the Zoo and Lake Merced, above Sunset Blvd
 2. Follow Tsunami Evacuation Route Signs
 3. Take their pets, clothing for the climate, and vital papers (identification, insurance, and other important information)
 4. Note Evacuation Assembly Sites (*Attachment F*) for evacuees
- People with disabilities (and those who assist them) will be allowed to drive out of the area, if personal vehicle use was prohibited due to poor road conditions.
- EMS units will transport people who need assistance or are medically unable, relocating them to care and shelter facilities.
- Pets will be allowed on evacuation buses and at Evacuation Assembly Sites.
 1. Separate pet care facilities will be established by Animal Care & Control if Evacuation Assembly Sites or shelters are established for the response

Residents will be encouraged to evacuate immediately

Evacuation Ingress and Egress

Evacuation routes will be established by the SFPD, in collaboration with SFSD, DPT, SFFD-NERT, and CHP. *Attachment E* provides Evacuation Routes and Traffic Control Points.

- Only emergency vehicles will be allowed ingress access to any area in the inundation zone
- Designated egress routes for evacuees will ensure timely evacuations.
- Tsunami Evacuation Route signs are posted on coastline in the Richmond and Sunset Districts, and on Skyline Blvd. near the Zoo and Lake Merced.
- SFPD will staff traffic control points, until the above listed Departments have sufficient resources to implement road and street closures.
- DPW will place message boards at requested intersections to divert traffic.
- SFPD, SFSD, CHP, and NPS will provide security by setting up roadblocks, barricades, and/or a system of patrols.

By Vehicle or On Foot

People residing or staying in the potential inundation zone need to evacuate at least 5 blocks by driving or walking uphill (east) or until they reach an Evacuation Assembly Site (*Attachment F*). This is considered the safe refuge distance

- In Richmond District evacuate above 47th Avenue
- In the Sunset District evacuate above 45th Avenue
- Near the Zoo and Lake Merced, evacuate above Sunset Blvd.

By Bus

Buses will be staged to transport people on foot to Evacuation Assembly Sites.

- **In the Richmond District** on Cabrillo Street (between 46th and 47th Ave)
- **In the Sunset District at:**
 - Lincoln Blvd. and 48th Avenue
 - On Noriega Street at 48th Avenue



On Taraval Street at 47th Avenue (Buses and LRV's will be used if possible)
On Sloat Blvd. at 47th Avenue

If the warning occurs during the day, 9AM to 3PM, MTA-MUNI can provide:

- At least 10 diesel buses in 30 minutes by diverting buses from routes 29, 71 and 23
- Evacuees may be transported to Care and Shelter facilities within 2-5 hours of their evacuation or stay in an Evacuation Assembly Site.

During the evening shifts, similar support may take longer as re-routing would occur.

Once an area is closed, SFPD, SFSD, DPT, SFFD-NERT, and CHP will establish Traffic Control Points. Entry/reentry by the public will be prohibited without authorization to release the area for reentry.

Evacuation - Care & Shelter

When residents evacuate the Tsunami inundation zone, Evacuation Assembly Sites will open at schools or other public facilities (*Attachment H*) safely outside the risk area. When an evacuation order is issued, the American Red Cross, Bay Area Chapter, Salvation Army, and other support agencies will be notified and requested to provide assistance.

If a damaging Tsunami displaces residents, the Care and Shelter facilities will be provide short-term emergency housing.

Specific Care and Shelter activities are in the San Francisco Care and Shelter Plan and in the Mass Care, Housing and Human Services Annex to the ERP.

Evacuation - Animal Control

When residents evacuate the Tsunami inundation zone, Animal Care and Control will coordinate shelters to house and care for displaced animals. Animal Rescue Teams, volunteer programs, and relationships with the California Veterinary Medical Association, and other non-profit animal groups may support their response activities.

Emergency pet sheltering and care may be at a temporary shelter(s) close to the emergency shelters for displaced residents, or at an existing Animal Care and Control facility, depending on the situation. (See San Francisco Care and Shelter Plan and the Mass Care, Housing and Human Services Annex to the ERP. Specific animal control activities are in the San Francisco Animal Response Annex to the ERP.).

Evacuation Re-entry Procedures

Evacuated areas must remain closed to the public after the **threat of a Tsunami** no longer exists. The SFFD, in coordination with the EOC and the Mayor, will decide when to authorize re-entry.

- The closed area will reopen by issuing public safety announcements
- Message boards from the Traffic Control Points will be removed
- Direction to residents at Traffic Control Points will ensure safety and sanitary precautions are provided

Assessments to the impacted area, **following significant flooding**, will be conducted before release for public re-entry:

- Extent of damage to public infrastructure, safety of roads, bridges, etc.



- Presence of public health risks in water, broken sewer lines, downed utility lines, animal or human remains, etc.
- Presence of hazardous materials or other risks

Specific procedures for limited reentry, **following a damaging Tsunami**, will be established based on the situation.

- If a Tsunami causes significant flooding and damage, the area may be hazardous and the potential for looting of damaged homes and businesses exists.
- Public reentry will be limited to residents and business owners and may be limited in duration.
- A valid driver's license or other form of government issued identification, (copy of a business license for a business owner), indicating residency inside the restricted area will be required for entry.

Types of Evacuations

Evacuations are full, partial or vertical in-place evacuations

- Full evacuations imply that the entire population, in the inundation zone, would need relocating to a designated area, a safe distance from the impact.
- Partial evacuation refers to a select evacuation, of a high-risk section of the run-up area, which places people in harms way.
- Vertical In-Place evacuations instruct people living in high-rise buildings to evacuate to the upper floors, beyond the worst-case run-up height.
 - Not all structures are suitable for vertical evacuations even if the structure technically provides adequate height above the projected inundation level (i.e. older, wood frame buildings directly in the path of a tsunami wave may not survive the wave impact and could collapse).
 - Vertical evacuations are for engineered high-rise structures, located on the upper fringes of the inundation area or when there is insufficient time to evacuate, before a near-source Tsunami wave arrives

2.4 PUBLIC EDUCATION AND AWARENESS

In order for the community to prepare and respond to a Tsunami, public awareness and educational outreach programs were conducted through:

- Posting Tsunami Evacuation Route signs along the coastline
- Posting Tsunami Evacuation Assembly Site signs at 6 school sites
- Conducting Spotter Training for Dispatchers and Ham Radio Operators
- Placement of door hangers to residents in the Tsunami Inundation Zone
- The Richmond and Sunset Districts ran a Tsunami article in their newsletter
- The Mayor's Office of Neighborhood Services distributed pamphlets at grocery store
- Tsunami pamphlets were distributed at local weekend fairs
- 72 Hours.Org website included a link to the Tsunami Inundation Map



SECTION 3 – RECOVERY

At the onset of an emergency, actions taken enhance the effectiveness of recovery operations. Recovery is both immediate short-term activity, intended to return vital life-support systems to operation, and long-term activity designed to return infrastructure systems to pre-disaster conditions. Recovery actions include cost recovery, required to receive state and federal reimbursement, when available. (See San Francisco's Recovery Plan, and Recovery and Mitigation Annex to the ERP for short and long-term recovery).

3.0 DAMAGE ASSESSMENT

Post-disaster damage assessments, of public and private property are coordinated through the Infrastructure Branch, in the Operations Section, of the EOC. Damage assessment activities will be coordinated using procedures outlined in SEMS, described in the ERP.

3.1 DEBRIS REMOVAL

Following a Tsunami or flooding event, removal of debris from San Francisco-owned streets, sidewalks, and structures will be coordinated through the Infrastructure Branch of the EOC. This Branch maintains plans and coordinates the disposal of hazardous materials that may result from the impacts of a disaster.

Street Cleaning

After a flooding event, street cleaning minimizes the number of cleanings required.

- Multiple cleanings increases the moisture level in the streets and facilitates the survival of microbial.
- After cleaning, using City water, sufficient time will be allowed for sun (ultraviolet light) exposure and drying to kill any harmful microbial.
- Persons should not contact the street with their bare hands or feet for two days after it has dried and exposed to sunlight.
- Property owners can request street cleaning by calling 311.

Sidewalk Cleaning

- Property owners maintain responsibility for cleaning their own sidewalks.
- DPH advises homeowners to wash their sidewalks with City water and allow the water to drain into storm drains.
- A two-day period of sun (ultraviolet light) exposure is necessary to dry out moisture and kill harmful microbial.
- Persons should not contact the sidewalk with their bare hands or feet for two days after it has dried and exposed to sunlight.

Landscaped Areas Cleaning

DPH advises homeowners to wash down landscaped areas with City water.



- Cleaning of landscaped areas on the sidewalks or on personal property is the responsibility of the property owner.
- Persons should minimize direct contact with the landscaped areas until it has dried and exposed to sunlight for at least two days.

3.2 PUBLIC OUTREACH

Immediately following a Tsunami or other flood, a series of outreach activities will take place in the affected area, including:

- DPW and PUC: Communications and outreach staff from DPW and PUC will send response crews to the area to provide residents and businesses with multilingual informational materials (flood brochures, door hangers with specific hazards, and response information)
- DPH: Dispatch inspectors to assess the flooding impact on the public health and to help support individuals with specific recovery needs. DPH will respond to requests for assistance from other city departments and assist with the evaluation of potential public health risks. They will refer individuals to services based on need.
- MONS: The Mayor's Office of Neighborhood Services will provide a "needs" assessment within the affected area and ensure residents are connected with services to support their recovery. MONS can advocate for the involvement of other City departments in response to identified needs.
- Community Agencies: Community organizations like the American Red Cross, Salvation Army, or Community Agencies Responding to Disasters (CARD) will assist affected individuals with care and shelter, or other identified recovery needs.

After an assessment of needs has been completed the above listed agencies will:

- Expedite the delivery of required services
- Conduct inter-agency coordination and communication to ensure receipt of needed services for a successful recovery to the impacted area.
- Continue to monitor the area to identify needs or additional problems.

3.3 DISASTER ASSISTANCE PROGRAMS

State and Federal Disaster Assistance

Disaster assistance programs are available to local governments, small businesses, and private residential property owners. Disaster assistance generally comes in four forms:

1. Mutual Aid: Non-financial assistance from local neighboring agencies or the State, which serves to assist the local government in responding to emergencies. Typically, mutual aid consists of labor, materials, and/or equipment. A local emergency must be declared to qualify for assistance.
2. Public Assistance: Financial assistance from the State to "public" or government agencies. A local and State emergency must be declared to qualify for assistance.



3. Individual Assistance: Financial assistance from the Federal government to private homeowners or businesses. However, any assistance from the Federal government or FEMA requires that the disaster be declared a State and Federal emergency.
4. Small Business Administration (SBA) Disaster Loan Assistance: Financial assistance from the Federal government to private homeowners or businesses. SBA Disaster Loan Assistance applies when at least 25 homes/businesses sustain uninsured losses or damages equivalent to at least 40% of the property value. No emergency declaration is required.

Local Non-Profit Disaster Assistance

Local non-profit organizations that offer rebuilding assistance to lower income person(s) are:

American Red Cross

85 Second Street
San Francisco, CA 94105
Tel: 415.427.8000
<http://www.bayarea-redcross.org>

The American Red Cross offers limited grants for home repairs following natural disasters. They also provide referrals to other local and national agencies that provide clean up, repair and rebuilding assistance.

Habitat for Humanity, San Francisco

78 Ocean Avenue
San Francisco, CA 94112
Tel: 415.406.1555
Fax: 415.406.1551
<http://www.habitatsf.org>

Habitat for Humanity offers contracting services for larger housing development projects.

Rebuilding Together, San Francisco

Pier 28
San Francisco, CA 94105
Tel: 415.905.1611
Fax: 415.905.1610
<http://www.rebuildingtogethersf.org/>

Rebuilding Together offers renovation assistance for single-family homes and schedules their contracting activities during one or two weekends in April or May every year.



SECTION 4 – TSUNAMI ANALYSIS

4.0 DEFINITIONS

A Tsunami is a series of waves generated in a body of water by an impulsive disturbance along the seafloor that vertically displaces the water. Subduction earthquakes at plate boundaries cause a Tsunami. However, Tsunamis can be generated by submarine landslides, the collapse of volcanic edifices, and violent submarine volcanic eruptions.

A single Tsunami event may involve a series of waves, known as a train, of varying heights. In open water, Tsunamis have long time lapses (from minutes to hours) before the next wave top passes a point after the previous one. A Tsunami wavelength can extend up to several hundred miles. The actual height of a Tsunami wave in open water is generally only 1 to 3 feet and is often practically unnoticeable. The Tsunami wave can travel across the ocean at 700 miles per hour. As the wave approaches land, the sea shallows and the wave no longer travels as quickly, and begins to “pile up” as the wave-front becomes steeper and taller. Therefore, the wave can increase to a height of 90 feet or more as it approaches.

Tsunamis not only affect beaches that are open to the ocean, but also bay mouths, tidal flats, and shores of large coastal rivers. Tsunami waves can diffract around land masses. Since Tsunamis are not symmetrical, waves may be stronger in one direction than another, depending on the source and surrounding geography. Tsunamis do propagate outward from their source, so coasts in the shadow of affected land mass are usually safe.

Tsunami Terminology:

- **Tsunami Information Statement** – a Tsunami Information Statement is issued to **inform emergency officials and the public that an earthquake has occurred**, or a Tsunami Advisory, Watch or Warning has been issued for another section of the ocean. In most cases, information statements are issued to indicate there is no threat of a destructive Tsunami and to prevent unnecessary evacuations. An information statement may caution about the possibility of destructive local Tsunamis. They may be re-issued with additional information, though normally these messages are not updated. An Advisory, Watch or Warning may be issued for the area, if necessary, after analysis and/or updated information becomes available.
- **Tsunami Advisory** – a Tsunami Advisory is issued due to the **threat of a potential Tsunami** that may produce strong currents or waves dangerous to those in or near the water. Coastal regions, historically prone to damage due to strong currents induced by Tsunamis, are at the greatest risk. The threat may continue for several hours after the arrival of the initial wave, but significant widespread inundation is not expected for areas under an advisory. Appropriate actions taken by local officials may include closing beaches, evacuating harbors and marinas, and repositioning ships to deep waters when there is time. Advisories may be updated to continue the advisory, expand or contract affected areas, upgrade to a Watch or Warning, or cancel the advisory.
- **Tsunami Watch** – a Tsunami **Watch is issued to alert emergency officials and the public of an event that may later impact the area**. The Watch may be



upgraded to a Warning, down graded to an Advisory, or canceled based on updated information and analysis. Therefore, emergency management officials and the public should prepare to take action. Watches are issued based on seismic information **without confirmation that a destructive Tsunami is underway.**

- **Tsunami Warning** – a Tsunami Warning is issued when **a potential Tsunami**, with significant widespread inundation, **is imminent or expected**. Warnings alert the public that widespread, dangerous coastal flooding accompanied by powerful currents are possible and may continue for several hours after arrival of the initial wave. Warnings also alert emergency management officials to take action for the entire Tsunami hazard zone. Appropriate actions taken by local officials may include the evacuation of low-lying coastal areas, and the repositioning of ships to deep waters if there is time. Warnings may be updated, downgraded, or canceled. To provide the earliest possible alert, initial warnings are normally based only on seismic information.

TYPE	Definition	Relative Risk
Tsunami Warning	Waves may impact SF coast w/in 1 hour	High
Tsunami Watch	Waves are 4-6 hours from CCSF coastline	Medium
Tsunami Advisory	Moderate impact is possible	Low-Level
Tsunami Information Statement	No threat of destructive Tsunami. Information on another area other than CCSF	Information Only – No Risk

Locally Generated Tsunami vs. Distant Source Tsunami

San Francisco is on a portion of the Pacific Plate called the “Ring of Fire”. The Pacific Ocean is considered “prime Tsunami territory”. This location makes our area vulnerable to Tsunamis ranging from near our shore (near-source) to thousands of miles away (distant-source). Tsunamis generated by a source close to shore can arrive in a matter of 30 minutes, leaving little time to react to the threat and initiate evacuations or protective actions.

Scientists at USGS¹ believe the majority of Tsunami related energy from a rupture on the Cascadia Subduction Zone would travel westerly, away from the West Coast and toward Japan. While the bulk of the energy may be away from our coast, a large 7.5 or greater magnitude earthquake on the Cascadia Subduction Zone could create a damaging Tsunami.

Other local earthquake faults that could generate a Tsunami include the San Gregorio, San Andreas and Point Reyes faults². Undersea landslides are another potential source of a Tsunami, as are large subduction earthquakes off the coast of Alaska, Japan or Russia.

Tsunamis generated by distant sources can provide hours of warning, as illustrated below³:

¹ Interview with Eric Geist – USGS Menlo Park

² Local Tsunami Source Regions of California -Mc McCarthy et. al. 1993

³ NOAA - <http://wcatwc.arh.noaa.gov/tt/tsafr.gif>



Location	Arrival Time
Pacific Northwest	1.5 – 2 hours
Alaska	5 hours
Russia	8.5 – 9 hours
Japan	10 – 11 hours

Seiches

Seiches are oscillations of enclosed and semi-enclosed bodies of water, such as bays, lakes or reservoirs, due to strong ground motion from seismic events, wind stress, volcanic eruptions, large landslides and local basin reflection of tsunamis. Seiches can result in creation of long-period waves that can cause water to overtop containment features or run-up on adjacent landmasses, similar to tsunami run-up.

Inside the San Francisco Bay, the area of potential inundation from a Seiche runs from the Palace of Fine Arts to the Central Basin including Treasure Island. Property damage could impact Treasure Island, the Marina, port facilities, cruise ship docks, the Presidio, Fisherman's Wharf area, and along the Embarcadero to China Basin.

4.1 TSUNAMI WARNING SYSTEMS

The National Oceanic and Atmospheric Administration (NOAA), operates the Tsunami Warning System with centers located in Hawaii and Alaska. The State NAWAS System provides warnings to the West Coast and Alaska.

The Warning Centers are linked to the Advanced National Seismic System (ANSS) that monitors earthquakes within the United States, to the international seismic monitoring systems and to a system of tide gauges and buoys. The California Integrated Seismic Network (CISN) also provides information regarding the magnitude and location of California earthquakes and a quick link to the WC/ATWC.

Tsunami notifications are initially based on seismic data; the initial notification is normally updated once additional information is available, at least every 30 minutes. The status of a Watch or Warning can be upgraded, downgraded or the impact area expanded based on the new information.

4.2 POTENTIAL IMPACTS

Significant Tsunamis can cause a wide variety of direct and in-direct impacts as tragically illustrated by the 2004 Southeast Asia Tsunami. The potential impacts include:

- Loss of life (human and animal)
- Mass injuries
- Damage to docks, piers, boats and ships
- Destruction of homes and businesses from the impact of waves and debris, flooding, buildings floating off foundations and scouring as water recedes
- Disruption of utilities and communications systems
- Damaged or destroyed roadways and bridges
- Hazardous material spills
- Fires
- Transportation accidents



- Damage and disruption of ecologically sensitive areas (e.g. wildlife refuges)
- Disruption of the economy (especially tourism and fishing industries)

Tsunami waves cause damage sometimes from the direct impact of the velocity of the waves (and the debris they carry), and other times as slow rising water that floats buildings off their foundations. The action of receding water can undermine structures and roads and carry entire structures for significant distances.

4.3 ESTIMATED INUNDATION ZONE

The California State Office of Emergency Services working under the California Seismic Hazard Mapping Act created Tsunami Inundation Map for San Francisco. Based on the computer models of our “worst case” scenario event, they estimate that the coastline could experience a 39 feet (12 meters) run-up in some locations. The map is intended for use as evacuation planning tools (*Attachment B*). The Tsunami run-up zone information is approximations due to limitations in modeling and baseline coastal data.

People caught in unprotected areas when the Tsunami waves reach shore face the greatest risk for loss of life or injury. People on beaches, standing or walking on beachfront sidewalks or driving on local streets can easily be drowned by the incoming waves, be struck by floating debris, or carried out to sea as the water recedes.

Extent and Probability of Future Events

Scientists have estimated that a 100-year return period Tsunami wave run-up elevation at the Golden Gate Bridge of 8.2 feet (National Geodetic Vertical Datum), but this wave run-up would dissipate as it moved eastward. By the time it reached the East Bay (at Alameda), it would be half as high.

Because the majority of the region's faults are strike-slip faults, a Tsunami is not expected to be a major threat as a result of a regional earthquake. The primary Tsunami threat along the central California coast is from distant earthquakes along subduction zones elsewhere in the Pacific basin, including Alaska. Since 1877, Alaska earthquakes have produced Tsunami run-ups in the Bay Area nine times or on average, every 28 years. Historically, the run-ups from these events have been less than 1 foot.

Coastal Risk Areas

The Inundation Area extends from Sutro Heights Park on the North, to the San Francisco County Line on the South (Ocean Beach), running north to south and parallel from 46th Avenue to the San Francisco Zoo. At that point the inundation line moves east to include the Zoo grounds and Lake Merced. Approximately 45 blocks of the Sunset District and 3 blocks of the Richmond District are in the affected area (*Attachment B*).

Facilities in Risk Area

San Francisco Zoo
Lake Merced Park
Lakeshore Plumbing Station
West Side Sewage Treatment Plant
Western edge of Golden Gate Park



Facilities Adjacent to Coastal Inundation Area

Janet Pomroy Center	at 207 Skyline Blvd. (center for people with disabilities)	
Fire Station #23	at 1348 45 th Avenue	(SFFD)
Independence High School	at 3045 Santiago St., cross street 42 nd Ave	(SFUSD)
Noriega Child Dev. Center	at 1775 44 th Avenue, cross street Noriega	(SFUSD)
Rivendell School	at 4501 Irving Street	(SFUSD)
Francis Scott Key School	at 1530 43 rd Ave., cross: Kirkham	(SFUSD)
Ulloa School	at 2650 42 nd Avenue, cross street Vicente	(SFUSD)

San Francisco Bay Risk Areas

The area of San Francisco inside the Bay that may be at-risk runs from Fort Point, along the Embarcadero, around by the Bay Bridge anchorage to Hunter's Point. Treasure Island, located half way between San Francisco and the East Bay, with the combination of near-sea level altitude and infill construction is at significant risk during any significant earthquake or Tsunami. An estimated increase in wave heights (above normal wave height of the tide cycle) inside the Bay, could reach 10 feet (3m).



SECTION 5 – PLANNING

5.0 PLANNING ASSUMPTIONS

1. San Francisco will utilize SEMS, NIMS and the NRP as a basis for planning, preparedness, and response to emergency situations.
2. Distant-source events may provide a 3 hour warning allowing for full EOC activation.
3. Local-source events have less than 60 minutes lead-time, requiring immediate action. Time will be limited for full activation of the EOC before impact.
4. The largest Tsunami wave normally occurs in the first 5 waves.
5. Large local earthquakes, 7.0 or greater magnitude, can potentially create Tsunamis through water displacement or by triggering a submarine landslide or slump.
6. The tsunami warning system will take on average 7-10 minutes to identify a Tsunami threat and communicate it to the media and state warning centers.
7. Current Tsunami Inundation and Run-up Maps are theoretical worst-case models. Actual events may produce more or less inundation.

5.1 PLANNING AND MITIGATION

Planning activities ensure long-term reduction of Tsunami and flooding potential in San Francisco. Mitigation activities focus on implementing alternatives to reduce the risk of Tsunami related damage or injuries in the City:

- Maintenance of seawalls and other similar structures
- Increased street/sidewalk landscaping to reduce impermeable surfaces in the City
- Permeable pavements and/or gutters to reduce surface runoff into the sewer system
- Storm water detention basins or wetlands in flood-prone regions
- Separate sewers in areas of the City
- Maintenance, testing, and public education for the Outdoor Public Warning System

5.2 PUBLIC INFORMATION CAMPAIGN

San Francisco residents and visitors should be educated on actions to take before, during and after a Tsunami occurs. Following simple protocols may reduce the risk of harm to themselves and to rescue personnel offering aid. Residents who need evacuation assistance are encouraged to join the Disaster Registry Program and develop a “personal buddy system” with their neighbors.

Information regarding how the public can register with the “Roam Secure” public notification system will be fully integrated into the CCSF public disaster education program. The Roam Secure system allows members of the public to receive emergency text messaging via e-mails, cell phones or digital paging/messaging systems, as well as to sign up on-line, specifying the types of messages they want to receive.

Several types of information are available to help residents and visitors to understand Tsunamis, potential impact, and how to prepare:

- Inundation Map
- Tsunami Preparedness Brochure
- Tsunami Information on the websites listed at the end of this section



CCSF disaster public information programs include a variety of formats and languages. Tsunami education material is an integral part of our disaster preparedness information that provided at different events:

- Street Festivals
- Town Hall/Neighborhood Meetings
- Fleet Week Disaster Education Fair
- Emergency Preparedness Events
- NERT Classes
- 1906 & Loma Prieta Earthquake Anniversary Activities
- School Festivals
- CBO Events
- Disaster Council

Websites

San Francisco DEM maintains a public disaster preparedness information website at <http://72hours.org>.

Up-to-date information regarding ocean wave heights is available on the University of California, San Diego <http://cdip.ucsd.edu> website. Information regarding Bay tides is available on the U.S. Geological Survey website <http://sfports.wr.usgs.gov/>. Comprehensive information regarding Tsunamis is available on the NOAA Tsunami Warning Center website <http://wcatwc.arh.noaa.gov/>.



SECTION 6 – PLAN CONSIDERATIONS

6.0 RELATIONSHIP TO OTHER PLANS

This is an Annex to San Francisco's ERP. This Annex outlines a broad response concept with attachments showing detailed information for each area. City departments, local agencies, and organizations with assigned response tasks should develop specific response procedures and checklists to support this plan.

6.1 AFTER-ACTION REVIEW

Within one month of a major incident, DEM will contact all participating agencies and convene an after-action review of the incident. DEM will prepare a post-incident report including recommendations for improving response to future incidents, and modifications to the strategies and procedures included in this plan. A copy of the post-incident report will be distributed to all participating agencies.

6.2 PLAN TESTING, TRAINING AND EXERCISES

DEM provides other San Francisco departments and partner agencies with a comprehensive training program to ensure that emergency responders and managers have received training in SEMS, use of emergency response equipment and supplies, health and safety, public notification, posting incident debriefings, and other emergency response subject material.

DEM will develop and conduct periodic Tsunami response exercises for emergency responders and managers, utilizing the exercise as another opportunity to evaluate and revise this Annex, as appropriate.

6.3 DOCUMENT MANAGEMENT AND DISTRIBUTION

The Tsunami Response Annex will be reviewed and revised, on a bi-annual basis. DEM will initiate the process, which will engage the support of departments with relevant responsibilities. Each revision of the Annex will be authorized by identified approval and advisory authorities, as stated in current CCSF administrative codes. The Annex may be modified as a result of post-incident analyses and/or post-exercise critiques. It may also be modified if responsibilities, procedures, laws, rules, or regulations pertaining to emergency management operations change.

Those departments having assigned responsibilities under this Annex are obligated to inform DEM when organizational or operational changes affecting this plan occur or are imminent. Changes will be published and distributed to relevant organizations.



ATTACHMENT A

DEM/DES Duty Officer Tsunami Checklist – Watch or Warning

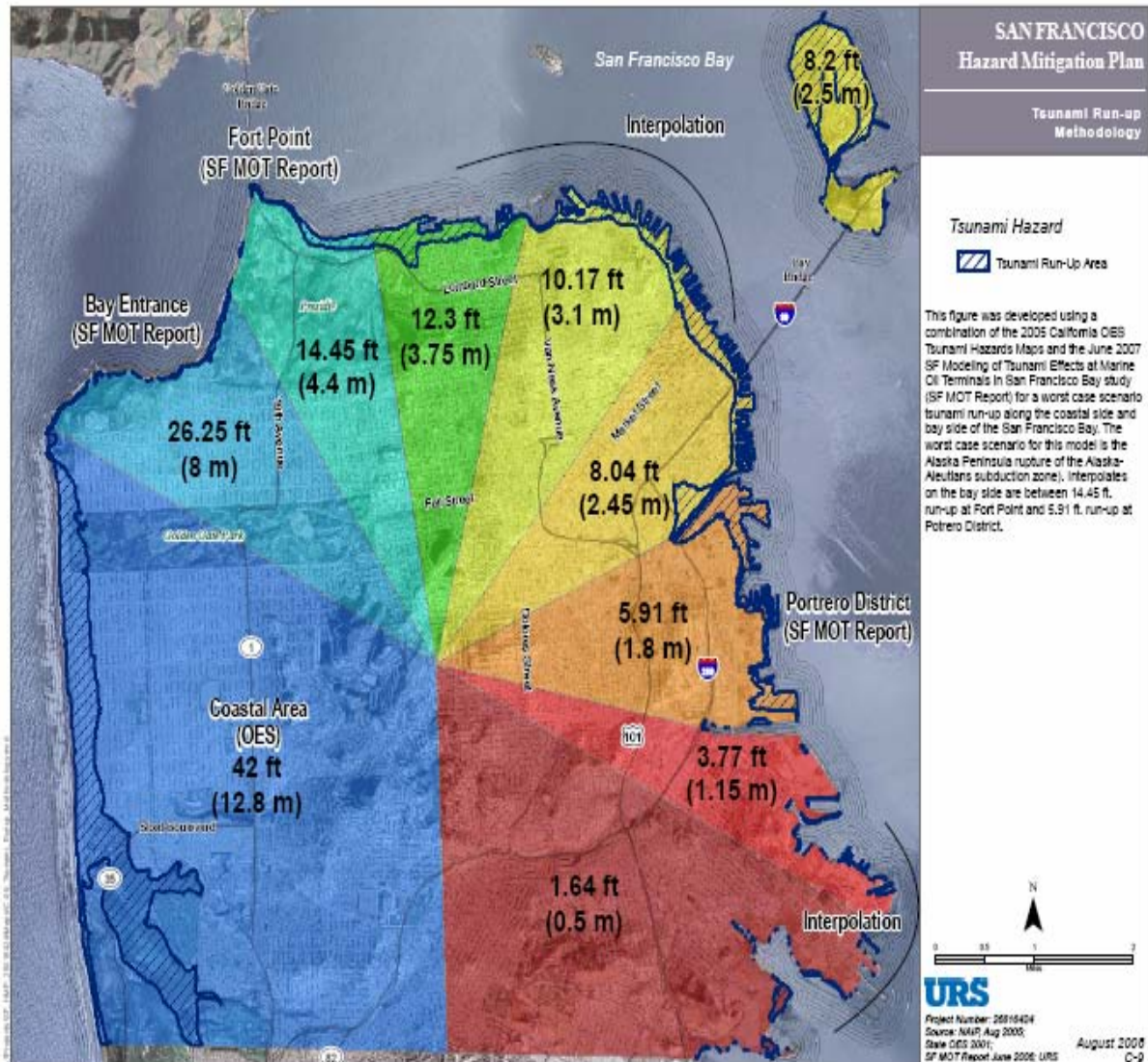
- ☐ **Collect Intel** on the event location by contacting the State Warning Center at 916-845-8911 and review the State NAWAS System teletype with DEM/DEC.
 - Time the Information Statement, Advisory, Watch or Warning was issued
 - Confirm that CCSF is covered under the Watch or the Warning
 - If an earthquake is the source event, what was the magnitude and location
 - Expected time of the first Tsunami Wave arrival to our shore
 - Projected flooding potential: NOAA will designate 1 of 3 levels from “Tsunami Not Known” to “Major Inundation”
- ☐ **Brief DEM Director/designee.** Receive authorization to:
 - Activate the Outdoor Public Warning System - including which zones: Coast and/or Bay, only if the Tsunami area includes both, and Treasure Island
 - Notify DEM/DES staff to report for duty
 - Active the Tsunami Response Annex
 - Order beaches or other low-lying areas evacuated
 - Determine partial or full activation of the EOC
 - Determine how calls from the public and media will be handled (activation of the JIC)
 - Contact the media and provide a briefing on local actions
 - Contact the Mayor's Office PIO to:
 1. Alert them of the situation
 2. Provide a briefing
- ☐ **Call Dept.'s/Agencies - Tsunami Notification Alert List** (*Attachment C*)
- ☐ **If evacuations are authorized**, contact DOT to:
 1. Release EAS and EDIS messages (*Attachment I & J*)
 2. Activate Outdoor Public Warning System
- ☐ **If evacuations are authorized**
 1. Open EOC in full activation status
 2. Contact MTA – MUNI to deploy buses and LRV's (*Attachment E*)
 3. Alert other CCSF EOC personnel of the situation and request assistance
 4. Provide briefing to arriving management staff of the EOC
 5. Contact San Mateo County Office of Emergency Services at 650-363-4790 and the Marin Office of Emergency Services at 415-499-6584 to brief them and coordinate our response actions and public messages
- ☐ **Notify within DSW Alert** - Incident Action Team
- ☐ **Activate “Alert SF”** notification system for the Tsunami group
- ☐ **Contact the Duty Officer, at State OES Coastal Region**, and prepare to receive and deliver a situation update. Determine if the Coastal Region will hold a situation conference call or provide regular situation updates

- ☐ **If a Tsunami Watch was issued, without confirmation of a Tsunami actually being created**, continue to monitor the State NAWAS System for situation updates.
- ☐ **Update the DEM Director** or designee as requested.
- ☐ **Issue EAS and EDIS Messages Tsunami Watch** (*Attachment I*)



ATTACHMENT B

City & County of San Francisco Coastal Tsunami Inundation Map



Source: San Francisco Hazard Mitigation Plan, August 2008

**ATTACHMENT C**
Notification Alert List – By Department/Agency*

Department/Agency	Office/Business Phone Number
311	3-1-1
American Red Cross	415-427-8000
Animal Care & Control	415-554-6364
California Highway Patrol	800-835-5247
Coast Guard	415-399-3547
Department of Emergency Management	415-558-3800
Fire Department	415-558-3500
Human Services Agency	415-557-5000
Medical Examiner's Office	415-553-1694
Municipal Transp. Agency	3-1-1
Nat'l Park Service (Golden Gate Rec. Area & Presidio)	415-561-4700
Police Department	415-553-0123 (non emergency)
Port of San Francisco	415-274-0400
Public Health	415-554-2500
Public Utilities Commission:	415-554-3289
Public Works	415-554-6920
Recreation and Parks	415-831-2700
Sheriff's Department	415- 553-1430
Technology, Dept. of (DOT)	415-581-7100
Treasure Island Development Authority	415-274-0660
Unified School District	415-241-6000
Zoo – San Francisco	415-753-7080

* The DEM Duty Officer, in addition to the web-based CCSF Alert System, both maintain an additional Notification Alert List that contains 24/7 emergency contact information for the organizations identified above.



ATTACHMENT D

Equipment Staging Locations

Equipment Staging Locations have been pre-designated by the San Francisco Fire Department. These locations are subject to change based on the discretion of the Incident Commander, Unified Command, or EOC Operations Section Chief.

Equipment Staging Locations are designated for first responder resources as directed by the ICP. The ICP will assign a Staging Location Operations Chief from the Fire Department to manage incoming and outgoing resources. Resources coming from San Francisco Departments and requested Mutual Aid Departments, include but are not limited to,:

Personnel
Vehicles
Equipment

Richmond District:

Legion of Honor Parking Lot

Legion of Honor Drive and Camino Del Mar
Enter Legion of Honor Drive off of Clement Street and 34th Avenue

Sunset District:

Sunset Recreation Center

2225 Lawton Street (between 28th and 29th Avenues)

Parkside Playground

1500 Vicente Street (between 26th and 28th Avenues)

Zoo Area:

Lakeshore Elementary School

At Middlefield Drive and Eucalyptus Drive

Additional, Equipment Staging Locations will be identified by the ICP, Unified Command, or EOC Operations Section Chief, as needed

**Resources are not to self deploy to Equipment Staging Locations
without authorization from the ICP**



ATTACHMENT E

Emergency Evacuation Routes - Traffic Plan

Emergency Evacuation Routes

Evacuation routes may be traveled by people in personal vehicles and on foot

Evacuation routes have been pre-identified by the San Francisco Fire Department. These routes are subject to change based on road hazards, weather conditions, the potential for additional Tsunami waves to impact the area, and at the discretion of the Incident Commander and Unified Command. Evacuation routes, include but are not limited to,:

Richmond District:

Ingress of Emergency Response Vehicles (Westbound)

Egress of Evacuees (Eastbound):

Point Lobos Avenue/Geary Blvd

Fulton Street

Egress of Evacuees ONLY (Eastbound) :

Balboa Street

Sunset District:

Ingress of Emergency Response Vehicles (Westbound)

Egress of Evacuees (Eastbound):

Lincoln Boulevard

Noriega Street

Taraval Street

Sloat Boulevard

Road closures - unless otherwise deemed safe by the ICP or Unified Command, are:

The Great Highway

Highway 35

Skyline Boulevard

Lake Merced Boulevard (west of Sunset Blvd.)

John Muir Drive at Lake Merced

Bus Routes – Emergency Evacuations of Evacuees on Foot

Richmond District:



MTA – MUNI will deploy **9 diesel buses** westbound on Fulton Street. Buses will turn right on 47th Ave., left on Cabrillo, left on 48th Ave. and stage for loading. Full buses will travel eastbound on Fulton Street to the Evacuation Assembly Site at Washington High School (*Attachment F*).

Sunset District:

MTA – MUNI will deploy **6 diesel buses** westbound on Lincoln Boulevard. Buses will stage on 48th Ave. for loading. Once full, buses will travel south on 48th Avenue to Kirkham Street. Turn left on Kirkham to 43rd Ave. to the Evacuation Assembly Site at Francis Scott Key School.

MTA – MUNI will deploy **6 LRV's** westbound on Judah Street. Once full, LRV's will deploy to 9th Avenue and Judah Streets. Evacuees will disembark the train and walk to a shelter location in Golden Gate Park, at the County Fair Building, at 9th Ave. and Lincoln Blvd.

MTA – MUNI will deploy **4 diesel buses** westbound on Noriega Street. Buses will stage on 48th Ave. for loading. Once full, buses will travel south on 48th Avenue to Ortega Street. Turn left on Ortega to 37th Ave. to the Evacuation Assembly Site at A.P. Giannini Middle School.

MTA – MUNI will deploy **6 LRV's** westbound on Taraval Street to 47th Ave. and stage for loading. Once full, LRV's will turn around and stop at Taraval and 41st Avenue. Evacuees will disembark the train and walk to the Evacuation Assembly Site at Independence High School located at Santiago and 41st Avenue.

MTA – MUNI will deploy **10 diesel buses** westbound on Sloat Blvd. Buses will turn right on 47th Ave. and stage for loading. Once full, buses will travel north on 47th Avenue to Vicente Street. Turn right on Vicente to 42nd Ave. to the Evacuation Assembly Site at Ulloa Elementary School.

Zoo Area:

MTA – MUNI will deploy **8 diesel buses** westbound on Sloat Blvd. Buses will turn around facing eastbound on Sloat Blvd. in front of the Zoo Entrance and stage for loading. Once full, buses will travel east on Sloat Blvd to Forest View Drive. Turn right on Forest View. until it dead ends into the Evacuation Assembly Site at Lowell High School.

Traffic Control Points

Traffic Control Points at intersections near the Inundation Area will need to be controlled through a coordinated effort between the following departments⁴, using personnel and vehicles:

- MTA - Parking and Traffic – 10 units (until more personnel can be mobilized)
- Police Department – 10 units (not including, officers needed for roving PA announcements and evacuations in the neighborhoods)
- Sheriff's Department – 8 units (not including, officers needed for roving PA announcements and evacuations in the neighborhoods)
- California Highway Patrol – 7 units

Traffic Control Points

Street/Highway	Intersection	Department
Pt. Lobos	El Camino Del Mar	CHP

⁴ Support provided until additional MTA - DPT personnel can be mobilized



Great Highway	Length of	CHP
Highway 35/Skyline Blvd.	Length of	CHP
Street/Highway	Intersection	Department
Point Lobos Ave.	45 th Avenue	Police
Geary Blvd.	45 th Avenue	Police
Anza Street	45 th Avenue	DPT
Balboa Street	45 th Avenue	DPT
Cabrillo Street	45 th Avenue	DPT
Fulton Street	45 th Avenue	Police
Lincoln Way	45 th Avenue	Police
Irving Street	45 th Avenue	DPT
Judah Street	45 th Avenue	DPT
Kirkham Street	45 th Avenue	DPT
Lawton Street	45 th Avenue	DPT
Moraga Street	45 th Avenue	Sheriff's
Noriega Street	45 th Avenue	Sheriff's
Ortega Street	45 th Avenue	Sheriff's
Pacheco Street	45 th Avenue	Sheriff's
Quintara Street	45 th Avenue	Sheriff's
Rivera Street	45 th Avenue	Sheriff's
Santiago Street	45 th Avenue	Sheriff's
Taraval Street	45 th Avenue	Sheriff's
Ulloa Street	45 th Avenue	DPT
Vicente Street	45 th Avenue	DPT
Wawona Street	45 th Avenue	DPT
Sloat Boulevard	Sunset Boulevard	Police
Lake Merced Blvd	Sunset Boulevard	Police

Evacuation Routes, Road Closures, Bus Routes, and Traffic Control Points for the Marina District, Fisherman's Wharf, Embarcadero, and Potrero District will be determined by the SFFD Incident Commander.

**All need to move above 47th Ave in the Richmond District
Above 45th Ave in the Sunset District
Above Sloat and Sunset Blvd. in the Zoo Are**



ATTACHMENT F

Evacuation Assembly Sites

Richmond District:

George Washington High School
600 32nd Avenue – Cross street: Anza

Sunset District:

Francis Scott Key Elementary School
1530 43rd Avenue – Cross street: Kirkham

A.P. Giannini Middle School
3151 Ortega Street – Between 37th and 39th Avenues

Independence High School
3045 Santiago Street - Cross Street: 42nd Avenue

Ulloa Elementary School
2650 42nd Avenue – Cross street: Vicente Street

Zoo Area:

Lowell High School
1101 Eucalyptus Drive

During an evacuation, people will be instructed to walk uphill to their closest Evacuation Assembly Site, or at least to 45th Avenue in the Sunset District and 47th Avenue in the Richmond District. These Assembly Sites are designated as refuge areas.

People will be further relocated by bus and other means of transportation from the Evacuation Assembly Sites to emergency shelters, based on the degree and location of damage, assessments being conducted by emergency response personnel, and directives from emergency management officials.



ATTACHMENT G

Care and Shelter Activation Procedures

The DEM/DES Duty Officer, EOC, or Human Services Agency will make notifications in order to open shelters as soon as possible or upon notification of required evacuations in the Inundation Areas.

Shelter Responders

- ❑ The DEM/DES Duty Officer, EOC, or HSA will notify the following individuals/agencies:
 - o American Red Cross
 - o EMS Duty Officer (DPH/EMS and SFFD/EMS)
 - o DPH Duty Officer
 - o HSA Liaison
 - o Animal Care and Control

- ❑ The need for additional resources for an immediate response, includes:
 - o MTA- MUNI to transport evacuees
 - o SFPD or SFSD for site security

Shelter Sites

- ❑ In conjunction with the American Red Cross, the Human Services Agency DOC or Human Services Branch of the EOC will determine which shelter locations will become operational. (See Shelter Database: <http://bayareashelters.org>. The User Name and password to this database can be retrieved via the DEM/DES Duty Officer.)
- ❑ HSA notifies site liaisons (*Attachment C*):
 - Recreation and Parks Department – Joe Medina 210-6480
 - San Francisco Unified School District
- ❑ Notify SFPD or SFSD of shelter sites and request periodic site security checks
- ❑ Ensure HSA, ARC, and DPH conduct shelter inspections and take corrective action as needed. Include assessment of showers, toilets, heat, lights, entrance and egress, etc.
- ❑ Notify additional DEM/DES staff as needed



ATTACHMENT H

PROCLAMATION BY THE MAYOR DECLARING THE EXISTENCE OF A LOCAL EMERGENCY

WHEREAS, California Government Code Sections 8550 *et seq.*, San Francisco Charter Section 3.100, and Chapter 7 of the San Francisco Administrative Code empower the Mayor to proclaim the existence of a local emergency (subject to ratification by the Board of Supervisors) when the City and County is affected or threatened by a natural disaster or other emergency conditions posing extreme peril to life or property; and

WHEREAS, Conditions of extreme peril to the safety of persons and property have arisen within the City and County due to a tsunami on or about [DATE OF INCIDENT]; and

WHEREAS, The Mayor does hereby proclaim that these conditions justify and require the proclamation of the existence of a local emergency,

NOW, THEREFORE,

I, [NAME], Mayor of the City and County of San Francisco, do hereby proclaim the existence of a local emergency within the City and County to be effective immediately on this day, [DATE OF PROCLAMATION].

It is further proclaimed and ordered that:

Under this proclamation of local emergency, the government of the City and County of San Francisco is organized under the provisions of the Incident Command System (ICS), which system forms an essential part of the City's Emergency Operations Plan. The head of each City department and agency will observe his or her proper relationship in the command structure outlined by the system and will be responsive to the orders and requests of the Lead Department designated to exercise supervision over his or her department during the course of this emergency.

Because of the extreme peril to its residents and visitors, the Governor of the State of California is hereby requested to include the area of the City and County of San Francisco in any emergency declaration by the State, and is further requested to ensure that the City and County is included in any emergency declaration that may be issued by the President of the United States.

It is further proclaimed and ordered that:

This proclamation of a local emergency shall be deemed to continue to exist until the Mayor or the Board of Supervisors terminates it. All departments of the City and County of San Francisco are strictly enjoined to cooperate with the requests for material and personnel resources that may emanate from the Incident Command Staff of said City and County, which is located in the Emergency Command Center of the City and County of San Francisco.

DATED:

Mayor of San Francisco



ATTACHMENT I

Prepare to Evacuate Notification

EAS Release

Tsunami Watch

This message is from the San Francisco City & County Department of Emergency Management. We have been warned by the National Weather Service, that a Tsunami or seismic sea wave (may have been) (has been) generated in the Pacific and may strike our coast. If a wave was generated it will arrive here at approximately _____.

A **Tsunami Watch** has been issued that covers the coastal area of the City and County of San Francisco. If a damaging Tsunami is confirmed, the "Watch" will be upgraded to a **Tsunami Warning** and evacuations ordered. Residents and visitors in the potential coastal inundation zone should prepare to evacuate immediately.

UNTIL THE WATCH IS CANCELLED, people should move away from beaches, coastal roads, and streets to higher ground. Tsunami waves often occur in a series spread over many hours and can be preceded by water receding from the shoreline. TSUNAMI waves can cause great damage to coastal cities and communities and kill or injure people caught by the waves.

Residents and visitors are encouraged to keep tuned to your local Emergency Broadcast station (KCBS 740 am or KSJO 92.3 – Spanish) for further information.

Also, be aware that the Outdoor Public Warning System sirens may be activated **IF A WARNING IS ISSUED**.

This is a Sample EAS Release – For a Tsunami Watch



ATTACHMENT J Evacuation Notification

EAS Release

Tsunami Warning

This message is from the San Francisco City & County Department of Emergency Management. We have been warned by the National Weather Service, that a Tsunami or seismic sea wave (may have been) (has been) generated in the Pacific and may strike our coast. If a wave was generated it will arrive here at approximately _____.

Under the provisions established by the City and County of San Francisco, we are ordering all persons in the risk area to evacuate to higher ground. People evacuating from:

The Zoo Area should evacuate to Lowell High School at 1101 Eucalyptus Drive
The Sunset Area should evacuate to:

Francis Scott Key Elementary School
1530 43rd Avenue – Cross street: Kirkham

A.P. Giannini Middle School
3151 Ortega Street (between 37th and 39th Avenues)

Independence High School
3045 Santiago Street - Cross Street: 42nd Avenue

Ulloa Elementary School
2650 42nd Avenue – Cross street: Vicente Street

The Richmond Area should evacuate to George Washington High School at 32nd Ave./Anza

Residents and visitors should evacuate immediately by vehicle, on foot, or by public transportation, uphill to an Evacuation Assembly Site. Stay out of the risk area until you are advised that re-entry may begin. All are encouraged to tune in to your local Emergency Broadcast station (KCBS 740 am or KSJO 92.3 – Spanish) for further information.

All need to move above 47th Ave in the Richmond District
Above 45th Ave in the Sunset District
Above Sloat and Sunset Blvd. in the Zoo Area

Tsunami waves often occur in a series spread over many hours and can be preceded by water receding from the shoreline. TSUNAMI waves can cause great damage to coastal cities and communities and kill or injure people caught by the waves.

Be aware that the Outdoor Public Warning System sirens (has been)(will be) activated.

During this emergency, police, fire, and emergency service officials are trying to save your life. Give them your fullest cooperation.



ATTACHMENT K

Glossary of Key Terms and Terminology

Amplitude: The rise above or drop below the ambient water level as read on a tide gauge.

Arrival Time: Time of arrival, usually of the first wave of the tsunami, at a particular location

Bathymetry: The measurement of the depths of oceans, seas, etc

Bore: Traveling wave with an abrupt vertical front or wall of water. Under certain conditions, the leading edge of a tsunami wave may form a bore as it approaches and runs onshore. A bore may also be formed when a tsunami wave enters a river channel, and may travel upstream penetrating to a greater distance inland than the general inundation.

CREST: Consolidated Reporting of Earthquakes and Tsunamis. A project funded through the Tsunami Hazard Mitigation Federal/State Working Group to upgrade regional seismic networks in Alaska, Washington, Oregon, California, and Hawaii and to provide real-time seismic information from these networks and the United States National Seismic Network to the Tsunami warning centers.

ETA: Estimated Time of Arrival. Computed arrival time of the first Tsunami wave at coastal communities after a specific earthquake has occurred.

First Motion: Initial motion of the first wave. A rise in the water level is denoted by R, a fall by F

Free Field Offshore Profile: A profile of the wave measured far enough offshore so that it is unaffected by interference from harbor and shoreline effects.

Harbor Resonance: The continued reflection and interference of waves from the edge of a harbor or narrow bay. This interference can cause amplification of the wave heights and extend the duration of wave activity from a tsunami.

Horizontal Inundation Distance: The distance that a Tsunami wave penetrates onto the shore. Measured horizontally from the mean sea level position of the water's edge, it is usually measured as the maximum distance for a particular segment of the coast.

Inundation: The depth, relative to a stated reference level, to which a particular location is covered by water.

Inundation area: An area that is flooded with water.

Inundation Line (limit): The inland limit of wetting, measured horizontally from the edge of the coast, defined by mean sea level.

Leading-Depression Wave: Initial Tsunami wave is a trough, causing a drawdown of water level

Leading-Positive Wave: Initial Tsunami wave is a crest, causing a rise in water level. Also called a leading-elevation wave.



Local/Regional Tsunami: Source of the Tsunami is within 1000 km of the area of interest. Local or near-field tsunami has a very short travel time (30 minutes or less), mid-field or regional Tsunami waves have travel times on the order of 30 minutes to 2 hours.

Note: "Local" tsunami is sometimes used to refer to a tsunami of landslide origin.

Maremoto: Spanish term for Tsunami

Marigram: Tide gauge recording showing wave height as a function of time.

Marigraph: The instrument which records wave height.

MLLW: Mean Lower Low Water. The average low tide water elevation often used as a reference to measure run-up.

Ms: Surface Wave Magnitude. Magnitude of an earthquake as measured from the amplitude of seismic surface waves. Often referred to by the media as "Richter" magnitude.

Mw: Moment Magnitude. Magnitude based on the size and characteristics of the fault rupture, and determined from long-period seismic waves. It is a better measure of earthquake size than surface wave magnitude, especially for very large earthquakes. Calibrated to agree on average with surface wave magnitudes for earthquakes less than magnitude 7.5.

Mutual Aid: Is defined as written or oral communication between and among a specified agency and the City and County of San Francisco requesting that specified agency to provide emergency assistance in the form of personnel, equipment, materials, and/or other unspecified services. The primary objective is to facilitate rapid, short-term deployment of emergency support prior to, during, and/or after an incident. Personnel safety, asset allocation and resource availability may limit or restrict a specified agencies' ability to satisfy a mutual aid request.

Normal Earthquake: An earthquake caused by slip along a sloping fault where the rock above the fault moves downward relative to the rock below.

Period: The length of time between two successive peaks or troughs. This may vary due to complex interference of waves. Tsunami periods generally range from 5 to 60 minutes.

Run-up: Maximum height of the water onshore observed above a reference sea level. This is usually measured at the horizontal inundation limit.

Seiche: An oscillating wave (also referred to as a seismic seawave) in a partially or fully enclosed body of water. May be initiated by long period seismic waves, wind and water waves, or a Tsunami.

Strike-Slip Earthquake: An earthquake caused by horizontal slip along a fault.

Teletsunami: Source of the Tsunami is more than 1000 km away from area of interest is called a distant-source or far-field Tsunami. Travel time is greater than 2 hours.

Thrust Earthquake: Earthquake caused by slip along a gently sloping fault where the rock above the fault is pushed upward relative to the rock below. This is the most common type of earthquake source of damaging Tsunamis.



Tidal Wave: Common term for Tsunami used in older literature, historical descriptions, and popular accounts. Tides, caused by the gravitational attractions of the sun and moon, may increase or decrease the impact of a Tsunami, but have nothing to do with their generation or propagation. However, most Tsunamis (initially) give the appearance of a fast-rising or fastebbing tide as they approach shore, and only rarely appear as a near-vertical wall of water.

Travel Time: Time (usually measured in hours and tenths of hours) that it took the Tsunami to travel from the source to a particular location.

Tsunami: A Japanese term derived from the characters "tsu" meaning harbor and "nami" meaning wave. Now generally accepted by the international scientific community to describe a series of traveling waves in water produced by the displacement of the sea floor associated with submarine earthquakes, volcanic eruptions, or landslides.

Tsunami Earthquake: A tsunamigenic earthquake which produces a much larger Tsunami than expected for its magnitude.

Tsunamigenic Earthquake: Any earthquake which produces a measurable Tsunami.

Tsunami Magnitude: A number that characterizes the strength of a Tsunami based on Tsunami wave amplitudes. Several different Tsunami magnitude determination methods have been proposed.



ATTACHMENT L Acronyms

ANSS:	Advanced National Seismic System
ARC:	American Red Cross
CALWS:	California Warning System
CCSF:	City & County of San Francisco
CLETS:	California Law Enforcement Telecommunications System
DEM/DEC:	Department of Emergency Management/Division of Emergency Communications
DEM/DES:	Department of Emergency Management/Division of Emergency Services
DPH:	Department of Public Health
DPW:	Department of Public Works
DOC:	Department Operations Center
DOT:	Department of Technology
EAS:	Emergency Alert System
EDIS:	Emergency Digital Information System
EOC:	Emergency Operations Center
ERP:	Emergency Response Plan
ETA:	Estimated Time of Arrival
FEMA:	Federal Emergency Management Agency
GGNRA:	Golden Gate National Recreation Area
GSA:	General Services Agency
HSA:	Human Services Agency
ICP:	Incident Command Post
ICS:	Incident Command System
JIC:	Joint Information Center
LRV:	Light Rail Vehicle (Muni Streetcar)
NIMS:	National Incident Management System
NOAA:	National Oceanic and Atmospheric Administration
NPS:	National Park Service
NRP:	National Response Plan
NWS:	National Weather Service
OA:	Operational Area (County)
PIO:	Public Information Officer
PTWC:	Pacific Tsunami Warning Center
PUC:	Public Utilities Commission
REOC:	Regional Emergency Operations Center (State Office of Emergency Services/HS)
SEMS:	Standardized Emergency Management System
SWC:	State Warning Center (Operated by State Office of Emergency Services/HS)
USGS:	United States Geologic Survey
WC/ATWC:	West Coast/Alaska Tsunami Warning Center