

# SUMMARY

The Island and County of Hawaii has experienced 40 natural disaster events since 1977 and two tsunamis since 1940. This island is uniquely exposed to all the major natural hazards due to its active volcanoes (lava flow and earthquake hazards), young geological age (sheetflow flooding due to undefined drainageways), vast land area larger than all the other islands combined (expansive areas vulnerable to wildfires), varied topography dominated by five mountains (complex hurricane wind acceleration patterns), and easternmost location in the Hawaiian islands chain (hurricane exposure). Of lesser concern is sandy beach erosion due to the geologically youthful age of this island resulting in few sandy beaches; instead, sea cliff erosion is of greater concern to control building too closely to the cliff edge.

The purpose of this multi-hazard mitigation plan is to provide a strategy to reduce or eliminate loss of life or property caused by natural hazard events. A multi-hazard strategy addresses the relationship among various types of hazards, leverages resources to benefit multiple hazards, and allocates limited resources to areas susceptible to the most severe or frequent hazards.

## **Planning Process**

The planning process engaged the many involved agencies and the public to increase awareness, facilitate input, and then to synthesize the information into a plan of action. The County Civil Defense Agency is the lead agency for all hazards planning in the County. For this initial effort, the Civil Defense enlisted the assistance of the Planning Department and Data Systems to coordinate the planning process. Although this plan is a culmination of the best efforts and the best available information at this time, the County recognizes that there are many areas for improvement and is committed to an ongoing process to update the plan with ever more public and agency participation.

To compile the data for this initial plan, meetings were held with agencies whose functions related to hazards analysis (e.g., Hawaii Volcanoes Observatory) or critical facilities (e.g., HELCO, Fire, Police, Department of Public Works, Red Cross). The County's GIS system was the repository of the information. One of the goals of the planning process was to build the County's GIS capacity recognizing its importance not only for mitigation planning but also for emergency response.

Public awareness and input was solicited through programs funded by FEMA's Project Impact that focused primarily on preparedness to respond to hazard events. Additionally, through the County's General Plan revision program, numerous public meetings were held throughout the County that provided a forum for discussion on hazard mitigation. One of the major changes proposed in the General Plan was to broaden the goals and objectives to cover multi-hazards where the current General Plan focuses only on flooding, and to introduce new policies such as to mandate consideration of natural hazards in all land use planning and permitting, and to discourage intensive development in high hazard areas. The County also formed a committee represented by several agencies and members of the public to examine the updating of the building code.

## Risk and Vulnerability Assessment

### Hazard Analysis

Using the GIS system, the high-risk areas exposed to the various hazards were mapped. The state of knowledge and mapping are summarized below:

- **Tsunami.** GIS mapping exists for tsunami inundation areas (delineation of historical and modeled runup used to control development) and tsunami evacuation areas (more conservative delineation than inundation areas based on identifiable landmarks such as roads and used to facilitate field evacuation logistics). The Flood Insurance Rate Maps (FIRM) identify the tsunami inundation risk areas (VE zone). However, the FIRM needs to be updated to ensure that the VE zone encompasses the limits of historical inundation where such historical information exists. The tsunami evacuation maps need to be updated with recent coastal developments.
- **Hurricanes.** For high wind risks, the micro-areas exposed to wind acceleration due to topography need better mapping. For storm surge risks, the Flood Insurance Rate Maps (VE zone) are not based on storm surge modeling, and therefore it is not known the extent to which the VE zone adequately accommodates storm surge risks.
- **Flooding.** Although the FIRM is available in digitized format for the GIS, the accuracy requires improvement based on updated topographic information. Additionally, a system needs to be established to incorporate revisions to the FIRM (called Letter of Map Revisions or LOMR's) into the GIS system. Improvements are needed to the rainfall and streamflow gaging system to improve forecasting and real-time monitoring.
- **Earthquake.** The entire island is currently in a single earthquake zone. Better maps are needed to distinguish areas where ground motion could be significantly increased by softer soil conditions.
- **Lava Flows.** Although GIS mapping exists that zones the entire island into nine lava hazard zones, the Hawaii Volcano Observatory is presently working to replace this map with a probabilistic hazard map and a modeling system to predict direction and speed of flow for a given eruption.
- **Droughts and Wildfire.** No GIS mapping exists to identify vulnerable households and economic activity (e.g., agriculture) subject to droughts. No GIS mapping exists to identify the high risk wildfire areas based on vegetation, historical events, and climatic conditions.
- **Landslides and Sea Cliff Erosion.** No GIS mapping exists to identify inland areas susceptible to landslides and studies to establish safe setback limits to address sea cliff erosion risks.

Estimates of historical and potential future losses for each of the above hazards need to be developed in future updates of the plan to rank the severity of the risk imposed by each hazard. This loss estimation information would be used as one of several criteria to prioritize the allocation of limited resources to mitigate hazards.

### Critical Facilities and Special Populations/Areas

This plan focused on mitigating hazards to critical facilities and special populations or areas. Critical facilities include those public and private facilities that need to be operational during and after a hazard event to meet public health and safety needs, or to speed economic recovery. These facilities include:

- Emergency response facilities-- Civil Defense Emergency Operations Center, emergency shelters, fire and EMS stations, hospitals, police stations, Department of Public Works baseyards;

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- Infrastructure lifeline facilities-- transportation (harbors, airports, roads/bridges), energy (electrical, fuel, gas), communication (wired/cabled telecommunication, wireless), water, wastewater;
- Recovery facilities-- debris clearing and disposal, car rentals, buses, financial institutions, survival and building supplies;
- Secondary hazard facilities-- facilities that increase the hazard risk if damaged, including wastewater facilities and hazardous waste sites.

Special populations identified with demographic data are those that are more vulnerable and may require special assistance to prepare, evacuate, or recover include:

- Young and elderly;
- Non-English speakers;
- Persons with disabilities.

Special areas that are more vulnerable and may require special assistance to prepare, evacuate, or recover include:

- Residences and buildings not built under the 1991 Building Code and therefore more susceptible to hurricane and earthquake;
- Residences and buildings in high hazard areas;
- Residences and buildings experiencing recurring hazard damage;
- Remote residences that are distant from sirens or off-grid;
- Hotels and resorts;
- Schools, day care centers, and nursing homes;
- Parks and shopping centers.

The GIS system superimposed the hazard layers over the critical facilities and special populations/areas to identify those located in high hazard areas. Vulnerable critical facilities need to be assessed to determine whether the facility should be relocated or hardened. Vulnerable special populations and areas require a range of mitigation measures discussed in the plan.

The following table summarizes the vulnerable critical facilities, special populations, and special areas based on the best available data.

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**Summary of Vulnerable Critical Facilities, Special Populations, and Special Areas by District**

	<b>Puna</b>	<b>South Hilo</b>	<b>North Hilo</b>	<b>Hama-kua</b>	<b>North Kohala</b>	<b>South Kohala</b>	<b>North Kona</b>	<b>South Kona</b>	<b>Ka'u</b>
<b>Emergency response facilities</b>	shelters--major capacity deficiency; Pahoa Fire Station in lava flow hazard zone 2; communication system hardening and/or redundancy;	shelters--major capacity deficiency; communication system hardening and/or redundancy;	communication system hardening and/or redundancy;	communication system hardening and/or redundancy;	communication system hardening and/or redundancy;	shelters--major capacity deficiency; Kohala High & Elementary School and Waimea State office building require hardening; communication system hardening and/or redundancy;	shelters--major capacity deficiency; communication system hardening and/or redundancy;	communication system hardening and/or redundancy;	HOVE Fire Station in lava flow hazard zone 2; communication system hardening and/or redundancy;
<b>Infrastructure lifeline facilities</b>		Hilo Harbor-- no hardening plans for tsunami or hurricane surge; Hilo Airport-- no hardening or evacuation plans; Electrical generating station (Waiakea) in VE flood zone; electrical transmission lines along Saddle Road in lava flow hazard zone 2				Kawaihae Harbor-- no hardening plans for tsunami or hurricane surge	Kona Airport-- no hardening or evacuation plans		
<b>Recovery facilities</b>	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD
<b>Secondary hazard facilities</b>	TBD	TBD	TBD	TBD	TBD	TBD	TBD; Need hazardous response team	TBD	TBD
<b>Special populations</b>	High % of youngsters; high % of elderly; high disabled; high % public assistance; high non-English speakers	high % of elderly; high disabled; high non-English speakers	high % of elderly	high % of elderly		High % of youngsters; high non-English speakers	high % of elderly; high disabled; high non-English speakers	high non-English speakers	High % of youngsters; high % of elderly; high disabled; high % public assistance
<b>Special areas</b>	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD	TBD

TBD= To be determined in future update to this Plan.

## Mitigation Strategy

Mitigation goals and objectives to eliminate or reduce risk include:

- 1.0 Goal: Continually strive to improve the state of the art for the identification of hazard areas, predication capabilities, and warning systems.**

Objectives:

  - 1.1 Prepare GIS maps for all hazards with the best available information and formulate a strategy to upgrade the data.
  - 1.2 Improve flood prediction and field-monitoring systems.
  - 1.3 Improve local tsunami warning systems.
  - 1.4 Improve applicability of modeling systems to Hawaii Island conditions for hazard mapping, mitigation planning, scenario training purposes.
  - 1.5 Establish a warning system that is cognizant of warning siren gaps that require supplemental field warning, that strives to fill those gaps based on population, that is routinely tested and maintained, and that educates the public on proper response.
  - 1.6 Establish a rigorous reporting system after each major event to document the extent and cause of damage, lessons learned, and actions required to improve hazard mitigation, preparedness, response, or recovery.
- 2.0 Goal: Control future development and retrofit existing structures within hazard areas to minimize losses.**
  - 2.1 Periodically review the effectiveness of current land-use-related plans, codes, and standards to control future development within hazard areas.
  - 2.2 Update the building code as necessary to cost-effectively resist earthquake, hurricane, and flood susceptibility.
  - 2.3 Develop incentives, such as tax deductions and insurance discounts, to encourage retrofitting of existing structures to resist earthquake, hurricane, and flood susceptibility.
- 3.0 Goal: Ensure that all emergency response critical facilities and communication systems remain operational during hazard events.**
  - 3.1 Harden all essential emergency facilities and communication systems to withstand earthquake and hurricane forces (flood resistance not necessary since no emergency facilities should be located in the 100-year flood-prone areas).
  - 3.2 Enhance emergency communication systems to improve the type and speed of data transmission, and diversity of systems for redundancy.
  - 3.3 Establish communication contingencies for remote areas.
  - 3.4 Ensure road access to hospitals remain clear and that all hospitals have helicopter access.
  - 3.5 Develop a search and rescue system that can respond to individual emergencies and mass disasters.

- 4.0 Goal: Ensure that all lifeline infrastructure are able to withstand hazard events or have contingency plans to quickly recover after a disaster.**
- 4.1 Harden ports and airports to enable post-disaster operations.
  - 4.2 Harden major highway segments that have no alternate bypass to withstand earthquake and 100-year flood.
  - 4.3 Harden fuel storage facilities and ensure distribution network to critical facilities.
  - 4.4 Reduce vulnerability of electrical system to all hazards.
  - 4.5 Develop water systems that resist damage to all hazards and contingency plans to truck water.
  - 4.6 Develop post-disaster wastewater disposal contingency plans that do not depend on water.
  - 4.7 Ensure post-disaster debris collection and disposal capacity.
  - 4.8 Provide post-disaster transit and paratransit system.
- 5.0 Goal: Develop a training program of the highest standard to ensure that all involved personnel efficiently and effectively carry out their responsibilities as set forth in an updated emergency operations plan.**
- 5.1 Achieve a level of readiness among existing and new employees who understand their role in a coordinated system.
  - 5.2 Maintain an updated emergency operations plan to continually identify and add to contact list of resources that could provide assistance and improve procedures.
- 6.0 Goal: Provide adequate pre- and post-disaster emergency shelters to accommodate residents and visitors.**
- 6.1 Ensure that all hotels, resorts, and cruise ships have an emergency response plan that has been reviewed and approved by Civil Defense, and implemented with an active personnel training program.
  - 6.2 Identify and harden selected shelters to withstand hurricane.
  - 6.3 Comprehensively inventory potential shelters to address mass temporary post-disaster housing requirements.
  - 6.4 Provide services to address visitor needs for daily needs, communication with families back home, and alternate travel arrangements.
- 7.0 Goal: Develop a level of awareness among the general public and businesses, particularly the visitor industry, that results in calm and efficient evacuations, self-sufficient survival skills, and willingness to abide by preventive or property protection requirements.**
- 7.1 Develop a broad-based public information program that utilizes a diversity of communication media.
  - 7.2 Develop special public information programs targeted to vulnerable populations.
  - 7.3 Develop a community-based network that double-functions as the Community Emergency Response Team and provides input into mitigation planning.

**8.0 Goal: Minimize post-disaster recovery disruption by developing systems for efficient clean-up, documentation of damage and injury, and processing of appropriate aid to rebuild businesses and the economy.**

- 8.1 Inventory potential debris movement resources and develop a plan to coordinate these resources.
- 8.2 Develop educational programs to instruct residents and businesses on clean-up and disposal options.
- 8.3 Educate businesses on business interruption planning.
- 8.4 Develop efficient field data collection systems to document damage and process aid.
- 8.5 Partner with financial institutions to facilitate customers' post-disaster access to cash.

**9.0 Goal: Protect natural and cultural resources to the extent practicable that buffer hazards or have significant value.**

- 9.1 Within the context of a multi-objective open space plan, identify significant natural and cultural resources and alternative means of protection.

To implement the mitigation goals and objectives, the following table summarizes the priority actions in three categories:

- Administrative actions not requiring major funding;
- Ongoing funded studies that need to be incorporated into future updates of this plan;
- Actions requiring funding.

**Summary of Mitigation Actions**

I.D. No.	Project Description	Hazards	Lead Agency	Budget	Funding Source	Priority	Objectives
1.0	<b>Administrative actions not requiring major funding:</b>						
1.1	Review the General Plan natural hazard policies in light of this mitigation plan and American Planning Association suggested policies	All hazards	Planning	minimal	County	High	2.1
1.2	Review the feasibility to adopt the 2003 International Building Code	Hurricane, Earthquake	Department of Public Works	minimal	County	High	2.2
1.3	Update tsunami evacuation maps	Tsunami	Data Systems w/ Civil Defense	minimal	County	High	1.1
1.4	Develop relocation policies for repetitive loss structures	All hazards	Civil Defense w/ Public Works	minimal	County	Medium	

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1.5	Work with hotels, cruise ship industry, nursing homes, schools, hospitals, and shopping centers to develop emergency response plans	Hurricane, Earthquake, Tsunami	Civil Defense	minimal	County, private (visitor industry)	High	6.1, 6.4, 7.2
1.6	Study feasibility of participating in the Community Rating System	Flooding	Public Works	minimal	County	Low	1.1, 1.2, 2.3, 5.1, 7.1
1.7	Study feasibility of including non-structural earthquake damage prevention into building code	Earthquake	Public Works	minimal	County	Low	2.2
1.8	Identify hardening projects to implement 1993 seismic evaluation study of fire stations and hospitals	Earthquake, Hurricane	Civil Defense, with Public Works, Fire, and Hospitals	minimal	County	High	3.1
1.9	Explore with utilities feasibility of underground power lines	Hurricane, Earthquake, Tsunami	Civil Defense, with Planning & utilities	to be determined	County shared w/ utilities	Medium	4.4
1.10	Conduct hazard loss estimation study; incorporate cost-benefit methodology as a factor in prioritizing projects	All hazards	Civil Defense	minimal	County	Medium	1.4
1.11	Develop routine training program for disaster response and recovery	All hazards	Civil Defense	minimal	County	High	5.1, 8.4
1.12	Evaluate warning sirens coverage	All hazards	Civil Defense	minimal	County	Medium	1.5
1.13	Develop a formal post-event reporting system and information clearinghouse	All hazards	Civil Defense	minimal	County	Medium	1.6, 8.4
1.14	Evaluate disaster-level search & rescue capabilities	All hazards	Civil Defense, w/ Fire, Police, DPW	minimal	County	High	3.5
1.15	Evaluate vulnerability of County water systems and water trucking capacity	Hurricane, Earthquake	Dept of Water Supply, w/ Civil Defense	minimal	County	Medium	4.5
1.16	Evaluate waterless wastewater disposal options	Hurricane, Earthquake	Dept of Environmental Mgt	minimal	County	Medium	4.6
1.17	Implement Disaster Debris Action Manual	Hurricane, Earthquake, Tsunami, Flood	Dept of Environmental Mgt	minimal	County	Medium	4.7, 8.1

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I.D. No.	Project Description	Hazards	Lead Agency	Budget	Funding Source	Priority	Objectives
1.18	Develop post-disaster transit plan	Hurricane, Earthquake, Tsunami, Flood	Mass Transit Agency, w/ Civil Defense	minimal	County	Medium	4.8
1.19	Update debris estimation	Hurricane, Earthquake, Tsunami, Flood	Dept of Environmental Mgt	minimal	County	Medium	8.1
1.20	Coordinate TDSR sites	Hurricane, Earthquake, Tsunami, Flood	Dept of Environmental Mgt	minimal	County	Medium	8.1
1.21	Maintain list of debris management contractors and update boilerplate contracts	Hurricane, Earthquake, Tsunami, Flood	Dept of Environmental Mgt	minimal	County	Medium	8.1
<b>2.0</b>	<b>Ongoing funded studies that need to be incorporated into future updates of this plan</b>						
2.1	Emergency shelter evaluation	Hurricane	Army COE	budgeted elsewhere	Army COE	High	6.2, 6.3
2.2	GIS mapping of hotels, church shelters, hazardous waste sites	Hurricane, Earthquake, Tsunami, Flooding	Data Systems	budgeted elsewhere	FEMA	High	6.3, 3.1
2.3	Develop probabilistic lava flow maps and modeling	Lava flow	Hawaii Volcanoes Observatory	budgeted elsewhere	USGS	High	1.1
2.4	Organize public awareness and preparedness program, including CERTs, through Project Kumiai; also include public education on pet care	All hazards	Civil Defense w/ Research & Development, Planning	budgeted elsewhere	FEMA, County	High	7.1, 7.2, 7.3, 8.2, 8.3, 8.4, 8.5
2.5	Update Emergency Operations Plan	All hazards	Civil Defense	budgeted elsewhere	FEMA	High	5.2
2.6	Implement State Drought Plan	Drought	Civil Defense, with Fire and DWS	budgeted elsewhere	DLNR	Medium	1.1
2.7	Identify wildfire hazard areas	Wildfire	State Drought Council, with Civil Defense & Fire	budgeted elsewhere	FEMA, State	Medium	1.1
2.8	Adapt HAZUS-M or other hazard modeling to Hawaii Island	Hurricane, Earthquake, Flood	State Civil Defense	budgeted elsewhere	FEMA, State	Medium	1.4
<b>3.0</b>	<b>Actions requiring funding</b>						
3.1	Harden public schools for emergency shelters	Hurricane, Flooding, Tsunami	Dept of Acctg and Gen Services (DAGS)	Included in State's mitigation plan	FEMA, State, County	High	3.1
3.2	Modernize FIRM maps in accordance with priority mutually established between County and DLNR	Flood, Hurricane, Tsunami	Dept of Public Works	\$2,000,000 annually for approx. 5 years	FEMA, State, County	High	1.1

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3.3	Identify high windspeed areas and vulnerable structures	Hurricane, Earthquake	Civil Defense w/ Public Works	\$300,000	FEMA, State, County	High	1.1
3.4	Identify earthquake-induced ground failure areas	Earthquake	Civil Defense w/ Public Works	\$100,000	FEMA, State, County	Medium	1.1
3.5	Explore incentives for existing homeowners and businesses to retrofit their structures, and participate in building fairs to publicize	Hurricane, Earthquake, Flooding	Department of Public Works	\$10,000	County	High	2.3
3.6	Study hardening requirements for Hilo and Kawaihae Harbors	Tsunami, Hurricane, Earthquake	Dept of Transportation	included in State plan	Homeland Security, FEMA, State	High	4.1
3.7	Study hardening and evacuation requirements for Hilo and Kona Airports	Hurricane, Earthquake	Dept of Transportation	included in State Plan	Homeland Security, FEMA, State	High	4.1
3.8	Study hardening, floodproofing, and bypass alternatives for major highways	All hazards	Dept of Public Works	50,000	FEMA, State, County	High	4.2, 3.4
3.9	Study hardening requirements for fuel storage and distribution to critical facilities	Hurricane, Earthquake, Tsunami	Civil Defense, with fuel providers	50,000	Homeland Security, FEMA, County	High	4.3
3.10	Develop rainfall and streamflow gaging system suitable to flood monitoring	Flooding	USGS	200,000	USGS, State, County	High	1.2
3.11	Develop technology and training system for efficient field monitoring of in-progress event	All hazards	Civil Defense	30,000	FEMA, County	High	1.2, 5.1
3.12	Identify landslide and coastal erosion hazard areas and mitigation actions	Landslides	Civil Defense w/ Dept of Transportation, Public Works	DOT study done; 50,000 for coastal cliffs	FEMA, State, County	Low	1.1
3.13	Upgrade and coordinate emergency communication system	All hazards	Civil Defense, w/ Fire, Police, military, ham operators, wired and wireless operators	to be determined	FEMA, State, County, private	High	3.1, 3.2, 3.3
3.14	Study hardening requirements for electrical system	Hurricane	HELCO	to be determined	HELCO	Medium	4.4
3.15	Upgrade EOC's GIS and communication systems	All hazards	Civil Defense	\$100,000	FEMA, County	Medium	3.1, 3.2

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3.16	Develop scenario training and mitigation planning capabilities	All hazards	Civil Defense	to be determined	FEMA, County	High	5.1, 1.4
3.17	Prepare multi-objective open space plan	All hazards	Planning	200,000	various	Medium	9.1

**Plan Update and Maintenance**

This mitigation plan will be reviewed annually with input from an interagency Hazard Mitigation Steering Committee and an organized network of community groups in each district established under a program called Project Kumiai. The annual review will result in revised workplans; budget requests to the County CIP, State Civil Defense, and other funding sources; suggested amendments to codes and plans; and proposed revisions to the text of this plan.

*Summary*