

## 1 4 | HAZARDS

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3 Hazards from natural forces have been measured in Hawai'i since the early 1800s. Since 1955  
4 there have been 24 major disaster declarations in the State of Hawaii due to tropical cyclones,  
5 earthquakes, landslides, lava flows and tsunamis. Natural disasters have inflicted significant  
6 property losses and resulted in death and injury to residents and visitors in the County of Maui. Both  
7 direct and indirect costs should be considered in calculating the total loss from natural disasters,  
8 since recovery efforts divert available public and private resources, adversely impacting economic  
9 productivity.

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11 The main focus of disaster recovery is how to build resiliency, the bounce-back capabilities,  
12 into communities. People must first recognize the inherent risks involved in their choices of  
13 where and how to live. Then the communities can adopt "approaches that eliminate,  
14 reduce, mitigate or transfer those risks in ways that make them more manageable over the  
15 long haul"<sup>1</sup>.

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17 *Communities with strong disaster resilience capabilities were often those that were*  
18 *already doing well at the things citizens and businesses most value – having*  
19 *leaders that people trust and institutions that work, having a healthy environment,*  
20 *having a regularly maintained infrastructure designed to anticipate stresses, and*  
21 *having a flexible economy that provides opportunities for broad cross-sections of*  
22 *workers and investors.*<sup>2</sup>

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24 The islands that constitute Maui County are exposed to hazards that are sometimes unique to each  
25 island. Moloka'i has greater exposure to high surf from the large Northwestern Pacific swells than  
26 other islands. Wildfires and drought have significantly impacted Moloka'i. Floods and coastal  
27 erosion with economic, social, and environmental significance are more common on Moloka'i  
28 because its population center is near shorelines and steep graded mountains. All islands in the  
29 County have similar exposure to tropical cyclones because of their geographic location. Similarly,  
30 all islands in the County have comparable exposures to earthquakes.

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32 The hazard mitigation planning process analyzes a community's risk from natural hazards,  
33 coordinates available resources, and implements actions to reduce risks. Natural hazards must be

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<sup>1</sup> <http://www.soest.hawaii.edu/coasts/sealevel/>

<sup>2</sup> Brown, Ben. (December 2010) *What is Resilience? A Roadmap to Resilience: Towards a Healthier Environment, Society and Economy for South Alabama. A Report by the Coastal Commission of Alabama.*

1 considered when planning for future growth and development of a community. The Maui County  
2 Hazard Mitigation Plan (HMP) provides a strategy to reduce or eliminate loss of property or life  
3 caused by natural hazard events. The HMP addresses the relationship among various types of  
4 hazards, identifies actions that benefit multiple hazards, and prioritizes resources to areas  
5 susceptible to most severe or most frequent hazards.

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7 The 2010 HMP is being updated and will include information on hazard events that have impacted  
8 the County since the 2010 Plan was published, as well as more information on the potential impacts  
9 of climate change and sea level rise (SLR). The updated HMP will also focus on mitigating the  
10 impacts of flooding in order to improve the County's Community Rating System (CRS) class ranking,  
11 which is currently 8. This rating provides a 10% annual discount off flood policy premiums. A ranking  
12 of 1 out of the 10 classes is the highest and would provide a 45% discount. The County is in the  
13 process of updating the Flood Insurance Rate Maps (FIRMs) that are used to determine which  
14 property owners will be mandated by FEMA to purchase flood insurance and the cost of the  
15 insurance.

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20 **Climate Change and Hazards**

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22 Scientists agree that climate change is warming the earth based on an extensive body of scientific study,  
23 although the range and rate of climate change is still being determined. Some changes in Hawaii and  
24 other Pacific Islands are already measurable SLR, increasing ocean acidity, increasing water and land  
25 temperatures, and changing rainfall patterns. Early measurements have also revealed decreasing base  
26 flows in streams, changing wind and wave patterns, and changing plant and animal habitats and species  
27 distribution. Research currently indicates that global mean sea level may reach approximately 1 foot by  
28 mid-century and 2.5 to 6.2 feet by the end of the century; however, there are significant unknowns in  
29 predicting SLR<sup>3</sup>.

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31 The 2014 Hawaii *Climate Adaptation Initiative Act* (Act 83) established an interagency climate adaptation  
32 committee tasked with developing a SLR vulnerability and adaptation report that addresses potential  
33 statewide climate change impacts out to 2050. The interagency committee of county and community  
34 representatives will be overseen by the Department of Land and Natural Resources (DLNR) and the Hawaii  
35 State Office of Planning. The committee will make recommendations about the best ways to prepare for  
36 SLR and the secondary effects. The committee is required to issue a report that will be available to the  
37 public before the end of 2017. Act 83 also authorizes the Office of Planning to coordinate development of

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3 <http://www.soest.hawaii.edu/coasts/sealevel/> 6/29/2015  
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1 climate adaptation plans and policy recommendations and to use the committee's report as framework for  
2 addressing other climate threats and climate change adaptation priorities.

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4 The predicted impacts from SLR include increased coastal erosion, coastal bluff/cliff failure, groundwater  
5 table elevation, storm surge and inundation of low-lying areas. This will increase the likelihood of property  
6 damage and community exposures to hazards, such as high drought conditions and associated higher risk  
7 for wildfires. The impacts of SLR can increase saltwater intrusion in parts of the aquifer and cause the  
8 groundwater table to rise resulting in inundation of low-lying areas and the infrastructure within (Rotzoll &  
9 Fletcher 2013). SLR will accelerate in the future altering the frequency and severity of wave inundation,  
10 erosion and flooding events. Man-made structures and residents close to the shoreline pose particular  
11 challenges for hazard planning and adaptation to SLR.

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14 **Existing Conditions**

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16 Extensive areas of Kaunakakai and the east-end communities are located at low coastal  
17 elevations placing them at relatively high-risk from tsunami, coastal flooding, stream flooding, storm  
18 surge and inundation. Areas around the tourist resort at Kaluakoi and the entire campground at  
19 Papohaku Park are also in tsunami inundation zones.

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21 Moloka'i has nine potential shelters for hazard evacuations with a total capacity of 5,391 people.  
22 Molokai High and Kualapuu Elementary are rated as hurricane shelters with a combined capacity  
23 of 3,197 people. While this capacity could accommodate over 40% of the population, studies  
24 indicate that only 35% of residents are likely seek public shelter during a hurricane.<sup>4</sup> Three shelters  
25 are rated for tsunamis and three for tropical cyclones. Only one shelter has been Red Cross  
26 approved. A State of Hawaii Civil Defense facility survey found recurring deficiencies with existing  
27 shelters (Martin & Chook, 2010)<sup>5</sup>.

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<sup>4</sup> Source: County of Maui, Department of Civil Defense

<sup>5</sup> Martin & Chock. (2010) *Maui County Multi-Hazard Mitigation Plan*.

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2 Table 4-1 Moloka'i Hazard Evacuation Shelters<sup>6</sup>

Shelter Name	Address	City	Capacity (Persons)
<b><u>DOE Schools</u></b>			
Molokai High	2140 Farrington Ave	Hoolehua	2,309
Kaunakakai Elementary	30 Ailoa St	Kaunakakai	711
Kilohana Elementary School	334 Kamehameha V Hwy	Kaunakakai	504
Kualapuu Elementary	260 Farrington Ave	Kualapuu	858
Maunaloa Elementary School	128 Maunaloa Hwy	Maunaloa	100
<b>Subtotal</b>			<b>4,482</b>
<b><u>County Facilities</u></b>			
Mitchell Pauole Community Center	90 Ainoa St	Kaunakakai	600
Kilohana Community Center	334-A1 Kamehameha V Hwy	Kualapuu	110
Kualapuu Community Center	1 Uwao St.	Kualapuu	68
Maunaloa Community Center	140 Maunaloa	Maunaloa	131
<b>Subtotal</b>			<b>909</b>
<b>Grand Total</b>			<b>5,391</b>

3 **Table Notes: 1)** Facilities are identified as possible shelters that may be available depending on the type of  
 4 event; shelter sites will be announced. **2)** Molokai High and Kualapuu Elementary are rated as hurricane  
 5 shelters.

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7 There are 11 disaster warning sirens on island: eight on the south shore, one on the Kalaupapa  
 8 Peninsula, one in Maunaloa and one on the west end. An additional six sirens are planned for  
 9 Moloka'i as part of the Statewide Modernization and Upgrade Plan. Sirens have an effective  
 10 average range of one-half mile. The Civil Air Patrol provides coastal warnings and the County of  
 11 Maui Civil Defense Agency transmits warnings to the public through the Emergency Alert System  
 12 (EAS), which includes simultaneous broadcasts over all radio and television systems. Text and  
 13 emails are sent to Civil Defense Notifications and Emergency Alert subscribers. Disaster response  
 14 is coordinated through the County's Emergency Operation Center on Maui and the Moloka'i  
 15 Incident Command Post. Communications are augmented through satellite transmission.

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<sup>6</sup> Source: County of Maui, Department of Civil Defense

1 **Flooding and Erosion** – Annual storms can bring multiple hazards that impact coastal and inland  
2 areas. These impacts include flash floods, high waves, storm surge, high winds and hurricanes.  
3 SLR increases the effect of high waves and storm surge that contribute to beach and shoreline  
4 erosion and coastal inundation. Major flood problems are associated with the heavy flow of four  
5 water courses in east Moloka`i. Wailua Stream, Wawaia Gulch, Kamalo Gulch and Kawela Gulch  
6 become blocked due to inadequate bridge openings or deposits of eroded sediment. Many streams  
7 run freely onto the roads as a result of inadequate drainage and stormwater infrastructure. This  
8 typically occurs around the east side of Kawela and at One Ali`I Beach Park. Roadway flooding can  
9 hamper travel and access. When streams and rivers flood on the mauka side of the road, heavy  
10 debris often settles on the roadways. Additionally, mud runs off onto roadways making roads  
11 impassable and creating hazardous driving conditions. There are several unnamed waterways that  
12 flood areas by the Kaunakakai Fire Station and Maui College impacting the cemetery and Kapaakea  
13 Homestead. Rising sea levels will also block the drainage of streams causing overflow at the stream  
14 mouth. Detailed information and data on flooding and erosion is contained in the 2010 *Maui County*  
15 *Hazard Mitigation Plan*, Chapter 10 and Chapter 13.

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17 **Tsunami** - Up to May of 2010, 27 tsunamis with run-up heights greater than 3.3 feet (1 meter) have  
18 made landfall in the Hawaiian Islands during recorded history and eight have had significant  
19 damaging effects on Maui, Moloka`i or Lanai. Tsunamis in the Hawaiian archipelago have  
20 commutatively killed the largest number of people of all natural hazards affecting the islands.  
21 Tsunamis reaching Moloka'i have exhibited tremendous variability in terms of run-up heights,  
22 inundation distances, and the damage they have inflicted. The April 1946 tsunami on Moloka`i,  
23 produced run-up heights of 7 and 44 feet on the east and west sides of Kalaupapa Peninsula,  
24 respectively.

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26 New GIS maps for all islands in the County has been developed for tsunami inundation areas. These  
27 maps include delineations of historical and modeled run-up data; they are used for determining  
28 building standards and tsunami evacuation areas. Historically in Hawaii, the National Flood  
29 Insurance Program (NFIP) Flood Insurance Rate Maps (FIRMs) included the historical tsunami  
30 inundation limits. The new Digital Flood Insurance Rate Maps (DFIRMs) should be amended to  
31 include for these limits.

32 *Detailed information and data on tsunamis is contained in the 2010 Maui County Hazard Mitigation*  
33 *Plan, Chapter 9.*

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35 **Dams and Reservoirs** - Dam and reservoir failures can cause can cause damaging flash floods.  
36 The sudden release of impounded water can occur during a flood that overtops or damages a dam  
37 or reservoir; this can occur on a clear day if the dam has not been properly constructed or

1 maintained. The Kualapu`u Reservoir is an earthen dam located in central Moloka`i, that stores 1.2  
2 billion gallons of water for irrigation purposes. The dam is 57 feet high and is 7,100 feet long with a  
3 drainage area of 134 acres. This state regulated reservoir that was built in 1969 has a high flash  
4 flood hazard rating.<sup>7</sup> The nearest town is Ho`olehua Palaa Homestead located one mile away.  
5 Kualapu`u Reservoir has a state approved Emergency Action Plan (EAP) and an engineering  
6 assessment was completed in January 2015.

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8 *Detailed information and data on dam and reservoir failures is contained in the 2010 Maui County*  
9 *Hazard Mitigation Plan, Chapter 11.*

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12 **High Surf** - The most predictable and frequent coastal hazards in the Hawaiian Islands are sudden  
13 high waves combined with strong near shore currents. The greatest number of deaths, injuries and  
14 rescues are from high waves breaking at the shoreline. High surf is defined as waves ranging in  
15 height from 10 feet to 20 feet or more. High wave events threaten lives, coastal property, and  
16 infrastructure. High waves from hurricanes present a more complex hazard since they may coincide  
17 with high tide, storm surge, and high winds to produce a combined threat. They generally occur from  
18 June through December and most often hit the eastern shores of the Hawaiian Islands as hurricanes  
19 approach. High waves produced by north Pacific swells affect the entire northern coast of Moloka`i.  
20 There is a greater threat to the more accessible and frequented areas along the north facing shores  
21 of the west Kalaupapa Peninsula between Ilio Point and the town of Mo'omomi.<sup>8</sup>

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24 **Wildfire** -Wildfire is the term applied to any unwanted and unplanned fire burning in forest, shrub,  
25 or grass areas regardless of whether naturally or human induced. Historically, Moloka`i has been  
26 very susceptible to wildfire; there are nine years on record where more than one thousand acres  
27 burned. Between 1975 and 2009, wildfires on Moloka`i burned over 65,000 acres, which is  
28 approximately twice as much acreage as wildfires consumed on Maui during the same time period.  
29 Wildfires can cause widespread damage to watersheds, human communities, and associated  
30 downslope coral reef ecosystems. The danger of wildfire is related to arid conditions, frequent high  
31 winds and the high fuel potential of vegetation. Nine out of ten wildfires are human caused.  
32 Moloka`i's central area and west end are dry regions with agricultural lands that are particularly  
33 susceptible to drought conditions, and are therefore at high risk of wildfire.

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<sup>7</sup> "High hazard" means a dam's or reservoir's failure will result in probable loss of human life.  
Source: HAR-190-1-Dam-Safety-Rules1.pdf

<sup>8</sup> *Atlas of Natural Hazards in the Hawaiian Coastal Zone, 2002*

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2 In the early 2000's the Moloka'i Fire Task Force was created to improve interagency coordination  
3 and communication regarding wildfires on Moloka'i. The original core group consisted of Maui  
4 County Fire and Rescue Operations , The Nature Conservancy (TNC) and the State Department of  
5 Fish and Wildlife (DOFAW). The Task Force has since evolved and many other private sector, state,  
6 county and local community agencies have become involved. The Task Force maintains a positive  
7 working relationship between the myriad of agencies involved in wildfire protection and the Moloka'i  
8 community.

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10 The Task Force collects wildfire risk data and oversees development of the Community Wildfire  
11 Protection Plan (CWPP). The CWPP addresses elements of wildfire protection, hazard assessment,  
12 wildfire mitigation priorities, and community outreach and education. The goals and objectives of  
13 the plan follow the requirements of the *Healthy Forests Restoration Act* (HFRA), which describes a  
14 CWPP as a fire mitigation and planning tool for at-risk communities that meet criteria contained in  
15 the HFRA.

16 *Detailed information and data on tsunamis is contained in the 2010 Maui County Hazard Mitigation*  
17 *Plan, Chapter 14 (drought) and Chapter 15 (wildfire). Additionally, the impact of drought on Moloka'i*  
18 *was addressed in the October 2004 County of Maui Drought Mitigation Strategies and the 2005*  
19 *State Drought Plan.*

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21 **Hazardous Substances & Waste** - The Hawaii Environmental Response Law (HERL) requires the  
22 DOH to report annually to the State Legislature about sites with potential or known hazardous  
23 substances, pollutants, or contaminants.<sup>9</sup> The 2014 Site Rehabilitation Prioritization (SRP) List of  
24 Priority Sites reported ten sites on Moloka'i with potential or known contamination. There was also  
25 a list of sites eligible for possible remedial action under Comprehensive Environmental Response  
26 Compensation and Liability Act (CERCLA) that identified one Moloka'i site for possible listing.  
27 Additionally, in 2014 there were four Moloka'i sites located on federal property managed and funded  
28 under the Department of Defense/State Memorandum of Agreement (DSMOA) Program.<sup>10</sup>

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30 *Detailed information and data on high surf is contained in the 2010 Maui County Hazard Mitigation*  
31 *Plan, Chapter 16.*

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<sup>9</sup> *Martin & Chock. (2010) Maui County Multi-Hazard Mitigation Plan.*

<sup>10</sup> *Environmental Response and Planning Community Knowledge Report to the Twenty-Seventh Legislature, State of Hawaii 2014*

1 **B. ISSUES**

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Issue 1: There is low public awareness about hazard preparedness, mitigation, response, and recovery.

Issue 2: In coastal areas, SLR will increase risk of inundation, flooding, storm surge, beach erosion, and shoreline retreat.

Issue 3: South-central Moloka'i has a history of wildfires and the low-rainfall area west of Kaunakakai has a higher risk of wildfire.<sup>11</sup>

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7 **C. GOAL, POLICIES, ACTIONS**

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**Goal Moloka'i will be prepared for natural and human-created hazards.**

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12 **Policies**

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1. Promote public education about natural and human-induced hazards in order to improve preparedness and response and to reduce hazard risk and impacts.

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2. Support a more coordinated emergency response system that includes clearly defined and mapped evacuation routes and Red Cross approved shelters located away from areas susceptible to natural hazards.

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3. Support and advocate for better preparedness capacity by improving inter-agency planning, coordination, and implementation.

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4. Support the integration of science based coastal hazards information into land use planning and permitting, including revision of the Special Management Area (SMA) boundary in accordance with Hawaii State Act 286 (2012) *Climate Change Adaption Priority Guidelines*.

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5. Require that the shoreline development entitlement and permitting process include analysis of shoreline hazards, including erosion and SLR. Maximize protection of coastal natural resources and ecosystems and avoid the perpetuation of shoreline armoring.

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6. Encourage the location or relocation of all critical infrastructure, facilities, and development out of the evacuation and inundation zones vulnerable to coastal

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<sup>11</sup> Draft Maui County Hazard Mitigation Plan Update, 2015



- 1 hazards in accordance with the 2012 Hawaii State *Climate Change Adaption*  
 2 *Priority Guidelines*.  
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 4 7. Prioritize mitigation efforts that will provide potential funding opportunities to  
 5 harden, flood proof, or retrofit vulnerable critical facilities and infrastructure.  
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 7 8. Support the goals, objectives and actions of the 2014  
 8 *Moloka'i Community Wildfire Protection Plan*.  
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10 **Actions**  
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<b>Table 4.1 Hazards</b>				
<b>No.</b>	<b>Action</b>	<b>Lead - County / Other</b>	<b>Partners</b>	<b>Policy No.</b>
4.01	Continue the development of Moloka'i Incident Command Post in coordination with County Civil Defense .	Civil Defense	Red Cross Civil Air Patrol Police Department Fire and Public Safety DPW EMS VOAD	3
4.02	Identify and submit flood and pre-disaster mitigation projects that qualify for funding under the FEMA Pre-Disaster Mitigation Program, Hazard Mitigation Assistance Program, NFIP Severe Repetitive Loss Program and other FEMA funded mitigation and NFIP grants consistent with the Maui County Hazard Mitigation Plan.	Civil Defense	FEMA Region IX NFIP	3
4.03	Develop programs and distribute materials for public outreach and education to better educate the community on disaster preparedness, hazard mitigation, multi-hazard risks and vulnerabilities and post-disaster recovery. Target materials and programs that will provide information on steps to take to protect lives and strengthen property against natural and human related disasters.	Civil Defense	Fire Department Mayor's Office Environmental Coordinator Red Cross Molokai Wildfire Task Force	1
4.04	Seek community information on possible hazardous waste sites buried decades ago; investigate and remediate if needed.	Department of Environmental Management	State DOH Mayor's Office (Environmental Coordinator)	1

## Moloka'i Community Plan

4.05	Identify critical infrastructure, lifelines, roads, and structures that are vulnerable to coastal hazards, including SLR, and develop a more coordinated emergency response system of well-defined and mapped evacuation routes.	Civil Defense	DPW DWS DEM	1, 2
4.06	Identify critical infrastructure, lifelines, roads, and structures that are vulnerable to wildfires and develop a more coordinated emergency response system of well-defined and mapped evacuation routes. Formalize existing practices on the use of heavy equipment during fires.	Fire and Public Safety	DLNR- DOFA Volunteer Fire Crew Moloka`i Fire Task Force	1, 2
4.07	Develop a wildfire information campaign and signage to build public awareness of wildfire hazard. Improve community awareness of the human, economic, and environmental costs associated with wildfires caused by negligence or accident. Engage the community in creating and maintaining fire breaks.	Fire and Public Safety	Moloka`i Fire Task Force	1
4.08	Support wildfire mitigation activities such as green belts around subdivisions and vegetation control around power poles that will minimize risk of wildfire susceptibility to properties and subdivisions.	Planning	Moloka`i Fire Task Force MECO	8
4.09	Complete an inventory of vulnerable critical facilities and infrastructure. Include this information in Maui County HMP for future mitigation project funding.	Planning	Civil Defense	7
4.10	Map SLR projections for specific geographic areas on Moloka`i utilizing data from the National Oceanic and Atmospheric Administration (NOAA) Digital Coast SLR and Coastal Flooding Impacts Viewer. Map other climate related coastal hazard areas.	Planning	NOAA Pacific Services Center, UH Sea Grant	6, 7
4.11	Continue work with FEMA to update FIRMS that incorporate best available information on climate change and SLR.	Planning	FEMA	1
4.12	Implement additional CRS activities to improve class ratings and discounts on flood insurance premiums.	Planning	FEMA	1
4.13	Conduct erosion analysis of Moloka`i's shoreline to determine rate of erosion and use the results to determine setback calculations that also factor in incremental effects of SLR.	Planning	NOAA Pacific Services Center, UH Sea Grant	1

4.15	Coordinate with Federal, State and County agencies to obtain current SLR information and maps. Plan phased relocation of critical structures and roadways. Plan long-term strategic retreat of buildings. Identify priority planning areas where resources and planning efforts should be focused. Identify how and where to use adaptation strategies such as retreat, accommodation, and protection.	Planning	NOAA Pacific Services Center, UH Sea Grant Civil Defense DPW	5
4.16	Per the Maui County Hazard Mitigation Plan, update the HAZUS MH model to incorporate detailed data on state and county bridges located in Moloka'i.	Civil Defense	FEMA	6
4.17	Per the Maui County Hazard Mitigation Plan, utilize the funding provided for in the State Highways Modernization Plan to retrofit, rehabilitate and/or replace highway bridges vulnerable to earthquake hazard.	Civil Defense	DOT	6, 7
4.18	Support development of a cultural archive of the kapuna's knowledge of traditional hazard mitigation practices.	Planning	DHHL	

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