HAZARD MITIGATION PLAN UPDATE

County of Maui, Hawai'i

JULY 2020

Protect people, the environment, the local economy, and infrastructure from natural hazards and climate change.

Maui Emergency Management Agency
200 S. High Street, Wailuku, Hawai'i 96793
https://www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan

County of Maui, Hawai‘i

HAZARD MITIGATION PLAN UPDATE

JULY 2020

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Maui Emergency Management Agency

County of Maui

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Steering Committee

The Maui Emergency Management Agency would like to thank the following people and organizations for supporting the development of this Plan. This group was considered the Steering Team throughout the planning process.

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Adoption Resolution

> *E1. Does the plan include documentation that the plan has been formally adopted by the governing body of the jurisdiction requesting approval? (Requirement §201.6(c)(5))*

A hazard mitigation plan must document that it has been formally adopted by the governing body of the jurisdiction requesting federal approval of the plan, as outlined in 44 CFR Section 201.6(c)(5). Disaster Mitigation Act of 2000 (DMA) compliance and its benefits cannot be achieved until the plan is adopted. This Plan will be submitted for a pre-adoption review to Hawai‘i State Civil Defense, Federal Emergency Management Agency (FEMA) Region IX, and the Insurance Services Office prior to adoption. Once pre-adoption approval has been provided, Maui County will formally adopt the Plan. A copy of the resolution is provided below.

County of Maui Hazard Mitigation Plan Update

The County of Maui Hazard Mitigation Plan Update is a master plan for the County that identifies the hazards and risks posed by natural and technological disasters, identifies hazard mitigation actions and activities to reduce losses from such disaster and establishes priorities and a long-term sustained process to implement said actions.

Natural disasters have inflicted significant property losses and resulted in death and injury to residents and visitors in the County of Maui. Since 1955, there have been over ## major disasters declarations in the State of Hawaii due to tropical cyclones, earthquakes, landslides, lava flows and tsunamis.

Beyond direct costs attributed to natural disasters, indirect costs also need to be considered in calculating the total cost of natural disasters. Disaster recovery efforts divert available public and private resources, adversely impacting the productivity of the economy.

County of Maui Hazard Mitigation Plan Update represents the County of Maui’s commitment to reduce risks from natural hazards and serves as a guide for decision makers as resources are committed in an effort to reduce the effects of natural hazards.

In accordance with the Disaster Mitigation Act of 2000, Public Law 106-390 this Plan is hereby approved and implemented.

Maui County Emergency Management Agency is responsible for annual maintenance and updates of the Plan and advising all county agencies on its implementation.

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Record of Changes

This 2020 Local Hazard Mitigation Plan, including Appendices, will be reviewed and approved on a biannual basis by the Steering Committee and following any major disasters. All updates and revisions to the Plan will be tracked and recorded in the following table. This process will ensure the most recent version of the Plan is disseminated and implemented by the County.

Table 1. Summary of changes.

Date of Change	Entered By	Summary of Changes

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Chapter 1. Introduction and Assurances

In 2014, FEMA wrote, "The purpose of mitigation planning is to identify policies and actions that can be implemented over the long term to reduce risk and future losses. Mitigation plans form the foundation for a city's long-term strategy to reduce disaster losses and break the cycle of disaster damage, reconstruction, and repeated damage. The planning process is as important as the plan itself. It creates a framework for risk-based decision-making to reduce damages to lives, property, and the economy from future disasters."[1]

FEMA's Disaster Mitigation Act of 2000 states, "DMA 2000 (Public Law 106-390)[2] provides the legal basis for FEMA mitigation planning requirements for State, local and Indian Tribal governments as a condition of mitigation grant assistance. DMA 2000 amended the Robert T. Stafford Disaster Relief and Emergency Assistance Act by repealing the previous mitigation planning provisions and replacing them with a new set of requirements that emphasize the need for State, local, and Indian Tribal entities to closely coordinate mitigation planning and implementation efforts."[3]

The County of Maui created this Plan as part of an ongoing effort to reduce the negative impacts and costs from damages associated with natural hazards, such as floods, hurricanes, and sea level rise. This Plan meets the requirements of the Disaster Mitigation Act 2000. More importantly, the Plan was created to reduce loss of life, land, and property due to natural hazards that affect the County of Maui. It is difficult to predict when natural hazards will impact the planning area, but it is accurate to say that they will. By implementing the mitigation actions listed in this Plan, the impact of natural hazards will be lessened. Local Mitigation Plans must be updated at least once every five years in order to remain eligible for FEMA hazard mitigation project grant funding.

A local jurisdiction must review and revise its plan to reflect changes in development, progress in local mitigation efforts, and changes in priorities, and resubmit it for approval within five (5) years in order to continue to be eligible for mitigation project grant funding. (44 CFR §201.6(d)(3)). This Plan serves as an update to the 2015 County of Maui Hazard Mitigation Plan.

Background

Hazard mitigation is defined as a method to reduce or alleviate the loss of life, personal injury, and property damage that can result from a disaster through long- and short-term strategies. Strategies include implementing planning approaches, policy changes, programs, projects, and other activities that can mitigate the impacts of hazards. The responsibility for hazard mitigation lies with many, including

[1] Federal Emergency Management Agency. (2014). Multi-Hazard Mitigation Planning. Retrieved from http://www.fema.gov/multi-hazard-mitigation-planning
[2] Disaster Mitigation Act of 2000, Pub. L. 106-390, as amended.
[3] Federal Emergency Management Agency. (2014). Disaster Mitigation Act of 2000. Retrieved from http://www.fema.gov/media-library/assets/documents/4596?id=1935

private property owners; business and industry stakeholders; and local, state, and federal government agencies.

The federal Disaster Mitigation Act (DMA) of 2000 (Public Law 106-390) requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. Prior to 2000, federal disaster funding focused on disaster relief and recovery, with limited funding for hazard mitigation planning. The DMA increased the emphasis on planning for disasters before they occur.

DMA encourages state and local authorities to work together on pre-disaster planning and promotes sustainability for disaster resistance. “Sustainable hazard mitigation” includes the sound management of natural resources and the recognition that hazards, and mitigation must be understood in the largest possible social and economic context. The enhanced planning network called for by the DMA helps local governments articulate accurate needs for mitigation, resulting in faster allocation of funding and more cost-effective risk reduction projects.

Natural hazards impact citizens, property, the environment, and the economy of Maui County. Tropical cyclones, landslides, earthquakes, tsunamis, flooding, and high surf have exposed Maui County residents and businesses to the financial and emotional costs of recovering after natural disasters. The risk associated with natural hazards increases as more people move to or visit areas affected by those hazards.

The inevitability of natural hazards and the growing population and activity within Maui County create an urgent need to develop strategies, coordinate resources, and increase public awareness to reduce risk and prevent loss from future hazard events. Identifying risks posed by hazards and developing strategies to reduce the impact of a hazard event can assist in protecting life and property of citizens, communities, and visitors. Local residents and businesses can work together with the County to create a hazard mitigation plan (HMP) that addresses the potential impacts of hazard events.

Purpose

DMA compliance is only one of multiple objectives driving this planning effort. Elements and strategies in this Plan were selected because they meet a program requirement, as well as the needs of Maui County and its citizens. This HMP identifies resources, information, and strategies for reducing risk from natural hazards identified as a concern in Maui County, and will help guide and coordinate mitigation activities. The Plan was developed to meet the following objectives:

- Meet or exceed program requirements specified under the DMA.
- Enable Maui County to continue using federal grant funding to reduce risk through mitigation.
- Meet the needs of Maui County as well as state and federal requirements.
- Create a risk assessment that focuses on Maui County hazards of concern.

- Meet the planning requirements of the Federal Emergency Management Agency's (FEMA) Community Rating System (CRS), allowing Maui County to maintain or enhance its CRS classification.
- Coordinate existing plans and programs so that high-priority initiatives and projects to mitigate possible disaster impacts are funded and implemented.

All residents and businesses of Maui County are the ultimate beneficiaries of this HMP update. The Plan identifies strategies and actions to reduce risk for those who live in, work in, and visit Maui County. It provides a viable planning framework for all foreseeable natural hazards. Key stakeholders' participation in development of the Plan helped ensure that outcomes will be mutually beneficial. The Plan's goals and recommendations can lay groundwork for the development and implementation of local mitigation activities and partnerships.

History of the Plan

Maui County prepared an initial Hazard Mitigation Plan in 2005. This document represents the third comprehensive update (the first update was made in 2010, the second in 2015). Maui County has made progress on implementing the mitigation strategy detailed in the 2015 Plan. This Plan includes status of those actions and an updated mitigation strategy with new goal statements and mitigation actions. Most importantly, Maui County government and the Maui County Council remain committed to hazard mitigation and the implementation and maintenance of the Hazard Mitigation Plan.

Changes Since the 2015 Plan

The process to update the Plan began formally in November 2019, however, the County did implement several mitigation actions and develop a formal update report in 2018. The Planning Process included a total Plan update, all chapters were revised to reflect current conditions and priorities in the County. The layout of the Plan is simpler for instance all hazards are included in one chapter. The mitigation actions are numbered 1-50 and presented in tables that are simpler to review. In addition, a Mitigation Action Tracker was developed. This is web-based spreadsheet that enables the County to keep track of the implementation status of each action and allows them to quickly sort the actions by lead department, hazard, timeframe, etc.

Most importantly, the planning process for this 2020 mitigation plan update emphasized stakeholder engagement and a risk assessment that studied eight community planning areas. The planning process was amended in late February 2020 because of the Covid-19 pandemic. All in-person meetings were rescheduled as virtual meetings.

Changes in Development

> *D1. Was the plan revised to reflect changes in development? (Requirement §201.6(d)(3))*

The content in the Hazard Mitigation Plan is consistent with the Maui County General Plan, a long-term comprehensive blueprint for the physical, economic, and environmental development and cultural identity of Maui County. The Countywide Policy Plan, adopted in 2010, provides goals, objectives, policies, and implementing actions for achieving the desired direction of the County's future. The Countywide Policy Plan provides a policy framework for the Maui Island Plan and the nine community plans (County of Maui, 2014).

Decisions on land use will be governed by these planning documents. The hazard mitigation plan will work together with these programs to support wise land use in the future by providing vital information on the risk associated with natural hazards in the planning area. The results of the risk assessment will be integrated into the Natural Hazards Element of the Community Plans. This will ensure that all future trends in development can be established with the benefits of the information on risk and vulnerability to natural hazards identified in this plan.

The Planning Department played an integral role in the development of this Plan update and is committed to weaving elements of the Hazard Mitigation Plan into the continued development of Community Plans. This will ensure that all future trends in development can be established with the benefits of the information on risk and vulnerability to natural hazards identified in this Plan.

Changes to development are addressed in the risk assessment under the Flood hazard Vulnerability Section, in the Development Trends subsection. This section provides development trends provided by Maui County officials, an overview of zoning on Maui island, and Special Management Areas on Maui Island of Molokaʻi Island.

Local Mitigation Efforts

> *D2. Was the plan revised to reflect progress in local mitigation efforts? (Requirement §201.6(d)(3))*

The Capability Assessment includes an analysis of the County's ability to mitigate risk. It accounts for new ordinances and plans, for instance the dune grading ordinance and updated Community Plans. The Vulnerability Analysis includes sea level rise scenarios using new state/local data. A status update for all mitigation actions listed in the 2015 Plan is included. This Plan includes 50 mitigation actions, while the previous Plan included 63. In addition, the responsibility for implementing mitigation actions is divided among 8 departments. The Steering Committee decided that having the Maui Emergency Management Agency responsible for all actions was ineffective to Plan implementation.

Changes in Priorities

> *D3. Was the plan revised to reflect changes in priorities? (Requirement §201.6(d)(3))*

Current priorities for Maui County were gathered from the Steering Committee, public and stakeholder engagement, data collection, and review of current plans such as the Community Plans. In addition, four hazards (extreme heat, extreme cold, hazmat, health risks) were added to this Plan. Health Risk covers pandemic/COVID to address recent concern, as well as other health concerns. Extreme Heat profile covers concerns over recent heat waves. Sea level rise vulnerability analysis was included to address rising concerns regarding sea level rise concerns. Finally, the process of plan implementation and maintenance was amended to reflect the priority of integrating this Plan throughout County departments.

FEMA Recommendations

The lists below indicate recommendations from FEMA recorded on the Local Hazard Mitigation Plan Review Tool, September 2, 2015. Some of the recommendations were incorporated for this Plan update. The Steering Committee and the Hazard Mitigation Officer strive to improve the Plan and its implementation every five years, as they recognize the enormous benefit of the Plan.

Planning Process

2015 FEMA Recommendations

- The Plan should include supporting documentation of the planning process, including agendas, sign-in sheets, meeting minutes, etc. of meetings, and other planning process activities.
- The Plan should include a summary of comments from stakeholders and the public and how they were addressed/incorporated into the Plan.
- Future iterations of the Plan should include business and the private sector employers in the planning process.

2020 Mitigation Plan Response

- Appendix A includes Steering Committee meeting sign-in sheets and agendas and public meeting sign-in sheets and agendas. Also included are meeting flyers and press releases.
- Comments from stakeholders are included throughout the Plan in appropriate places to support the Plan.
- The planning process did include private sector employers and businesses such as Maui Electric and Feed My Sheep, a non-profit organization.

Risk Assessment

2015 FEMA Recommendations

- For the majority of hazards, especially those with a geographic boundary, the types and numbers of existing buildings, infrastructure, and critical facilities located in identified hazard areas are detailed, along with potential loss estimates. In some instances, however, the exposure and vulnerability and potential loss estimate discussions could be more specific for some hazards, such as coastal erosion, wildfire, etc.
- The types and numbers of future buildings, infrastructure, and critical facilities located in identified hazard areas should be identified.

2020 Mitigation Plan Response

- For the 2020 HMP update, we expanded the assessment for multiple hazards such as coastal erosion, wildfire, and sea level rise. We also included a more complete social vulnerability assessment. We used the best available provided by the county for existing types and numbers.
- Our analysis incudes types and numbers where county data permitted, especially for critical facilities. In addition, we expanded the infrastructure analysis to include roads and bridges.

Mitigation Strategy

2015 FEMA Recommendations

- The Plan identifies nearly 65 mitigation actions for implementation by individual planning partners. This seems like a large number of mitigation actions within the 5-year period until the next update. Although the Plan already prioritizes these mitigation actions, it would be beneficial to further prioritize the mitigation actions to make the implementation and monitoring process more manageable.

2020 Mitigation Plan Response

- The mitigation strategy now includes 50 mitigation actions for implementation and 19 of them are prioritized as high ranking. In addition, the responsibility for implementation now falls on 8 different departments. The intention of this change is to incorporate the Hazard Mitigation Plan into multiple levels of County government and to position the Plan as a priority throughout the County.

Plan Implementation Process

2015 FEMA Recommendations

- The Plan should identify any barriers or obstacles to successful implementation or completion of mitigation actions along with possible solutions for overcoming risk.
- The Plan should include documentation of annual reviews and committee involvement since the adoption and approval of the previous plan. The Plan should also identify any barriers or

obstacles encountered during the plan maintenance period and how the current plan maintenance process was changed, if at all.

2020 Mitigation Plan Response

- The Appendix includes a copy of the 2018 Progress Report. This report details some of the Steering Committee involvement in implementing the Plan such as the Disaster Preparedness Expo hosted by Maui Emergency Management Agency.
- Chapter 7. Plan Implementation includes a description of the revised Plan maintenance process and the reasons for changes.
- Beyond the technical challenges of seeking grant funding, the most difficult part of implementing the Plan was the entire responsibility fell to one department and the total number of actions. This updated Plan disperses responsibility and lessened the number of actions.

Plan Summary

Below is a summary of the chapters in the Hazard Mitigation Plan. The planning process closely adhered to FEMA guidelines and to the intent of those guidelines.

Chapter 2. Maui County Profile

Chapter 2 sets the stage for the Plan by describing Maui County in detail. It includes history of the islands and profiles of the nine community planning areas. The chapter includes details regarding natural resources such as climate and physical setting. It details population and demographic statistics and makes the distinction between residents and visitors. The breakdown of ethnicity is included in a section regarding cultural diversity and language. The chapter includes details regarding employment and employment trends. It gives the reader an overall picture of Maui County.

Chapter 3. Planning Process

The Planning Process chapter describes how the Work Plan and Outreach and Engagement Plan were implemented for the purposes of developing the Plan. Plan development was divided into five tasks and included eight Maui County Community Planning Areas. The Planning Team, led by the Maui County Emergency Management Agency Hazard Mitigation Officer, Anthony J. Joyce and consisting of the consulting team worked closely with a large Steering Committee comprised of public and private stakeholders.

Figure 1. Moloka'i Residents Identifying High Hazard Areas

The Steering Committee played an integral role in Plan development. They participated in four formal planning meetings and multiple smaller meetings with their respective departments or agencies and the Planning Team. The Planning Process also include a large community outreach and engagement effort that consisted of four public meetings, a public survey with almost 500 participants, stakeholder meetings and site visits. The picture shows Moloka'i residents identifying high hazard areas on island.

Chapter 4. Risk and Vulnerability Analysis

The Risk Assessment chapter of the 2020 Maui County Hazard Mitigation Plan Update assessed 15 hazards, including four new hazards: Extreme Cold, Extreme Heat, Hazardous Materials Incidents (mobile and fixed site), and Health Risks. All hazards were assessed using Maui County's eight community planning areas. Community planning areas group like areas to allow for more precise assessment of risk, as risk to each hazard varies across the county due to topography, wind and rainfall patterns, and coastal conditions, among other characteristics. In addition, impacts to socially vulnerable populations were included in this update, including the development of a social vulnerability index (SVI) for the county's community planning areas. Further, a priority risk index (PRI) tool was used to score and rank hazards for each community planning area and for Maui County overall, and key findings for each hazard are presented in a Summary of Overall Risk section.

Hāna

The Hāna community planning area is vulnerable to many different types of natural hazards. Notably, Hāna experiences flooding from heavy rainfall events on windward mountain slopes, and from hurricanes and tropical storms. It is common for heavy rainfall to trigger landslides and rockfalls throughout the community planning area, but Hāna Highway is especially vulnerable. Similarly, flooding

also causes road closures throughout the planning area. Damaging winds are also a frequent hazard within the Hāna.

Kīhei-Makena

The Kīhei-Mākena community planning area is vulnerable to many types of hazards. Coastal erosion is a concern in the community planning area, notably in the North Kīhei, Halama Street, and Wailea areas. Further, the community planning area experiences coastal and inland flooding. Flash flooding is a problem in Kīhei, especially in low-lying coastal areas where surface runoff cannot properly drain to the sea. Coastal flooding along North and South Kīhei Road is common, even during low magnitude events. Kīhei-Mākena also experiences King Tides and high wave flooding. Further, the planning area is one of the most vulnerable to tsunamis and wildfires.

Lānaʻi

The Lānaʻi community planning area is vulnerable to many types of hazards, but is most notably at-risk to flooding, windstorms, and hurricanes. Most development within the community planning area is inland, which minimizes impacts from coastal flooding on the island. Further, the islands of Maui and Molokaʻi largely protect the Island of Lānaʻi from erosion to the north and northeast. Therefore, the majority of erosion on Lānaʻi occurs on the southwest side of the island.

Makawao-Pukalani-Kula

The Makawao-Pukalani-Kula community planning area is the only community planning area in Maui County that does not have shoreline and is therefore not vulnerable to coastal hazards. However, the planning area is subject to other types of natural hazards, such as flooding, windstorms, and hurricanes. Flooding typically occurs in Makawao-Pukalani-Kula when gulches overflow due to heavy rainfall. Wildfires tend to occur in the northernmost portion of the community planning area. Further, the summit of Haleakalā experiences freezing temperatures in the winter months and can experience blizzard-like conditions during Kona storms.

Moloka'i

The Moloka'i community planning area is vulnerable to many hazards, including coastal erosion, flooding, windstorms, hurricanes, tsunamis, and wildfires, among others. On Moloka'i, flooding along the Kaunakakai Gulch has caused closures along Maunaloa Highway, and swift water rescues have been carried out in Hālawa Valley. Further, Moloka'i has experienced some of the county's largest wildfires, including the 2009 Kaunakakai Wildfire that burned over 8,300 acres. In addition, coastal erosion impacts Moloka'i's southern shoreline, characterized by scarped dunes, fallen trees, and outcrops of basalt rock.

Pāʻia-Haʻikū

The Pāʻia-Haʻikū community planning area is vulnerable to several types of natural hazards, including flooding, coastal erosion, windstorms, landslides, and wildfires, among others. Flooding typically occurs along gulches near Haʻikū, are wildfires are most common in the northern part of the community planning area.

Wailuku-Kahului

The Wailuku-Kahului community planning area is vulnerable to many types of natural hazards. Coastal erosion has impacted most shorelines in the Wailuku-Kahului community planning area, but Kahului Harbor, and Kanaha, Spreckelsville, and Baldwin Park are noted for having significant rates of erosion. In addition, the planning area is one of the most vulnerable to tsunamis and was the hardest hit area during the 1960 tsunami generated by the Great Valdivia Earthquake in Chile. Severe flooding has occurred in the Iao Valley along the Wailuku River, and wildfires are prevalent near Kahului.

West Maui

The West Maui community planning area is vulnerable to many natural hazard types, including flooding, coastal erosion, windstorms, landslides, and wildfires, among others. Many shorelines in West Maui are experiencing coastal erosion, such as Alaeloa, Honokōwai, Lahaina, and Ukumehame. Flooding occurs throughout the community planning area but is most notable in Lahaina, and almost half of the West Maui's structures are within tsunami evacuation zones. Further, West Maui has experienced the more wildfires than any other community planning area over the last 20 years.

Chapter 5. Capability Assessment

The Capability Assessment serves the purpose of determining the ability of Maui County to implement a mitigation strategy. It identifies opportunities for enhancing mitigation policies, programs, or projects. A capability assessment has two primary components: an inventory of a local jurisdiction's relevant plans, ordinances, programs, or activities already in place; and an analysis of its current capacity and resources to carry them out.

The Capability Assessment determined that Maui County is well positioned to mitigate risks from natural hazards, and it is believed that through the implementation of this Plan and other efforts it will continue to do so in a deliberate and meaningful manner. In addition, Maui County has maintained compliance with the NFIP and CRS for many years. They are well positioned to continue this level of compliance.

Chapter 6. Mitigation Strategy

The Steering Committee developed a mission statement and goals for this Plan. These reflect current County of Maui priorities and are consistent with the State of Hawaiʻi Hazard Mitigation Plan.

Mission Statement

Protect people, the environment, the local economy, and infrastructure from natural hazards and climate change.

Goals

1. Protect the life, health, safety and welfare of Maui County residents and visitors.
2. Promote the long-term resilience of the County's economic, environmental, historical and cultural resources.
3. Protect and adapt property and infrastructure from the impacts of natural hazards and climate change.
4. Improve awareness and mitigation of risks associated with natural hazards and climate change.
5. Enhance the implementation of this Hazard Mitigation Plan through active involvement and Plan integration across all County Departments.

Mitigation actions presented in this update are activities designed to reduce or eliminate losses resulting from natural hazards. The update process resulted in the identification of 50 mitigation actions for implementation. The 19 highest priority actions (not in any particular order) are shown below:

1. Explore options and necessary code and regulation changes to allow greywater reuse systems for irrigation and toilet flushing.
2. Adopt the most current building codes to mitigate risk associated with flooding.
3. Develop a water conservation ordinance to include xeriscaping regulations to promote water conservation (Maui Island Plan Action 6.3.2)
4. To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.
5. Identify alternative locations for emergency supply of diesel, gas, and propane on Molokaʻi for a minimum of 30 days.
6. Share funding sources for building retrofits or other modifications with owners of residential buildings to mitigate the effects of high winds. Encourage the use of load path connectors, hurricane shutters, safe rooms, reinforced garage doors, replacement of non-ductile infrastructure, strengthen structural frames, inspect and retrofit roofs, gable end walls for wind resistance.
7. Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.
8. Integrate the Hazard Mitigation Plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.
9. The County of Maui will consider and adapt to all of the hazards listed in this Plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.

10. Support the revitalization and expansion of the Firewise USA program to additional communities.
11. Establish an alternative route to and from West Maui for use during disasters.
12. Coordinate with the State to adapt State Highway Route 450 in Moloka'i at MM 15-16 (east side experiencing major erosion and undermining in the last few years).
13. Support cross-departmental collaboration and planning in resilience and climate action efforts.
14. Expand Beach and Dune Restoration Projects 1) Identify and prioritize erosion hotspots for mitigation via beach nourishment where applicable. 2) Pursue Federal/State/County funding for beach nourishment and restoration (including pre-positioning for post-disaster financial assistance). 3) Work with State regulatory agencies to streamline permitting for beach restoration. 4) Promote living shoreline projects instead of shoreline hardening where feasible. 5) Protect/restore coral reefs as they provide a barrier for erosion, high surf/coastal flooding and tsunamis.
15. Update dune restoration guidance. Provide dune restoration training. Develop an outreach initiative to encourage or establish new dune restoration volunteers/stewards. Install ADA compliant dune walkovers in identified locations.
16. Participate in the CRS program and identify opportunities across all relevant County departments and programs to improve current CRS class.
17. Conduct a multivariate GIS analysis to identify and categorize open spaces for the County of Maui to purchase and preserve based on highest ROI for hydrological capacity and positive impact on flood mitigation.
18. Adopt internal protocols for how to intake, process, approve and file all new FDPs in order to ensure consistent and clear records for upcoming CRS audits. Having a more thorough digital record of approved FDPs will facilitate the Floodplain Manager achieving a greater score during the CRS Audits.
19. Encourage Low Impact Development (LID) approach to site development and stormwater management through development of best practices guide.

Chapter 7. Plan Implementation and Maintenance

Full implementation of the recommendations of this Plan will require time and resources. The measure of the Plan's success will be its ability to adapt to changing conditions. Maui County will assume responsibility for adopting the recommendations of this Plan and committing resources toward implementation. The framework established by this Plan commits Maui County to pursue initiatives when the benefits of a project exceed its costs. Maui County developed this Plan with extensive public input, and public support of the actions identified in this Plan will help ensure the Plan's success.

The Maui County Emergency Management Agency, and specifically the Hazard Mitigation Officer will have lead responsibility for overseeing the implementation and maintenance of the Hazard Mitigation Plan and will organize and lead the Steering Committee. The Steering Committee is a volunteer body that oversees the development and implementation of mitigation actions. Together the Hazard

Mitigation Officer and the Steering Committee will generate progress reports and when necessary update the Hazard Mitigation Plan.

Authority and Assurances

The County of Maui will continue to comply with all applicable Federal laws and regulations during the periods for which it receives grant funding, in compliance with 44 CFR 201.6. It will amend its Plan whenever necessary to reflect changes in City, State or Federal laws and regulations, as required in 44 CFR 201.6.

The Hazard Mitigation Steering Committee recognizes the following FEMA publications (and future publications) to provide guidance on plan development and implementation:

- Local Mitigation Planning Handbook (March 2013)
- Local Mitigation Plan Review Guide (October 2011)

Chapter 2. Maui County Profile

Introduction and History

Situated in the middle of the Pacific Ocean, approximately 2,400 miles southwest of the continental United States, lies the Hawaiian Archipelago, consisting of 132 volcanic islands, atolls, reefs and shoals. Among these and located at the southeastern end of the island chain, are the eight main Hawaiian Islands that comprise the State of Hawaiʻi. Four of these islands, Maui, Molokaʻi (excluding the Kalaupāpā peninsula, which constitutes the County of Kalawao), Lānaʻi, and Kahoʻolawe comprise the County of Maui, and define the planning area for the 2020 Hazard Mitigation Plan Update. The Island of Kahoʻolawe, though a part of Maui County, will only be peripherally included in the planning process due to its status as a nature reserve with no permanent residents.

The first inhabitants of the islands that make up Maui County arrived from the southern islands of Polynesia, approximately 800 to 1,000 years ago. These original inhabitants formed societies across the islands, but detailed historical information is limited. European settlers arrived in the late 1700s. From that point onward, the islands of Maui County saw development that was similar but distinctive for each island.

The following is a summary of key points in the histories of the islands of Maui County.

Island of Maui

The towns of Hāna, Makawao, Wailuku, and Lahaina housed most of the native and arriving population in the early years after European contact.[4]

In 1848, Kamehameha III proclaimed the Great Māhele, or land division, establishing private ownership of lands in Hawaiʻi.

Sugar planting and refining throughout Hawaiʻi was established between 1836 and 1861.

In 1876, the Hawaiian Reciprocity Treaty with the United States allowed for duty-free admission of Hawaiian sugar to the U.S., resulting in a substantial increase of profits for island growers. With massive growth of the sugar industry, the need for labor grew, resulting in the importation of workers from other countries.

The pineapple industry began on Maui in 1890. By 1930, over 28 percent of Maui's cultivated lands were dedicated to pineapple.

During World War II, the military population on Maui reached approximately 200,000, outnumbering local residents four to one.

[4] County of Maui. (2015). *County of Maui Hazard Mitigation Plan Update.* Prepared by Tetra Tech.

With a decline of the sugar and pineapple industries after World War II and bourgeoning economies on Oahu and the U.S. mainland, Maui lost 24 percent of its population between 1940 and 1960. In 1959, the Report of Land Use for the Island of Maui proposed that, to reverse the trend, Maui could work to capture a greater share of Hawaiʻi's tourist industry. The need for visitor facilities gave birth to the concept of the resort destination area, and in 1961 Kāʻanapali became the first of its kind in Hawaiʻi.

As Maui's population grew, settlement patterns expanded rapidly, spreading out from existing population centers. Central, South, and West Maui have grown significantly in the subsequent decades with the birth of new subdivisions and visitor accommodations. Maui's rapidly expanding population eventually spread to the Upcountry area of the island, which experienced significant growth in the residential market beginning in the 1970s.

Island of Molokaʻi

The oldest known Hawaiian settlement is located on the island of Molokaʻi in Hālawa Valley, located at the eastern end of the island.[5]

In 1832, a Protestant mission was established at Kaluaʻaha, along the south east coast of the island.

Kalaupāpā, a small, unincorporated community on the north shore of the island, was established as a leper colony in 1866 for patients seriously affected by Hansen's disease. When the isolation law was repealed in 1969, residents chose to remain living there. With a current population of fewer than 100 people, Kalaupāpā is the only settlement within Kalawao County, and is now part of the Kalaupāpā National Historical Park.

In the late 1800s, King Kamehameha V built a vacation home in Kaunakakai and was responsible for the planting of over 1,000 coconut trees in Kapuāiwa Coconut Grove.

Beginning in 1897 much of the western end of the island was purchased by Molokaʻi Ranch to operate a cattle ranch. From 1923 to 1985 thousands of acres of that land was leased to pineapple producers.

In 2008, community members opposed attempts by Molokaʻi Ranch to expand operations, and what was then the island's largest employer shut down all operations including hotels, a movie theater, restaurants and golf course, dismissing 120 workers.

Tourism is not as large an industry on Molokaʻi as it is on other islands in the state, as accommodations are limited; residents value the quiet, rural lifestyle, and have resisted attempts to dramatically increase tourism on the island.

[5] Ibid.

Island of Lānaʻi

In his campaign to unify the Hawaiian Islands under one ruler in the 1700s, Kamehameha I killed much of Lānaʻi's population, leaving few settlements or inhabitants.[6]

In 1922, James Dole, president of the Hawaiian Pineapple Company, purchased the entire island, and much of the land was used for pineapple plantations. When the pineapple industry started to plateau in the 1980s, the company, by that time called Dole Food Company, was reformed into a new company named Castle & Cooke.

When David H. Murdock bought Castle & Cooke, he gained control over Lānaʻi Island and began developing it as a tourist destination.

In 2012, Larry Ellison, CEO of Oracle Corporation purchased 98 percent of the island from Murdock. The island's focus on tourism remains.

Island of Kahoʻolawe

The Island of Kahoʻolawe was home to a school from 1828 to 1837 and a penal colony from 1832 to 1853.

In 1858, the government issued the first of many ranch leases for the island. Ranching remained a primary use until 1952.

The island was ceded to the United States in 1898 and later taken over by the U.S. military following the bombing of Pearl Harbor in 1941.

Military use of the island remained significant until 1993, when the island was transferred to the State of Hawaiʻi under a federal act that called for clearance or removal of unexploded ordnance and environmental restoration of the island. The state designated the island as the Kahoʻolawe Island Reserve, to be used solely for preservation of native Hawaiian culture, preservation of historical and environmental resources, rehabilitation of habitat, and education.

Geographic and Environmental Overview

The island of Maui is the largest island within Maui County (see Figure 2 below) and is divided into four districts: Lahaina, Wailuku, Makawao, and Hāna. The Makawao district also includes the Island of Kahoʻolawe. The islands of Molokaʻi and Lānaʻi are separate districts. Even though a separate county, the County of Kalawao is typically treated as a district of the County of Maui for statistical purposes. The seat of government for the county is located on Maui in the town of Wailuku.

[6] Ibid.

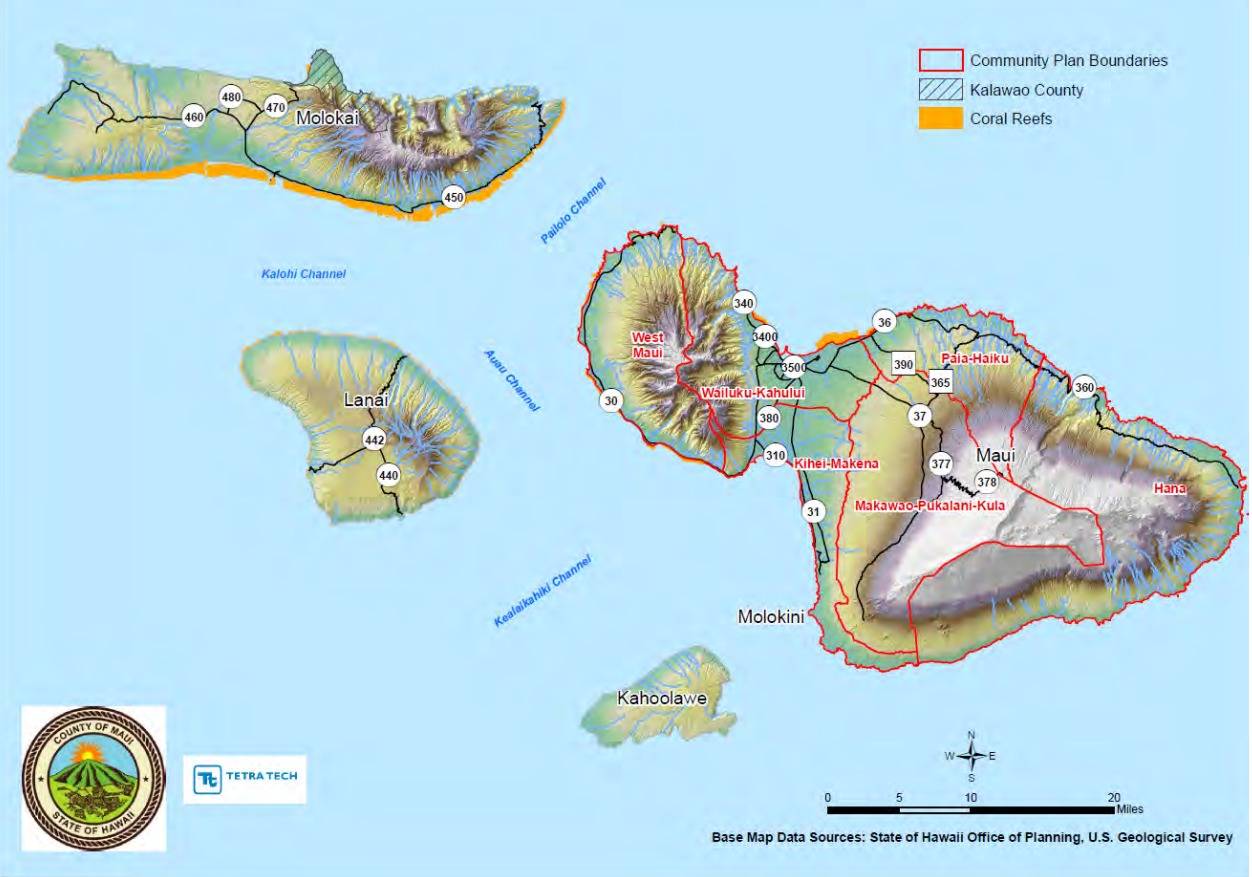

Figure 2. Map of Maui County[7]

Community Planning Areas

Nine Community Planning Areas have been designated within Maui County for the purposes of strategic planning and development:

1. Hāna
2. Kahoʻolawe
3. Kīhei-Mākena
4. Lānaʻi
5. Makawao-Pukalani-Kula
6. Molokaʻi
7. Pāʻia-Haʻikū
8. Wailuku-Kahului
9. West Maui

[7] Community Plan boundaries are not delineated for Molokaʻi and Lānaʻi because the Community Plan boundary and the Islands' geographic boundary are conterminous. Due to geographic location, coral reef and Community Plan boundaries overlap.

These planning areas are shown in the Figure 3 below.

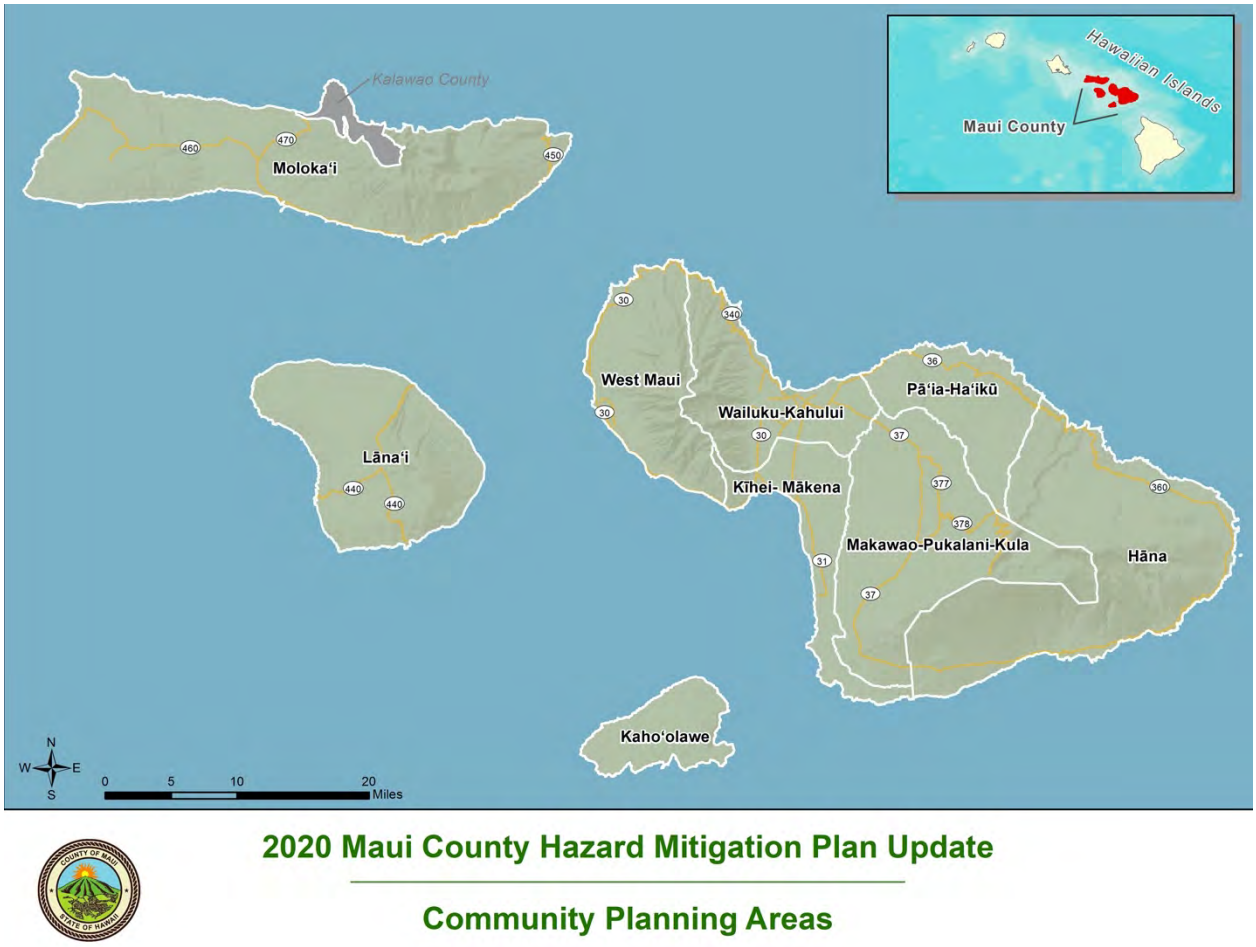

Figure 3. Community Planning Areas

Each Community Planning Area has a Community Plan that serves as a strategic planning document to guide government action and decision-making. Community Plans provide recommendations concerning land use, density and design, transportation, community facilities, infrastructure, visitor accommodations, commercial and residential areas, and other matters related to development that are specific to the region of each plan. As a requirement of Maui County Code 2.80B, community plans for each area are updated every 10 years. [8]

Eight of the nine Community Planning Areas form the basis for discussion and assessment throughout the Hazard Mitigation Plan Update and have been the focus for community outreach and engagement over the course of the planning process. Because of Kaho'olawe's designation as an island reserve, and

[8] County of Maui. (2020). Retrieved from: https://www.mauicounty.gov/423/Community-Plans

having no residential population, it factors only peripherally into the Plan update. Brief descriptions of each of the Community Planning Areas follow:

Hāna

The Hāna Community Planning Area encompasses approximately 265 square miles (145,000 acres) of the eastern portion of the island of Maui[9] and is therefore generally referred to as "East Maui." The remote town of Hāna is situated along the easternmost shoreline of Maui, approximately 55 miles from the County seat of Wailuku and serves several small rural settlements dispersed along the coast, including Keʻanae, Wailua, Nahiku, Kīpahulu and Kaupo. The single narrow and winding road linking Hāna Town with the rest of the island is renowned for its scenic beauty, one-lane bridges and stunning waterfalls, but frequently experiences outages during the wet season when landslides and flooding can close the roadway for hours to days at a time (see Figure 4). As a result, the small populations in this planning area have developed resilient and creative ways to sustain their livelihoods and support their rural lifestyle. An estimated 1,642 people live in the Hāna Community Planning Area,[10] served by a small airport, fire station, public works base yard, schools, a hotel, several small businesses and a community health center.

Figure 4. Road to Hāna Blocked by Landslide

Kahoʻolawe

Kahoʻolawe is the smallest and southernmost of the four major islands comprising Maui County. Lying seven miles offshore of Mākena, Maui, and 16 miles from the island of Lānaʻi, Kahoʻolawe is 11 miles long and 7 miles wide, with a total of 28,600 acres. Once known for its abundant fishing, limited dryland agriculture, and schooling in celestial navigation and other ancient cultural arts, Kahoʻolawe has suffered greatly over the last two centuries from environmental degradation due to overgrazing, military use, and introduction of alien species. Efforts to rehabilitate the land have been underway since 1994, after congressional legislation conveyed Kahoʻolawe back to the State of Hawaiʻi and established the

[9] Maui County Council. (1994). *Hāna Community Plan*.

[10] Population for Community Planning Areas were derived from Census Tract level data from the US Census American Community Survey (ACS) 5-year Estimates, 2014-2018. While most of Maui County's 35 populated census tracts closely align with Community Planning Area boundaries, two census tracts on the island of Maui (Tract 304.04 in the area of Makawao and Haiku-Pauwela to the north, and Tract 320 spanning Maalaea and Olowalu to the west) exhibited significant population distribution across multiple planning areas. These cases were evaluated using an ancillary 30-meter gridded population dataset from Facebook (Facebook, 2019. "United States: High Resolution Population Density Maps & Demographic Estimates." Accessed via Humanitarian Data Exchange: https://data.humdata.org/dataset/united-states-high-resolution-population-density-maps-demographic-estimates), as well as aerial imagery from Google Maps. ArcGIS zonal statistics were used to estimate the proportion of the census tract population living in each planning area.

Kahoʻolawe Island Reserve and the Kahoʻolawe Island Reserve Commission (KIRC) to manage the island and its surrounding waters.[11] The Kahoʻolawe planning area has no resident population.

Kīhei-Mākena

The Kīhei-Mākena Community Planning Area, often referred to as "South Maui," spans just over 72 square miles of the southern coast of the island of Maui and includes the communities of Māʻalaea, Kīhei, Wailea and Mākena. Between the small community of Māʻalaea, furthest west, and the more urban portion of the planning area to the east, lies a sizeable wetland known as Kealia Pond. Māʻalaea has a functioning harbor which was established in 1950. The town of Kīhei is the residential and commercial center for the region.

Kīhei-Mākena has been one of the fastest growing areas of Maui over the past several decades. In 1990 the resident population was 15,365.[12] An estimated 27,938 people now live there. The abundance of sunny, dry weather and sandy beaches not only makes the Kīhei-Mākena area a desirable place to live, but a popular visitor destination as well. This region of Maui has considerable shoreline development, including hotels, resorts, condominiums and residences ranging from affordable to exclusive.

Lānaʻi

Known as the Pineapple Island,[13] the island of Lānaʻi – comprising its own Community Planning Area – covers just over 140 square miles and is the sixth largest of the main Hawaiian Islands. Uniquely, in the late 1800s, nearly all the land on the island was acquired by one person. Title to 98% of the island has changed hands several times in the years since and is currently privately owned by Larry Ellison and managed by Pūlama Lānaʻi.

The centrally located plantation town of Lānaʻi City sprang up in the 1920s to support the pineapple plantations of James Dole's Hawaiian Pineapple Company, for which the island became known. Today, Lānaʻi City remains the center for most commercial and community activities. Two resorts, a fire station, single runway airport, schools and a small boat harbor at Kaumālapaʻu Bay serve the island and its residents.

When the pineapple plantations came to an end in the early nineties, Lānaʻi's economy shifted to luxury tourism and resort home construction. This shift combined with the economic recession of 2007-2008 resulted in fewer employment opportunities and the outmigration of residents seeking employment elsewhere. According to the U.S. Census, 3,135 residents made Lānaʻi their home in 2010. An estimated 2,826 people currently live on the island.

Lānaʻi is one of the driest of the inhabited main Hawaiian Islands, as it lies within the rain-shadow of Maui's West Maui mountains. The small boat harbor and one of the resorts are located within a tsunami

[11] Maui County Council. (1995). *Kahoolawe Community Plan*.
[12] Maui County Council. (1998). *Kīhei-Mākena Community Plan*.
[13] Maui County Council. (2016). *Lānaʻi Community Plan*.

evacuation zone and are susceptible to storm surge and sea level rise. Erosion due to land degradation is another hazard facing the island. These, along with management of limited water resources, protection and restoration of fragile ecosystems, and economic diversification are among the important themes concerning Lānaʻi residents.

Makawao-Pukalani-Kula

The Makawao-Pukalani-Kula Community Planning Area, referred to as "Upcountry," is located on the western slopes of Haleakalā and is the only planning area in the county without any shoreline resources.[14] Most of the residential population is located in the towns of Makawao and Pukalani, each with small concentrations of shops, restaurants and businesses surrounded by mixed suburban and rural land uses. Kula also has a small cluster of shops and businesses serving the community, but is predominantly rural and agriculturally focused, and famed for the quality of its flower and vegetable exports.

The largest of Maui Island's planning regions, Makawao-Pukalani-Kula encompasses 202 square miles and is highly diverse in terms of the physical environment, history and culture. Ranging from 600 to 10,000 feet in elevation and stretching from windward facing slopes of Haleakalā to the north around to the south-facing leeward slopes of Ulupalakua and Kanaio, the area has numerous micro-climates supporting diverse flora and fauna including rare species of native plants and birds.

The residential population of the planning area has grown significantly over the last several decades. In 1990, the U.S. Census estimated that 19,000 people lived in the area. Today, an estimated 27,397 people make Upcountry Maui their home.

Molokaʻi

The island of Molokaʻi is the fifth largest of the eight main Hawaiian Islands, covering 261 square miles or 172,000 acres (including Kalaupāpā). The island has 88 miles of coastline, with the longest continuous fringing coral reef in the U.S. and the most intact pre-contact system of man-made fishponds that exist anywhere in Polynesia[15] along the southern shoreline.

Rich in natural and cultural resources, and the most rural of the Hawaiian Islands, Molokaʻi is often referred to as the "Last Hawaiian Island." Besides the island of Niʻihau, Molokaʻi has the highest percentage of Native Hawaiians in the state.[16]

Approximately 6,823 people make Molokaʻi their home. The 2010 U.S. Census estimated that 24 percent of the population is of Native Hawaiian ancestry (excluding Kalawao County).

The town of Kaunakakai, located about midway along the southern coast, is the island's major population and commercial center, with schools, shops and other services. Kaunakakai Harbor is the island's main

[14] Maui County Council. (1996). *Makawao-Pukalani-Kula Community Plan*.
[15] County of Maui. (2018). *Molokaʻi Island Community Plan Update*.
[16] Ibid.

point of entry for goods and resources, including fuel. A small airport is located six miles northwest of Kaunakakai. The island's only resort destination is on the western end of the island at Kaluakoʻi.

Many Molokaʻi residents still practice a subsistence-based lifestyle, relying on fishing, hunting, farming, and gathering for food, spiritual wellbeing, and cultural practices.[17] The rural lifestyle, strong sense of community, and connection to place and culture are deeply valued by Molokaʻi residents. The challenges of remoteness, limited infrastructure and few economic opportunities have been largely overcome by the resilience fostered by Molokaʻi's abundant social capital.

Pāʻia-Haʻikū

Located along Maui's north shore, the towns of Pāʻia and Haʻikū lie east of the more densely populated urban center of Kahului and west of the remote town of Hāna. Approximately 12,748 people live within the planning area which encompasses approximately 83 square miles (17,300 acres). Pāʻia is the more urban of the two, yet still retains a "small town" scale and character.[18] Haʻikū is further removed, yet still conveniently within approximately 15 miles of Maui's central business district. Being more rural than Pāʻia, residential growth in Haʻikū has developed on what were once agricultural lands. Extensive pineapple fields have been slowly replaced by small-scale development, "gentleman farms" and diversified agriculture. Two small urban areas that were once pineapple canneries host small businesses, restaurants and grocery stores. Unlike Pāʻia, public infrastructure in Haʻikū lacks a municipal sewage treatment system, and roadways are not routinely maintained.

Wailuku-Kahului

Located on the north shore of the island of Maui, the Wailuku-Kahului Community Planning Area spans 104 square miles; including roughly half of the Central Valley's agricultural lands and the eastern half of the West Maui Mountains. Home to 62,817 people, "Central Maui" is the primary urban, business and industrial center of the island. The historic town of Wailuku, nestled at the foot of the West Maui Mountains, serves as the seat of county government. The adjoining and more expansive town of Kahului is the critical entry point for imported goods by way of the harbor, and transit hub for residents and visitors via the county's main airport.

Kahului is home to the University of Hawaiʻi Maui College campus as well as a number of venues including parks, sports facilities, community theaters, the War Memorial Center, and the Maui Arts and Cultural Center capable of supporting large community gatherings and cultural events.

Outside of the main urban areas of Wailuku and Kahului are the more rural settlements of Waiheʻe to the north and Waikapū and Puʻunēnē to the southeast. Surrounding agricultural lands, once managed by HC&S, are being transitioned to diversified agriculture and other uses. Gaps in management and a significant dry spell contributed to major fires in the central valley in 2019.

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[17] Ibid.

[18] Maui County Council. (1995). *Paia-Haiku Community Plan*.

West Maui

Encompassing 96 square miles and roughly half of the western portion of the island of Maui, the West Maui Community Planning Area is home to an estimated 23,165 people. Development is centered on the western slopes of the West Maui Mountains and along the coast, stretching from the small community of Oluwalu in the south to Kapalua in the north. Between the two are the communities of Lahaina, Kāʻanapali, Honokōwai, and Nāpili.

Lahaina, once the capital of the Hawaiian Kingdom and home to Hawaiian royalty, is the primary urban, commercial and service center for this planning area. Kāʻanapali, to the north, was the state's first master-planned resort area, and continues to attract a significant number of visitors each year.

West Maui's growing resident and visitor populations have put a strain on housing, infrastructure and other resources such as water and wastewater services.[19] Large populations live, work or go to school within tsunami evacuation zones. Sea level rise has caused significant shoreline erosion which is threatening multiple residential structures and the single transportation lifeline between the area and the rest of Maui. West Maui is not without its challenges, but recent community planning efforts are tackling these and other issues of importance to the region's future.

Natural Resources and Environment

Maui County's natural resources range from tropical rain forests and jagged-peaked mountains to the near-shore environment and coral reefs. The islands are home to flora, fauna and ecological communities that can be found nowhere else in the world.[20] These natural resources face pressure from development, invasive species, natural hazards and climate change. According to the Federal Register[21] the U.S. Fish and Wildlife Service lists 49 plant species and 10 animal species as "endangered" within the Hawaiian Islands. Of these, 26 plant species and 8 animal species make one or more of the islands of Maui County their home.

Hawaiʻi's environment and natural resources are integral to the economy, sense of place and traditional culture of the island communities. Consideration and care of natural resources in the context of hazard mitigation planning is relevant not only because of the potential impacts upon them, but because of the ecosystem services they provide, such as reducing hazard impacts on the built environment.

Climate

Rainfall varies considerably across the Island of Maui, with windward areas experiencing much heavier rainfall than leeward areas. The slopes of Haleakalā (East Maui) and Puʻu Kukui (West Maui) force moist

[19] County of Maui Department of Planning. (2019). *Draft West Maui Community Plan Update*.
[20] County of Maui. (2015). *County of Maui Hazard Mitigation Plan Update.* Prepared by Tetra Tech.
[21] U.S. Fish and Wildlife Service. (2016). Federal Register. Doc. 2016-23112. Retrieved from: https://www.federalregister.gov/documents/2016/09/30/2016-23112/endangered-and-threatened-wildlife-and-plants-endangered-status-for-49-species-from-the-hawaiian

northeasterly trade wind air upwards, causing the formation of clouds and showers. Subsiding air over the leeward slopes suppresses cloud and shower development, leaving these areas mostly dry. Median annual rainfall is 200 to 300 inches on the windward side of Haleakalā and about 350 inches near the summit of Puʻu Kukui; but leeward areas such as Kīhei have a mean annual rainfall of only 10 inches. Trade winds are also deflected around the volcanic masses and funneled through gaps and valleys, causing local wind accelerations and eddies. A notable example is a feature known as the "Maui vortex," a persistent circulation that usually occurs during trade wind conditions over the western slopes of Haleakalā.[22]

Similarly, the eastern portion of Molokaʻi receives much more rain than the western portion. Trade wind-driven rains throughout the year come in from the northeast and drop most of their moisture in the northern windward highlands, seldom on the southern or lee side of the island. The average annual rainfall is 20 inches in West Molokaʻi and at the Molokaʻi airport in the middle of the island. The eastern slopes of Kamakou (East Molokaʻi) receive an average of 150 plus inches a year. Kona storms are major storms that come from the south once or twice a year, normally between October and April, and may drop 8 to 10 inches of rain within hours. Molokaʻi is warm year-round, with an average yearly temperature of 74°F. During the winter months (December through March), Molokaʻi experiences cooler nighttime temperatures as low as the lower 60s with more frequent rain and stronger ocean currents.[23]

The Island of Lānaʻi is sheltered from the prevailing northeasterly trade winds by the mountains of West Maui. Because of its protected location, Lānaʻi has a much dryer climate than the other main Hawaiian Islands. Average annual rainfall at the summit of the island's highest peak, Lānaʻihale, is 30 to 40 inches. Lower-lying areas of the island have an average annual rainfall of 10 to 20 inches.[24]

Kahoʻolawe has a very dry climate because of its low relief and sheltered location in the shadow of Haleakalā on the Island of Maui. Annual mean precipitation throughout the island is 10 to 20 inches.[25]

Table 2 below summarizes normal climate data collected by weather stations across the planning area between 1981 and 2010 by the National Climatic Data Center (NCDC).[26]

Table 2. Normal precipitation and temperatures for selected weather stations in Maui County, 1981 to 2010

Normal Precipitation and Temperatures for Selected Weather Stations in Maui County, 1981 to 2010

Haleakalā Ranger Station 338				
Season	**Precipitation (in.)**	**Min. Temp (°F)**	**Avg. Temp (°F)**	**Max Temp (°F)**
Annual	49.74	45.7	54.2	62.8
Winter	18.93	43.4	52.0	60.5

[22] County of Maui. (2010). *County of Maui Multi-Hazard Mitigation Plan 2010*. Prepared by Martin & Chock, Inc.
[23] Ibid.
[24] Ibid.
[25] Ibid.
[26] National Climatic Data Center (NCDC). (2020). Retrieved from: https://www.ncdc.noaa.gov/cdo-web/datatools/normals

Summer	6.07	48.3	57.0	65.7
Spring	13.97	43.7	52.4	61.0
Autumn	10.77	47.2	55.6	64.0
Hāna Airport Station 355				
Season	**Precipitation (in.)**	**Min. Temp (°F)**	**Avg. Temp (°F)**	**Max Temp (°F)**
Annual	79.23	68.3	74.2	80.2
Winter	19.66	65.4	71.7	78.1
Summer	16.02	70.7	76.5	82.2
Spring	21.68	66.9	72.8	78.7
Autumn	21.87	70.0	75.9	81.8
Kahoʻolawe Station				
Season	**Precipitation (in.)**	**Min. Temp (°F)**	**Avg. Temp (°F)**	**Max Temp (°F)**
Annual	17.24	66.5	70.9	75.3
Winter	7.08	64.4	68.9	73.4
Summer	2.46	68.2	72.5	76.9
Spring	3.33	64.9	69.3	73.7
Autumn	4.37	68.5	72.8	77.1
Kahului Airport Station				
Season	**Precipitation (in.)**	**Min. Temp (°F)**	**Avg. Temp (°F)**	**Max Temp (°F)**
Annual	17.83	67.4	75.9	84.3
Winter	8.11	63.9	72.4	81.0
Summer	1.20	70.7	78.9	87.2
Spring	4.74	65.7	74.2	82.7
Autumn	3.78	69.3	77.8	86.3
Kapalua Airport, West Maui Station 462				
Season	**Precipitation (in.)**	**Min. Temp (°F)**	**Avg. Temp (°F)**	**Max Temp (°F)**
Annual	29.01	69.1	75.5	81.9
Winter	11.16	66.5	72.5	78.6
Summer	3.75	71.3	78.0	84.7
Spring	7.89	67.6	74.0	80.4
Autumn	6.21	71.0	77.4	83.8
Kaunakakai Molokaʻi Airport				
Season	**Precipitation (in.)**	**Min. Temp (°F)**	**Avg. Temp (°F)**	**Max Temp (°F)**
Annual	24.68	67.3	74.5	81.6
Winter	11.42	63.8	71.0	78.1
Summer	1.72	70.6	77.6	84.6
Spring	5.65	65.2	72.6	80.0
Autumn	5.89	69.7	76.8	83.8
Kula Hospital Station 267				
Season	**Precipitation (in.)**	**Min. Temp (°F)**	**Avg. Temp (°F)**	**Max Temp (°F)**
Annual	30.76	54.9	63.2	71.4
Winter	10.17	52.4	60.4	68.3
Summer	5.36	56.9	65.5	74.2
Spring	7.00	53.4	61.6	69.8
Autumn	8.23	56.9	65.1	73.2
Lānaʻi Airport Station 656				
Season	**Precipitation (in.)**	**Min. Temp (°F)**	**Avg. Temp (°F)**	**Max Temp (°F)**

Annual	15.59	63.3	71.5	79.7
Winter	6.31	60.1	68.3	76.4
Summer	1.52	65.8	74.2	82.7
Spring	3.02	61.6	69.9	78.2
Autumn	4.74	65.5	73.4	81.4
Mākena Golf Course Station 249.1				
Season	**Precipitation (in.)**	**Min. Temp (°F)**	**Avg. Temp (°F)**	**Max Temp (°F)**
Annual	16.07	66.0	75.2	84.3
Winter	6.99	63.5	72.2	80.9
Summer	1.66	68.2	77.7	87.3
Spring	3.18	64.4	73.7	83.1
Autumn	4.24	67.9	77.0	86.0

Physical Setting

The Hawaiian Archipelago consists of 132 volcanic islands, atolls, reef, and shoals in the North Pacific Ocean. The islands that make up Maui County are among the eight main islands at the southeastern end of the island chain. The archipelago beyond those eight islands are known as the Northwestern Hawaiian Islands and forms part of the Papahānaumokuākea Marine National Monument created by Presidential Proclamation 8031 on June 15, 2006 under the authority of the Antiquities Act (16 U.S.C. 431-433).

The Island of Maui is the second largest island in the Hawaiian Archipelago, covering 772 square miles.[27] It was formed by two volcanic cones: Pu'u Kukui (Mauna Kahalawai) on the west side, with a current elevation of 5,788 feet; and Haleakalā on the east side of the island, with a current elevation of 10,023 feet. East Maui began its formation about 2 million years ago[28] and is geologically younger than West Maui, as apparent by the absence of deeply incised topography and extensive areas of volcanic lava and cinders on the southwestern slopes of Haleakalā. According to recent geologic studies[29] using radiocarbon dating techniques, the younger of the two – Haleakalā – last erupted along East Maui's lower southwest rift zone sometime between A.D. 1420 and 1620. The oldest exposed lava flow on East Maui is about 1.1 million years old. While considered "dormant," Haleakalā's eruptive history indicates

[27] The State of Hawaii Department of Business, Economic Development & Tourism. (2018). Table 05.10. Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/

[28] U.S. Geological Survey. (2017). Retrieved from: https://volcanoes.usgs.gov/volcanoes/haleakala/geo_hist_summary.html

[29] Sherrod, D. R., J. T. Hagstrum, J. P. McGeehin, D. E. Champion, and F. A. Trusdell (2006), Distribution,14C chronology, and paleomagnetism of latest Pleistocene and Holocene lava flows at Haleakalā volcano, Island of Maui, Hawai'i: A revision of lava flow hazard zones, J. Geophys. Res., 111, B05205, doi:10.1029/2005JB003876 Retrieved from: https://agupubs.onlinelibrary.wiley.com/doi/10.1029/2005JB003876

that it could erupt every ~200 to 500 years. Mauna Kahalawai on West Maui is considered extinct, having last erupted roughly 320,000 years ago.[30]

Maui earned its nickname of "The Valley Isle" due to the relatively flat isthmus of land that joins the two cones. Rich in alluvial deposits and decomposed basaltic materials, the gentle slopes of central Maui and tablelands of West Maui are well-suited to agriculture.

The Island of Molokaʻi is the fifth largest of the main Hawaiian Islands, covering approximately 261 square miles. It is 38 miles long and 10 miles wide and has approximately 100 miles of shoreline. It was formed primarily by the coalescence of two shield volcanoes 1.8 million to 1.3 million years ago: the east Molokaʻi volcano (also known as Kamakou) and the west Molokaʻi volcano (also known as Mauna Loa). The island's geology and topography vary considerably from east to west: east Molokaʻi has a range of mountains whose highest peak, Kamakou, has an elevation of 4,970 feet. The Kamakou Preserve (2,774 acres of rainforest) is located on this side of the island. Stream erosion has cut large amphitheater-headed valleys into its northern coast. Near the end of the shield stage of the East Molokaʻi volcano, its northern flank slid into the ocean, leaving behind the towering cliffs that dominate the northeast coast of the island. At more than 3,000 feet above sea level, these cliffs are the tallest sea cliffs in the world. Smaller and narrower valleys are found on the southern side of East Molokaʻi. The southeastern edge of the island is bordered by an alluvial plain produced from a series of semi-contiguous alluvial fans associated with upland gulches.

An East Molokaʻi volcanic episode approximately 300,000 years ago formed a 2,500-acre peninsula in the sea below the steep cliffs of the north side of Molokaʻi Island. The peninsula, known as Kalaupāpā, is virtually isolated from the rest of the island by cliffs 1,600 to 2,000 feet high. The island's broad Hoʻolehua Saddle forms a low-lying coastal plain along the south shore at the island's center.

On the west side of Molokaʻi, the sloping West Molokaʻi volcano reaches an altitude of 1,380 feet. This is the only Hawaiian volcano with no clear evidence of a summit caldera. The west side of the island has rolling arid land rather than valleys and is considerably drier than the east side. It is home to plantations, ranches, and small farms.

The Island of Lānaʻi is the sixth largest of the main Hawaiian Islands, with an area of 140 square miles. The island was formed from a single shield volcano that last erupted about 1.3 million years ago. A low-lying basin in the center of the island is what remains of the volcano's caldera.[31]

The smallest of the main Hawaiian Islands, Kahoʻolawe has a land area of 45 square miles. It was formed by a single volcano that underwent shield and post-shield stages. The highest point on the island is Puʻu Moaulanui at 1,483 feet above sea level.[32]

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[30] Sinton, John M. (no date). *Geologic History of Maui*. Retrieved from: http://www.soest.hawaii.edu/Library/Sinton_Maui.pdf
[31] County of Maui. (2010). *County of Maui Multi-Hazard Mitigation Plan 2010*. Prepared by Martin & Chock, Inc.
[32] Ibid.

Population and Demographics

Populations can be at increased risk to hazard events due to a number of factors, including age, limited resources, physical impairments, lack of awareness or understanding of hazards and warning messages, etc. Research has shown that people living near or below the poverty line, the elderly (especially older single men), individuals with disabilities, women, children, ethnic minorities, and renters all experience, to some degree, more severe effects from disasters than the general population. These vulnerable populations may vary from the general population in risk perception, living conditions, access to information before, during and after a hazard event, capabilities during an event, and access to resources for post-disaster recovery. Indicators of vulnerability – such as disability, age, and poverty – often overlap spatially and tend to characterize the populations living in areas of greater hazard exposure. From a planning perspective, understanding where there are higher concentrations of vulnerable community members helps to extend focused public outreach and education to these most vulnerable citizens.

Resident Population

Knowledge of the composition of the population and how it has changed in the past and how it may change in the future is needed for making informed decisions about the future. Information about population is a critical part of planning because it directly relates to current needs and future development related to housing, industry, businesses, public facilities and services, and infrastructure such as energy and transportation.

The U.S Bureau of the Census estimates the resident population of Maui County to be 167,295.[33] This estimate includes 88 persons living in the Kalaupāpā Settlement of Kalawao County on the island of Molokaʻi.

Resident population for each island[34] within the county for selected years, based on decennial censuses and American Community Survey 5-Year estimates[35] are shown in the table below.

Table 3. Resident population of the islands within Maui County.

Island	1970	1980	1990	2000	2010	2013-2017
Maui	38,691	62,823	91,361	117,644	144,444	153,997
Molokaʻi (including Kalawao County)	5,261	6,049	6,717	7,404	7,345	6,980 (86)
Lānaʻi	2,204	2,119	2,426	3,193	3,135	3,203

[33] State of Hawaii Department of Business, Economic Development & Tourism. (2018). State of Hawaii Data Book. Table 01.06. "Annual Estimates of the Resident Population" released April 2019. Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/

[34] The State of Hawaii Department of Business, Economic Development & Tourism. (2018). Table 01.05. Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/.

[35] Data for 2013-2017 are 5-year estimates based on a sample and are subject to sampling variability.

Kaho'olawe	-	-	-	-	-	-

Average population change[36] within Maui County is contrasted with the State of Hawai'i for five-year periods between 2000 and 2018[37] in the figure below.

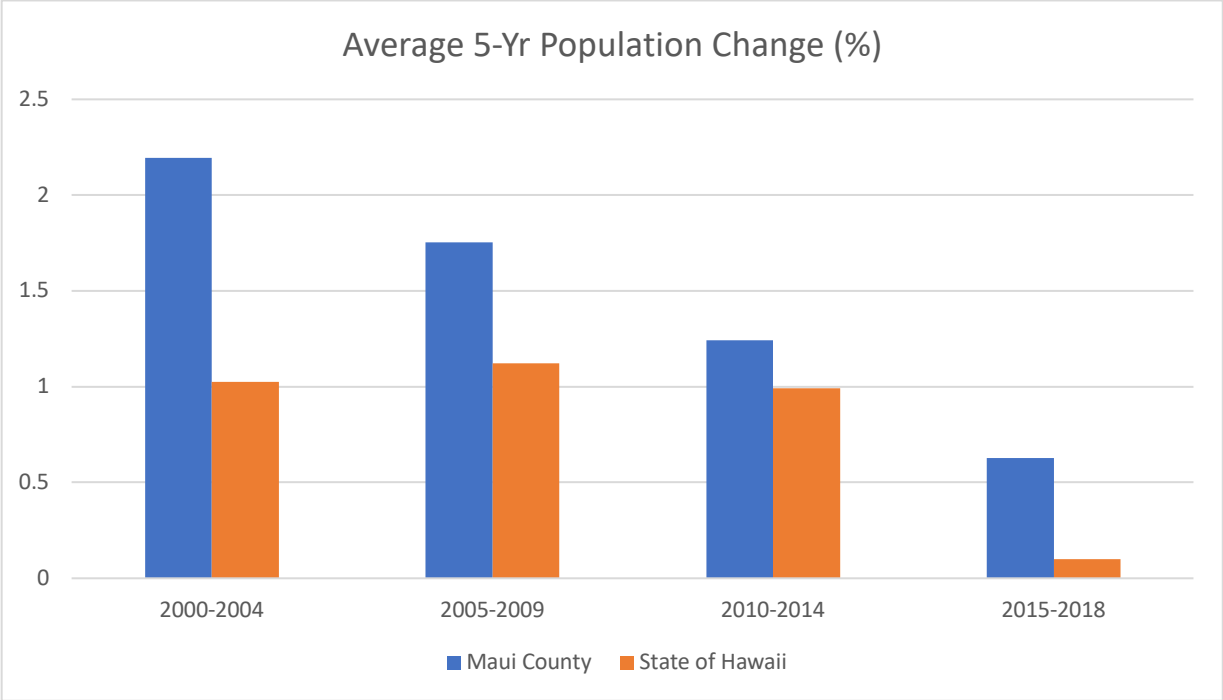


Figure 5. Average 5-year population change (%) for Maui County and the State of Hawai'i.

Table 4 below shows estimated populations for each Census Designated Place (CDP)[38] within each of the Community Planning Areas (in alphabetical order). CDPs with resident populations greater than 10,000 include Kīhei, Kahului, Wailuku and Lahaina.[39]

[36] State of Hawaii Department of Business, Economic Development & Tourism. (2018). State of Hawaii Data Book. Table 01.07. Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/

[37] Due to data availability, population change for 2015-2018 represents a four-year average.

[38] "Census designated places" (CDPs) were defined by the Hawaii State Department of Business, Economic Development & Tourism, in cooperation with the U.S. Census Bureau and the county planning departments, for the 2010 decennial census, under the authority granted by Sec. 26-18, Hawaii Revised Statutes. Although described in the legislation as "cities, towns, and villages," none of these places are an independent municipality with separate government and taxing powers; the boundaries determined for the CDPs are statistical rather than political. CDPs do not cover all land areas with populations, so island totals are not the sum of only their CDPs. Based on a sample and subject to sampling variability. Figures displayed are the average values between the years 2013 to 2017. Source: U.S. Census Bureau, 2013-2017 American Community Survey 5-year estimates.

[39] State of Hawaii Department of Business, Economic Development & Tourism. (2018). State of Hawaii Data Book. Table 01.12. Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/

Table 4. Resident populations of CDPs within Community Planning Areas of Maui County.

Community Planning Area	Census Designated Place (2010 boundaries)	Average Number of Residents (2013-2017)	Average Number of Households (2013-2017)
Hāna	Hāna	1047	276
Kīhei-Mākena	Kīhei	22220	8196
	Māʻalaea	253	169
	Mākena	150	59
	Wailea	5602	2563
Lānaʻi	Lānaʻi City	3185	1236
	Mānele	18	10
Makawao-Pukalani-Kula	Hāliʻimaile	1031	309
	Kēōkea	2282	691
	Kula	7520	2911
	Makawao	6832	2403
	Olinda	957	411
	Pukalani	8340	2926
Molokaʻi	Kaunakakai	3494	1199
	Kualapuʻu	2013	614
	Maunaloa	424	127
	ʻUalapuʻe	403	139
Pāʻia-Haʻikū	Haʻikū-Pauwela	7420	2739
	Pāʻia	2638	794
Wailuku-Kahului	Kahului	30706	7726
	Waiheʻe-Waiehu	9017	2448
	Waikapū	3294	945
	Wailuku	16995	6142
West Maui	Kāʻanapali	968	463
	Kapalua	303	135
	Lahaina	13223	3565
	Launiupoko	528	207
	Mahinahina	1075	409
	Nāpili-Honokōwai	7311	2790
	Olowalu	116	61

Visitor Population

A popular tourist destination, Maui County welcomed 247,017 visitors in January 2020, a 3.8% increase from January 2019 when 238,054 tourists visited the county. Of those visiting in January 2020, most (242,472 persons) spent time on Maui, with fewer visiting the smaller islands of Molokaʻi (6,786) and Lānaʻi (6,064). Visitors frequently visit more than one island during their stay, therefore values for visitors to individual islands reflect this. Overall, Maui County's January 2020 visitor population represented 29% of the total visitors to the state of Hawaiʻi.

According to the Hawai'i Tourism Authority's visitor statistics for 2019, on average there were 249,021 visitors in the Hawaiian Islands on any given day, up 3.0 percent from 2018. The average daily visitor count for Maui also grew by 3.0 percent from the previous year, with an average of 66,414 visitors on any given day.

On the Island of Maui, large visitor populations are concentrated in accommodations along the coasts of West Maui from Lahaina to Kā'anapali, and in South Maui from Kīhei to Wailea.

Given the above statistics, at any given time approximately one third (28.4%) of Maui County's population is comprised of non-residents. This has implications for hazard mitigation planning, as many tourists seek recreational activities such as hiking, swimming and other water sports in places of natural beauty yet lack the awareness of their exposure to hazards such as flash flooding of streams and natural freshwater pools, and coastal hazards such as high surf and strong currents.

Dependent Populations

According to the U.S. Census Bureau,[40] 30,603 persons (18.3 percent) of Maui County's population is 65 or older. An estimated 30,375 persons, or 18.2 percent of the population is age 14 or younger. See Figure 6 below. The age dependency ratio for Maui County is 57.3 meaning there are 57.3 dependent persons for every 100 working-age persons.

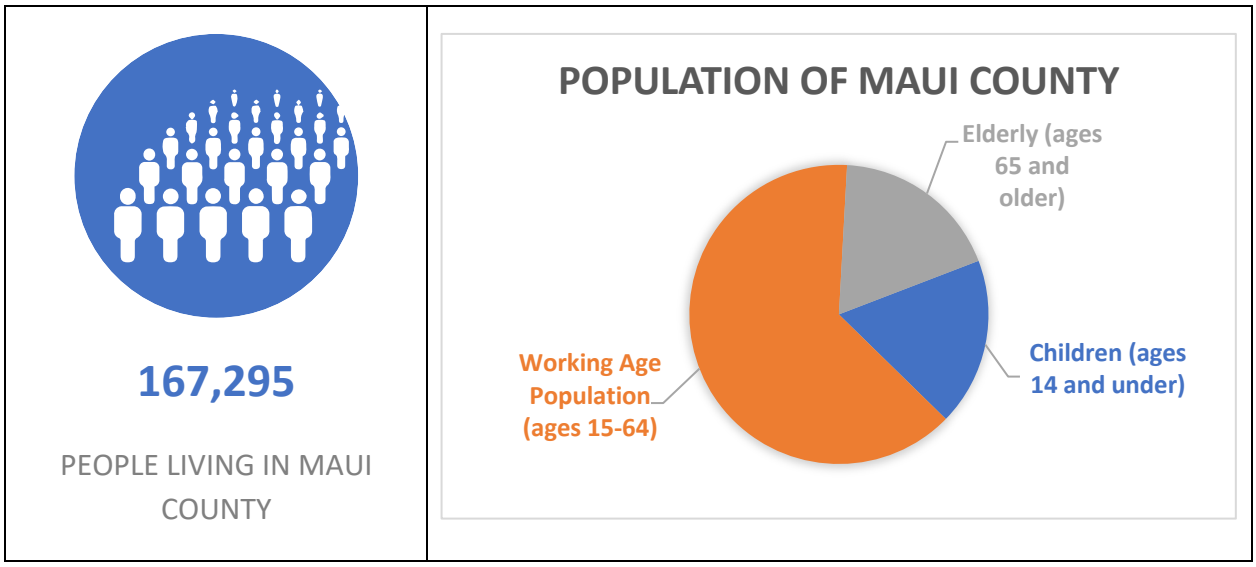


Figure 6. Dependent populations within Maui County

Figure 7 below shows the resident populations of Maui County for 2018 broken down further by age group.

[40] The State of Hawaii Department of Business, Economic Development & Tourism. (2018). Table 01.30. Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/

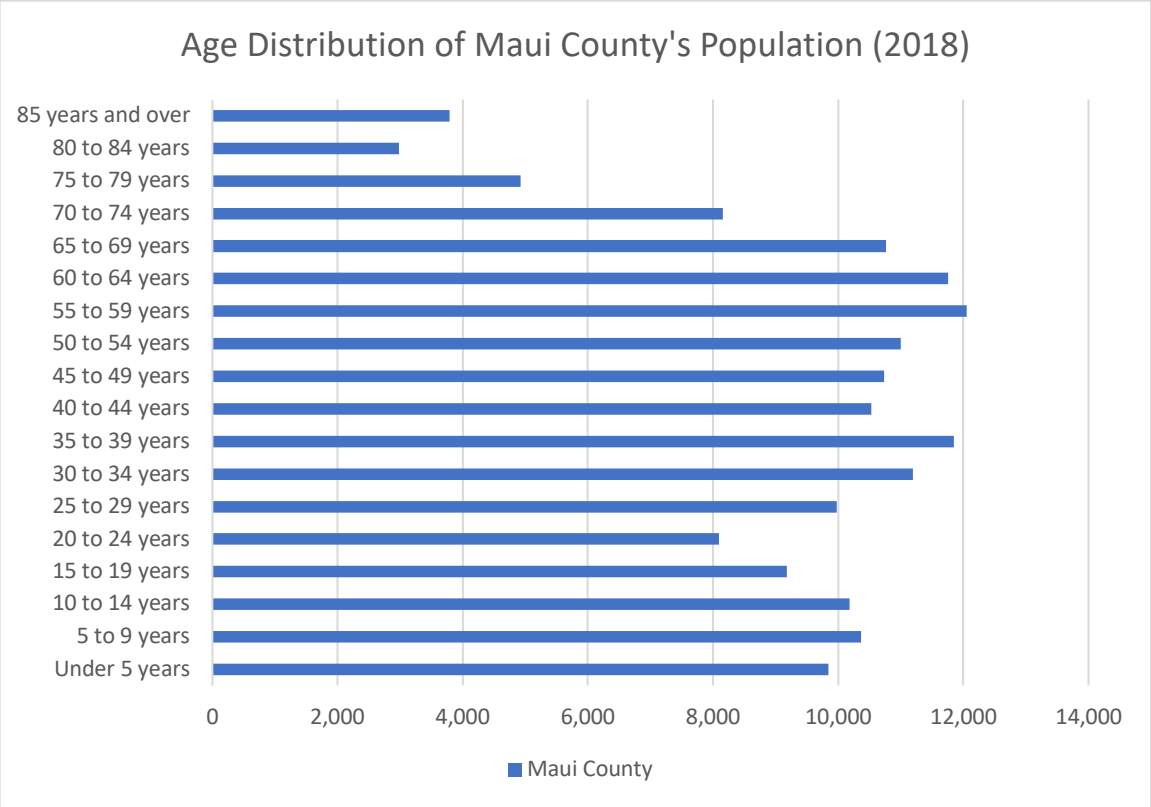


Figure 7. Age distribution of Maui County's population, 2018.

According to ACS 2018 data,[41] there are 17,762 persons within Maui County with disabilities of some kind, making up 10.8 percent of the total civilian non-institutionalized population.

By considering the elderly, disabled and impoverished populations living within Maui County, more effective planning can be implemented to safeguard lives before, during and after a disaster. As a group, *kupuna* or elders are more likely to lack the physical and economic resources necessary to respond to hazard events and may suffer health-related consequences, making recovery slower. They are more likely to be vision, hearing, and/or mobility impaired, and more likely to experience mental impairment or dementia. Additionally, elders are more likely to live in assisted-living facilities where emergency preparedness occurs at the discretion of facility operators. Emergency managers typically identify these facilities as "critical facilities" because they require extra notice to implement evacuation. Elderly residents living in their own homes may have more difficulty evacuating their homes and could be stranded in dangerous situations. This population group is more likely to need special medical attention, which may not be readily available during natural disasters due to isolation caused by the event. Specific

[41] Centers for Disease Control and Prevention/ Agency for Toxic Substances and Disease Registry/ Geospatial Research, Analysis, and Services Program. Social Vulnerability Index 2018 Database for Hawaii. Retrieved from: https://svi.cdc.gov/data-and-tools-download.html.

planning attention for the elderly is an important consideration given the current aging of the American population.

Children under 14 are particularly vulnerable to disaster events because of their young age and dependence on others for care and basic necessities. Very young children may additionally be vulnerable to injury or sickness; this vulnerability can be worsened during a natural disaster because they may not understand the measures that need to be taken to protect themselves from hazards.

The disabled are more likely to have difficulty responding to a hazard event than the general population. Local government is the first level of response to assist these individuals, and coordination of efforts to meet their access and functional needs is paramount to life safety efforts. It is important for emergency managers to distinguish between functional and medical needs in order to plan for incidents that require evacuation and sheltering. Knowing the percentage of population with a disability will allow emergency management personnel and first responders to have personnel available who can provide services needed by those with access and functional needs.

Cultural Diversity and Language

Hawaiʻi's population is comprised of many cultures and is considered the third most diverse of all U.S. states.[42] Approximately 18% of the population in the state of Hawaiʻi is foreign-born.[43] Of these, the most significant number of foreign-born persons (45.4%) originate from the Philippines; with 9.3% coming from Japan, 7.4% from China (excluding Hong Kong and Taiwan), 6.6% from Korea, 3.8% from Vietnam, 2.1% from Mexico, and less than 2% from various other countries around the world.[44]

Figure 8 below illustrates the ethnic distribution of Maui County's population according to a 2012 survey by the Hawaiʻi State Department of Health, Office of Health Status Monitoring.[45]

[42] World Population Review. (2020). Retrieved from: https://worldpopulationreview.com/states/most-diverse-states/
[43] The State of Hawaii Department of Business, Economic Development & Tourism. (2018). Table 01.41. Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/
[44] The State of Hawaii Department of Business, Economic Development & Tourism. (2018). Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/ Table 01.42. Average characteristics of people living in Hawaii between the years 2011 and 2015. Based on a sample.
[45] The State of Hawaii Department of Business, Economic Development & Tourism. (2018). Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/ Table 01.38. Ethnic stock by county, 2012. Based on a sample. Source: Hawaii State Department of Health, Office of Health Status Monitoring, special tabulation from the Hawaii Health Survey. (Definitions used differ from those in U.S. Census Bureau reports. Ethnicity is based on the ethnicity of the father and mother.)

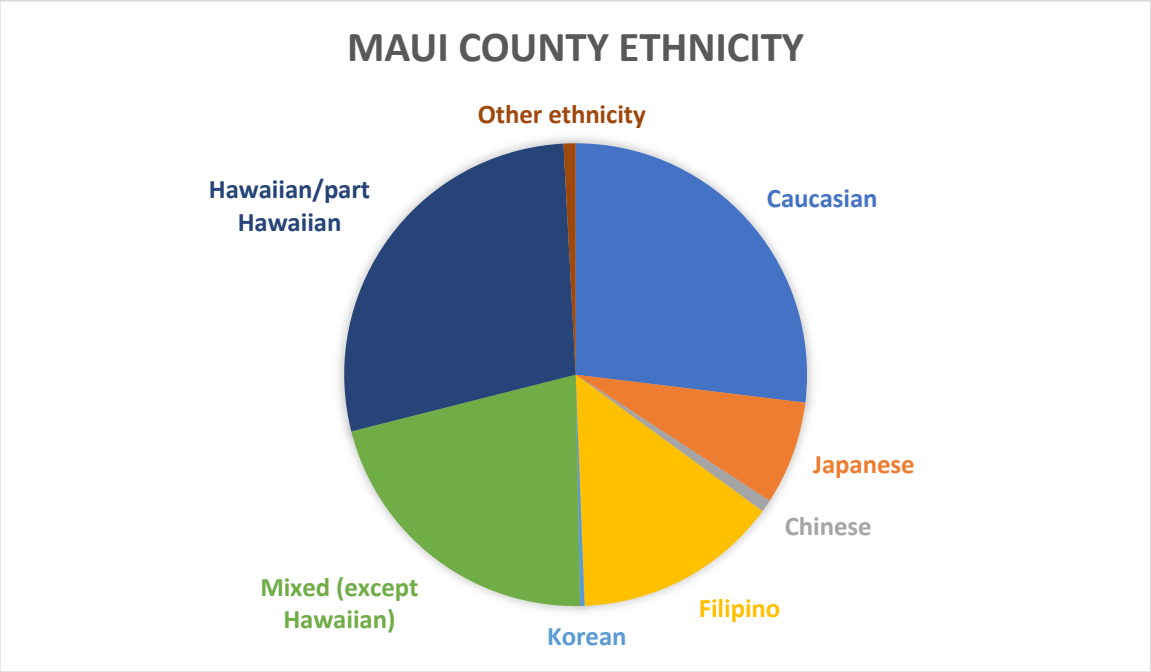


Figure 8. Ethnicity of Maui County resident population

Other than English, the most commonly spoken languages in the planning area are Asian and Pacific Island languages.[46] According to ACS 2018 estimates for Maui County (excluding Kalawao County), 3.3% of the population (5,198 persons) speaks English "less than well."

Given the diversity of the population within the planning area, disaster management planning efforts to make hazard alerts and warning information available in multiple languages would assist those who speak English "less than well." Special efforts may also be necessary during post-disaster recovery activities to be culturally sensitive and inclusive of under-represented groups.

Employment and Industry

In the United States, individual households are expected to use private resources to prepare for, respond to, and recover from, disasters to some extent. This means that households living in poverty are at a disadvantage when confronting hazards. Additionally, the poor typically occupy more poorly built and inadequately maintained housing, which are more susceptible to damage in earthquakes and floods than other types of housing. Furthermore, residents below the poverty level are less likely to have insurance to compensate for losses incurred from natural disasters. This means that residents below the

[46] The State of Hawaii Department of Business, Economic Development & Tourism. (2018). Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/. Table 01.43. Asian and Pacific Island languages include Chinese (including Mandarin and Cantonese), Japanese, Korean, Hmong, Vietnamese, Khmer, Thai, Lao, or other Tai-Kadai languages, Tagalog (including Filipino), Ilocano, Samoan, Hawaiian, or other Austronesian languages, and other languages of Asia.

poverty level have a great deal to lose during an event and are the least prepared to deal with potential losses.

The ACS 2018 estimates Maui County's per capita income at $33,792. The U.S. Bureau of Economic Analysis, Interactive Data Local Area Personal Income and Employment findings for 2017 are notably higher, estimated at $47,226 per capita[47] for Maui County. The median household income for the county was $72,762.[48] Approximately 7 percent of those employed within the state of Hawaiʻi hold down multiple jobs.[49] The Cost of Living Index for the second quarter of 2019 ranked Honolulu as the third most expensive urban area within all U.S. states. Maui County's high cost of living was recognized as both a weakness and a threat to future economic development during focus group sessions held as part of the 2016 update of the County's Comprehensive Economic Development Strategy (CEDS). Session participants noted that interruptions to Maui's single sector economy due to natural disasters and a changing climate could cause significant disruption to the financial well-being of many who rely on the visitor industry for their livelihoods. In March 2020, the volatility of financial markets due to the COVID-19 pandemic was credited for the 17.9 percent increase in the Median Sales Price for Single Family homes ($840,000) from the previous month, and the 9.1 percent increase to $555,000 for Condominium homes in Maui County.[50]

An estimated 10 percent of individuals and 6.6 percent of families within the planning area are living below the poverty line. Nearly 12 percent of those living in poverty are under 18 years of age. Poverty thresholds in Hawaiʻi are about 15 percent higher than those for other U.S. states, therefore the prevalence of poverty in Hawaiʻi may be understated.

As presented in the State of Hawaiʻi's *Self-Sufficiency Income Standard* (Hawaiʻi Department of Business, Economic Development and Tourism, 2019), Maui County had the highest self-sufficiency income requirements for two-adult couples without children, and the second highest for all other four family types. The report states that a two-adult couple with no children needed combined hourly wages of $22.26 (or $11.13 each on average) to be economically self-sufficient. That was 11.9% above the state minimum wage level and 148.4% above the federal poverty threshold for the state of Hawaiʻi. Family budgets in Maui County have higher food, housing and childcare costs than other counties in the state. Table 5 below illustrates the estimated self-sufficiency income requirements for 2018.

[47] The State of Hawaii Department of Business, Economic Development & Tourism. (2018). Table 13.12. Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/

[48] The State of Hawaii Department of Business, Economic Development & Tourism. (2018). Table 13.22. Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/. Based on inflation-adjusted 2017 dollars for 2013-2017.

[49] The State of Hawaii Department of Business, Economic Development & Tourism. (2018). Table 12.24. Retrieved from: https://dbedt.hawaii.gov/economic/databook/db2018/.

[50] Realtors Association of Maui, Inc. March 2020 Monthly Indicators Report. Retrieved from: https://www.ramaui.com/resources/market-statistics/

Table 5. Self-Sufficiency Income Requirement for selected family types, Maui County

Self-Sufficiency Income Requirement	One Adult	Two Adult Family	One Adult + One Preschooler	One Adult + One Preschooler + One School age	Two Adult + One Preschooler + One School age
Hourly	$16.80	$11.13	$27.31	$34.57	$19.21
Monthly	$2,956	$3,918	$4,806	$6,085	$6,761
Annual	$35,476	$47,017	$57,674	$73,018	$81,133

Employment Trends and Occupations

The visitor industry is the most dominant economic activity in Maui County, accounting for around two-thirds of the economy in terms of direct and indirect employment. Being highly dependent upon imported fuel sources, food, construction materials and common daily goods, stakeholders and residents alike recognize the need to diversify the economy to boost self-reliance. Diversification of the tourism industry toward eco- and wellness tourism, and expansion of other activities such as agriculture to include food crops, aquaculture, manufacturing, and renewable-energy sectors would offer additional opportunities for employment and income generation and build a more sustainable economic future for Maui County.

Table 6 below depicts average annual wages for 2018 in Maui County[51] for various industry categories. Note that on average, several industry categories do not meet the self-sufficiency income requirements of even a one- adult family type ($35,426) as referenced in Table 5 above, namely in occupations related to Retail Trade, Administrative and Waste Services, and Arts, Entertainment and Recreation.

Table 6. Average annual wages by industry category in Maui County, 2018.

Industry Category	Average Annual Wages
Government	$63,637
Natural Resources and Mining	$43,326
Construction	$70,352
Manufacturing	$45,258
Utilities	$106,947
Wholesale Trade	$55,767
Retail Trade	$33,126
Transportation and Warehousing	$38,298
Information	$64,708
Finance and Insurance	$62,640
Real Estate and Rental and Leasing	$46,116

[51] U.S. Bureau of Labor Statistics. (2018). Retrieved from: Hawaii Workforce Infonet: https://www.hiwi.org/vosnet/Default.aspx Employment and wages of workers covered by Hawai'i employment security law and unemployment compensation for federal employees classified by industry for calendar year 2018.

Industry Category	Average Annual Wages
Professional and Technical Services	$63,542
Management of Companies and Enterprises	$87,938
Administrative and Waste Services	$34,534
Educational Services	$38,782
Health Care and Social Assistance	$55,026
Arts, Entertainment, and Recreation	$30,769
Accommodation and Food Services	$41,904
Other Services, Except Public Administration	$35,501

According to the U.S. Bureau of Labor Statistics, the 2019 annual average job count for non-agricultural jobs in Maui County was 80,200.[52] Of these, 93 percent are service-providing, and 7 percent are goods-producing. Private industry makes up 88 percent of all service-providing jobs.

Leisure and Hospitality is the predominant industry in Maui County as shown in Figure 9. Average annual job count for Maui County non-agricultural industries, 2019 Figure 9. Average annual job count for Maui County non-agricultural industries, 2019 Figure 9. Average annual job count for Maui County non-agricultural industries, 2019below, representing 32 percent of all jobs in 2019. Other dominant industries include Trade, Transportation and Utilities; Education and Health Services; Government (including Federal, State and Local); and Professional and Business Services. Average annual job counts for each of the other industries listed accounted for less than 6 percent of jobs. Of those who commute to work, 73 percent commute alone (by car, truck or van), according to ACS 2018 estimates.

[52] U.S. Bureau of Labor Statistics. (2019). Retrieved from: Hawaii Workforce Infonet: https://www.hiwi.org/vosnet/Default.aspx Job count by industry for Maui County, 2019.

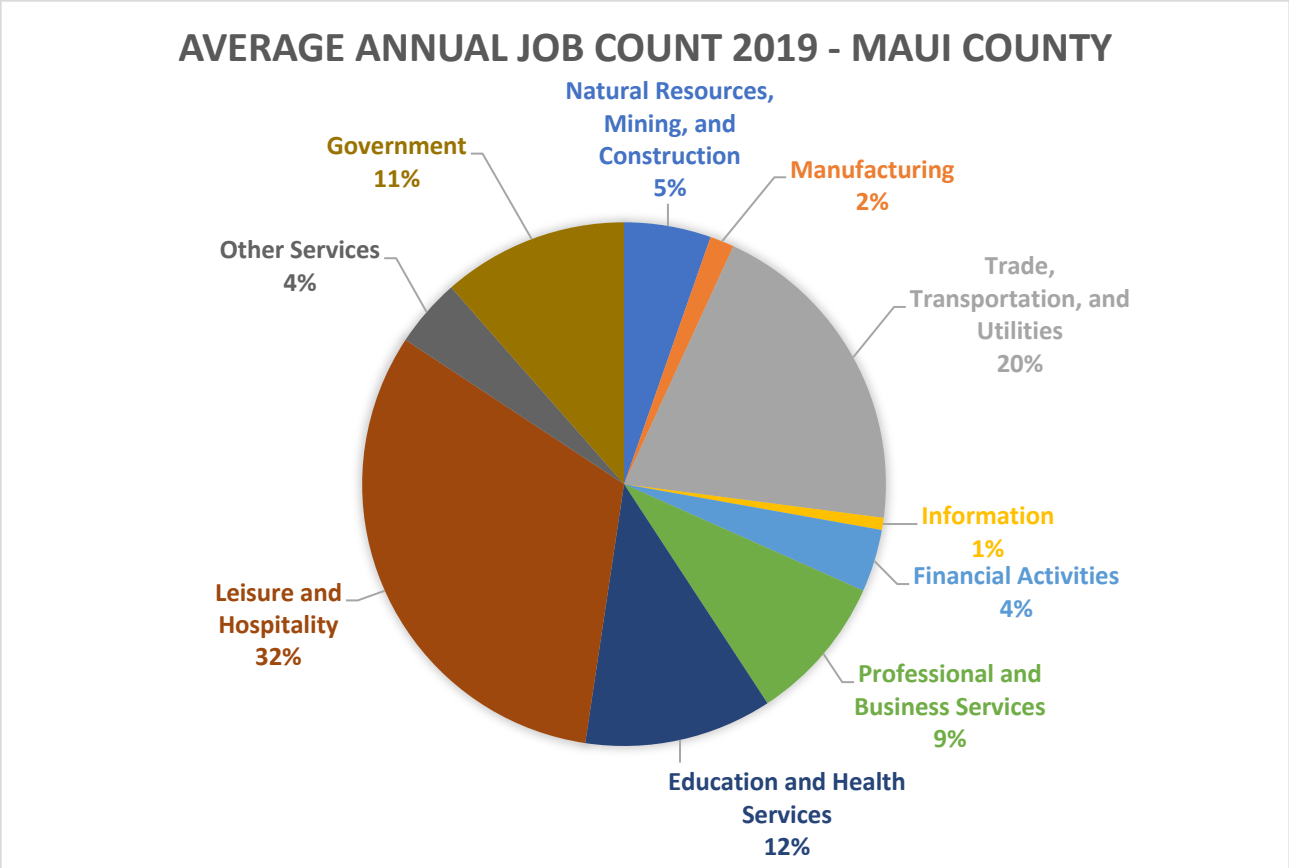


Figure 9. Average annual job count for Maui County non-agricultural industries, 2019

Table 7Table 7 below lists the top 50 employers within Maui County[53] ranked in order of number of employees. Many of the top employers in the county are hotels and resorts located in West Maui and the Kīhei-Mākena area, while most large private businesses and government employers are in the Wailuku-Kahului area.

Table 7. Top 50 employers in Maui County.

Rank	Name	Community Planning Area	Business Description	Employee Size	Year Established
1	Grand Wailea-Waldorf Astoria	Kīhei-Mākena	Resorts	1,000-4,999	1991
2	Ritz-Carlton-Kapalua	West Maui	Hotels & Motels	1,000-4,999	1992
3	Maui Memorial Medical Center	Wailuku-Kahului	Hospitals	500-999	2000
4	Four Seasons-Maui	Kīhei-Mākena	Hotels & Motels	500-999	1988
5	Westin Maui Resort-Spa Kāʻanapali	West Maui	Hotels & Motels	500-999	1971
6	Four Seasons Resort Lānaʻi	Lānaʻi	Hotels & Motels	500-999	1991
7	Kea Lani Maui Restaurant	Kīhei-Mākena	Restaurants	500-999	1991

[53] DATA.HAWAII.GOV. (2017). Retrieved from: https://data.hawaii.gov/Employment/Top-50-Employers-Maui-County/9i8q-bgfy Last updated August 21, 2017.

Rank	Name	Community Planning Area	Business Description	Employee Size	Year Established
8	Hyatt Regency Resort & Spa	West Maui	Hotels & Motels	500-999	1980
9	Mākena Beach & Golf Resort	Kīhei-Mākena	Resorts	500-999	1986
10	Walmart	Wailuku-Kahului	Department Stores	500-999	2003
11	Kāʻanapali Beach Club	West Maui	Resorts	500-999	1988
12	Royal Lahaina Resort	West Maui	Resorts	500-999	1909
13	Maui County Police Dept	Wailuku-Kahului	Police Departments	250-499	1988
14	Wailea Beach Resort-Marriott	Kīhei-Mākena	Hotels & Motels	250-499	1976
15	Four Seasons-Lānaʻi the Lodge	Lānaʻi	Hotels & Motels	250-499	2013
16	Hale Makua Health Svc	Wailuku-Kahului	Day Care Centers-Adult	250-499	1946
17	PWC the People Who Clean	West Maui	Janitor Service	250-499	1973
18	Lānaʻi Resorts LLC	Lānaʻi	Resorts	250-499	2014
19	Inn at Mama's	Pāʻia-Haʻikū	Cottages & Cabins	250-499	2006
20	Wailuku Elementary School	Wailuku-Kahului	Schools	250-499	1984
21	Kāʻanapali Beach Hotel	West Maui	Hotels & Motels	250-499	1984
22	Maui Electric Co Ltd	Wailuku-Kahului	Electric Companies	250-499	1987
23	Tiki Terrace Restaurant	West Maui	Full-Service Restaurant	250-499	1985
24	Sheraton Maui Resort & Spa	West Maui	Hotels & Motels	250-499	1988
25	Kaiser Permanente	Wailuku-Kahului	Clinics	250-499	2001
26	Aloha Air Cargo	Wailuku-Kahului	Air Cargo Service	250-499	2005
27	PWC Hawaiʻi Corp	West Maui	Janitor Service	250-499	1973
28	Maui County Fire Dept	Wailuku-Kahului	Govt Offices-County	250-499	1995
29	Macy's	Wailuku-Kahului	Department Stores	250-499	1984
30	Lodge at Koele	Lānaʻi	Resorts	250-499	1990
31	Aston Kāʻanapali Shores	West Maui	Condominiums	250-499	2009
32	Kula Hospital	Makawao-Pukalani-Kula	Hospitals	100-249	1996
33	Dorvin D Leis Co Inc	Wailuku-Kahului	Mechanical Contractors	100-249	1967
34	Bayada Home Health Care	Wailuku-Kahului	Home Health Service	100-249	2006
35	PWC the People Who Clean	West Maui	Cleaners	100-249	1973
36	Kaiser Permanente Maui Lani	Wailuku-Kahului	Physicians & Surgeons	100-249	2005
37	Maui Canoe Club	Kīhei-Mākena	Fraternal Organizations	100-249	2009
38	Goodfellow Brothers Inc	Kīhei-Mākena	Contractors-Engineering	100-249	1992
39	Sheraton-Vistana Resort	West Maui	Hotels & Motels	100-249	2016
40	Mama's Fish House	Pāʻia-Haʻikū	Full-Service Restaurant	100-249	1973
41	Costco Wholesale	Wailuku-Kahului	Wholesale Clubs	100-249	2003
42	Aloha Mixed Plate	West Maui	Restaurants	100-249	2003
43	Old Lahaina Luau	West Maui	Restaurants	100-249	1998
44	Baldwin High School	Wailuku-Kahului	Schools	100-249	1984
45	Lowe's Home Improvement	Wailuku-Kahului	Home Centers	100-249	2016
46	Maui Co. Water Supply Board	Wailuku-Kahului	Govt Offices-County	100-249	2001
47	Home Depot	Wailuku-Kahului	Home Centers	100-249	2002
48	Travaasa Hāna Hotel	Hāna	Hotels & Motels	100-249	1946
49	Maui Community Correctional	Wailuku-Kahului	Govt Offices-State	100-249	1992
50	Maui Beach Hotel	Wailuku-Kahului	Hotels & Motels	100-249	1984
51	Westin Ka'anapali Ocean Resort	West Maui	Hotels & Motels	100-249	2003
52	Valley Isle Motors Ltd	Wailuku-Kahului	Auto Dealers-New Cars	100-249	1923

According to ACS 2018 estimates, 67 percent of the planning area's population 16 and older is in the labor force.

Figure 10 below compares unemployment trends for the State of Hawai'i and Maui County from 1990 through 2019.[54] While Maui County's unemployment rates have closely aligned with the State's for some periods, there are others, namely the early nineties and between 2009 and 2011 when Maui County experienced somewhat higher unemployment rates. Maui County's lowest unemployment rate over the 30-year period was in 2018, at 2.4 percent.

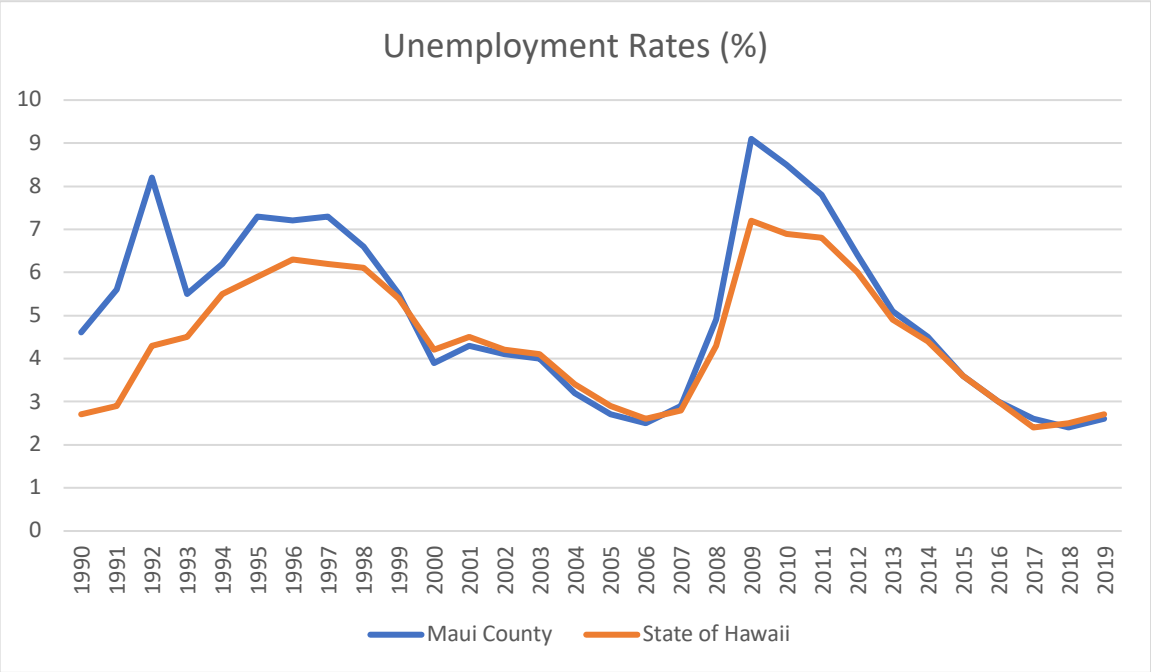


Figure 10. Maui County and State of Hawai'i unemployment rates (1990 to 2019).

Since the effects of the COVID-19 pandemic began to be felt in Maui County in early March of 2020 there has been a sharp increase in the number of applications for unemployment. According to State of Hawai'i Labor Statistics,[55] the number of claims filed by Maui County residents during the last week of March rose sharply to over 10,000 as compared with just over 2,000 the previous week and fewer than 200 the week before that. Numerous businesses have had to close their doors to customers to reduce possible transmission of the virus and travel restrictions mean that fewer visitors are coming to the islands on vacation. Maui County's economy will no doubt feel the effects of the pandemic for some time to come.

[54] U.S. Bureau of Labor Statistics. (2019). Retrieved from: Hawaii Workforce Infonet, Available at: https://www.hiwi.org/vosnet/Default.aspx Unemployment rates (civilian labor force) for the State of Hawaii and Maui County. Annual averages for years 1990 to 2019 (not seasonally adjusted).

[55] State of Hawaii. (2020). Retrieved from: https://labor.hawaii.gov/rs/home/unemployment/unemployment-claims-data/

Land Use

Table 8 summarizes the area of current land uses on each island in Maui County. As of 2012, Hawaii's Land Use Commission has classified the County of Maui as urban, rural, agricultural, and conservation.

Table 8. Land Use in the County of Maui

Land Use in the County of Maui

Land Class Description	Area (acres)	Land Class Description	Area (acres)
Lānaʻi		**Molokaʻi**	
Agricultural	356.6	Agricultural	126,793.4
Apartment	71.8	Apartment	51.2
Commercial	621.1	Commercial	121.6
Conservation	943.4	Commercialized Res	4.7
Hotel/Resort	80.1	Conservation	28,708.6
Industrial	45.7	Hotel/Resort	216.3
Residential	88,116.0[a]	Industrial	1,306.9
Not Classified	72.2	Residential	1,024.4
Total	**90,306.8**	Not Classified	1,161.7
		Total	**159,388.7**
Maui			
Agricultural	250,322.4		
Apartment	1,537.2		
Commercial	2,121.6		
Commercialized Res	120.1	**Kahoolawe**	
Conservation	193,047.9	Conservation	28,560.4
Hotel/Resort	1,057.0	**Total**	**28,560.4**
Industrial	3,455.3		
Residential	9,145.6		
Time Share	16.2		
Not Classified	5,717.9		
Total	**466,541.2**		

Source: Summarized from Maui County parcel and tax assessor data. Roads and rights-of-way are categorized as "not classified."

Note[a]: Residential estimates are derived from parcel data. A vast acreage in Lānaʻi is assigned to one parcel, which is identified as residential.

Chapter 3. Planning Process

The purpose of the hazard mitigation planning process is to create a County of Maui Hazard Mitigation Plan Update that meets all the requirements of both the Hawai'i Emergency Management Agency (HEMA) and the Federal Emergency Management Agency (FEMA). The planning process was developed in full compliance with the current planning requirements of FEMA, per the following rules and regulations.

- Robert T. Stafford Disaster Relief and Emergency Assistance Act (Public Law 93-288), as amended by the Disaster Mitigation Act of 2000
- Disaster Recovery Reform Act of 2018
- Code of Federal Regulations – Title 44, Chapter 1, Part 201 (§201.6: Local Mitigation Plans)
- Federal Emergency Management Agency Local Mitigation Plan Review Guide (dated October 1, 2011)

> *A1. Does the plan document the planning process, including how it was prepared and who was involved in the process for each jurisdiction? (Requirement §201.6(c)(1))*
>
> *a. Does the plan provide documentation of the plan was prepared? The documentation must include the schedule or timeframe and activities that made up the plan's development as well as who was involved?*
>
> *b. Does the plan list the participating jurisdiction(s) participating in the plan that are seeking approval?*
>
> *c. Does the plan identify who represented each jurisdiction? (at a minimum, it must identify the jurisdiction represented and the person's position or title and agency within the jurisdiction.)*

Development of the Hazard Mitigation Plan began in November 2019 and took approximately 10 months for completion. The Project Work Plan and the Outreach and Engagement Plan are included in Appendix A. The project of developing the Plan was divided into five tasks that overlap to some extent, as that is the nature of mitigation planning. These tasks are shown in the list below with their associated timeline:

1. Task 1. Planning Process (November 2019-July 2020)
2. Task 2. Hazard Analysis and Risk Assessment (November 2019-April 2020)
3. Task 3. Mitigation Strategy (November 2019-June 2020)
4. Task 4. Plan Review, Evaluation, and Implementation (July 2020)
5. Task 5. Plan Approval and Adoption (July 2020-October 2020)

The project approach was designed to assist Maui County with maintaining its current credit for floodplain management planning under FEMA's Community Rating System (CRS). Maui County currently has a CRS rating of Class 7. This will ensure that the hazard mitigation plan will continue to double as a creditable "floodplain management plan" under CRS Activity 510.

Developing the updated Hazard Mitigation Plan required a team-based approach led by the County of Maui Emergency Management Agency (MEMA). A small Planning Team was led by Anthony J. Joyce, Hazard Mitigation Officer, MEMA and the Jamie Caplan Consulting LLC team. The Planning Team worked directly with a Steering Committee that was formally recognized by the County's governing board (County Council) to maximize CRS points. This Committee provided key local knowledge for all aspects of Plan development.

The Steering Committee divided the County in eight planning areas that align with the Maui County Community Planning Areas. The planning areas were used for outreach as well as risk analysis and mitigation strategy development. Each Community Planning Area is unique, and efforts were made to capture their unique needs and interests. The eight planning areas are shown in the list below:

10. Hāna
11. Kīhei-Mākena
12. Lānaʻi
13. Makawao-Pukalani-Kula
14. Molokaʻi
15. Pāʻia-Haʻikū
16. Wailuku-Kahului
17. West Maui

The Steering Committee and MEMA took a community-driven approach to developing this version of the Hazard Mitigation Plan. This included meetings with key stakeholders and the public. The original Work Plan called for meetings in each of the eight planning areas, however, the planning process was modified due to the Covid-19 pandemic that began in February 2020 and prohibited in-person meetings and on-the-ground visits.

Steering Committee

The Steering Committee was organized to represent multiple aspects of the County including county government, nonprofit organizations, utilities, and state agencies. The list below shows the Steering Committee members, their representative organizations and titles.

- Herman Andaya, Administrator, Maui Emergency Management Agency
- CHāna Ane, Environmental Coordinator, Office of Economic Development
- Kathleen Aoki, Division Chief, Department of Planning
- Lauren Armstrong, Planner, Maui Metro Planning Group
- Lindsay Ball, Area Superintendent, Department of Education

- Michele Blair, Maui County Director, American Red Cross
- Jim Buika, Shoreline Planner/Chair, State Hazard Mitigation Forum, Department of Planning
- Lance De Silva, Forestry Program Manager, Division of Forestry & Wildlife
- Alex DeRoode, Energy Commissioner, Maui County
- Toni Eaton, Maui District Supervisor, Hawaiʻian Homelands
- Paul Haake, Captain, Fire Prevention Bureau
- Joyce Kawakami, CEO, Founder, Feed My Sheep
- Janet Kuwahara, Senior Manager of Operations, Maui Visitors Bureau
- Loren Lapow, Founder Maui Hero Project, Maui Hero Project
- Keanu Lau Hee, Special Assistant to the Mayor, Mayor's Office
- Zhantell Lindo, Executive Assistant, Council Member Keani Rawlins-Fernandez
- Dawn Lono, Executive Assistant, Council Member Shane Sinenci
- Sybil Lopez, Molokaʼi Planner, Department of Planning
- Bryan S. Manlapao, Sergeant, Maui Police Department, Lānaʻi
- Kim Masse, Sergeant, Maui Police Department, Lānaʻi
- Annette Matsuda, Maintenance Engineer, Department of Transportation
- Dick Mayer, President, Maui Community Associations
- Mavis Medeiros, Executive Assistant, Council Member Shane Sinenci
- Gail Miyahira, Maui County Coordinator, Hawaiʻi Healthcare Emergency Management
- Gale Notestone, Fire Captain, Maui Fire Department
- Tara Owens, Coastal Hazards Specialist, University of Hawaiʻi Manoa
- Chris Reynolds, Director - Operational Technology, Maui Electric
- Rowena Dagdag-Andaya, Director, Department of Public Works
- Diego Sanchez-Gomez, Floodplain Manager, Department of Planning
- Todd Teraoka, Fire Captain, Maui Fire Department
- Bridget Velasco, Public Health Planner, Department of Health

The Steering Committee met four times during the 10-month planning process, December 10, 2019, February 4, 2020, June 10, 2020 and July 1, 2020. Molokaʼi and Hāna each have their own Steering Committees and one meeting was held with each of their committees (February 5, 2020 in Molokaʼi and February 6, 2020 in Hāna). The agendas and sign-in sheets for all of these meetings are included in Appendix A. The original Work Plan called for holding a Steering Committee Meeting and a Public Meeting on Lānaʻi but due to the Covid-19 Pandemic this was not possible. Instead a conference call was held with Bryan S. Manlapao, and Kim Masse, both Maui Police Department, Lānaʻi Sergeants. Additional meetings were held with Steering Committee members and their departments or organizations on an as needed basis to gather data or information for each portion of the Plan's development. MEMA and the consulting team facilitated each Steering Committee meeting. All Steering Committee meetings were open to the public and announcements were posted to the County's Hazard Mitigation Plan webpage (https://www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan).

The table below details the topics of discussion and key findings from each of the Steering Committee meetings. Additional details regarding each meeting are included in Appendix A.

Table 9. Steering Committee Meetings – Topics of Discussion

Data and Location of Meeting	Topics of Discussion and Key Findings
December 10, 2019 (MEMA)	The first Steering Committee meeting was an opportunity for the Planning Team to introduce the project and emphasize the role of the Steering Committee. Additional Steering Committee members were recommended at this meeting and later added. The Steering Committee gave feedback regarding the Work Plan and the Stakeholder Engagement Plan. They reviewed an initial list of hazards and were asked to consider data they could provide toward the risk assessment. • Jim Buika, Planning Department reported he frequently consults with the State Historical Preservation Division regarding the location of cultural resources and burial sites. He also mentioned attending the Bureau of Ocean Management meeting regarding offshore energy generation that included a significant discussion of environmental and cultural concerns. • The Steering Committee recommended giving a presentation to the Maui County Council. They also recommended about half a dozen additional folks to invite to the Steering Committee. • Sea Level Rise was discussed, and several County departments are doing or plan to do risk assessments, these should be coordinated if possible. • Building code revisions were mentioned as necessary but challenging due to the cost of acquiring materials and educating contractors and inspectors.
February 4, 2020 (MEMA)	This meeting reviewed progress to date with an emphasis on the risk assessment and the mitigation strategy. The meeting began by asking participants what they view as key issues to mitigating risk in the County? The responses fueled information to include in the Capability Assessment. The Planning Team finalized the list of hazards to include in the mitigation Plan based on a discussion with the Steering Committee. The meeting also focused on developing the Mitigation Strategy goal and mission statements.

Data and Location of Meeting	Topics of Discussion and Key Findings
	• The Steering Committee made a list of key issues to mitigating risk in Maui. The list is long, but a few key items include: ○ Shelters, education, community outreach, infrastructure, permitting, empowering community, and housing. All of these were later addressed through mitigation actions. • Make the goals people focused, include the environment, and resiliency. • The Steering Committee had a Community Rating System discussion that included identifying needs in the following categories, warning & evacuation procedures, life & safety, and critical facilities.
February 5, 2020 (Moloka'i)	This meeting introduced the hazard mitigation planning process to Moloka'i leaders. The meeting focused on gathering specific details regarding Moloka'i and began with the questions, "what do you value most on Moloka'i and is that at risk to natural hazards and/or climate change?" The Planning Team gathered information regarding high risk areas and potential mitigation actions. • Identified high hazard areas including the major erosion along State Highway Route 450. The Kilohana Elementary School and the Kaunakakai School are both in high hazard areas. • Hazards of biggest concern area flooding due to heavy rain, wildfire, erosion, and run-off and sedimentation which impacts coastal habitats and wetlands. • Potential mitigation actions were identified including, moving the town to above the hospital, planning for disaster recovery, improving stormwater drainage. • Moloka'i formed the Emergency Preparedness Working Group to meet the needs of the island and build community.
February 6, 2020 (Hāna)	This meeting introduced the hazard mitigation planning process to Hāna leaders. The meeting focused on gathering specific details regarding Hāna and began with the questions, "what do you value most about Hāna and is that at risk to natural hazards and/or climate change?" The Planning Team gathered information regarding high risk areas and potential mitigation actions. • This group reported their biggest concern is water. The road to Hāna also creates a disaster because people become stuck and need to be

Data and Location of Meeting	Topics of Discussion and Key Findings
	rescued. In addition, stream flooding washes out the road and isolates areas. • The noted that Sea Level Rises is the most evident in between Hamoa Bay and Koki Beach. • They would like to mitigate risk by moving and hardening portions of the road, exploring nature-based solutions, and improving communication redundancy.
June 10, 2020 (Zoom)	This meeting reviewed the Plan development process and included preliminary survey results, results from the risk assessment including social vulnerability analysis, and final mission and goal statements for the mitigation strategy. Discussion focused on questions related to the risk assessment and how to complete development of mitigation actions. • Thirty-three people participated in this meeting! They reviewed the hazard ranking from the initial risk assessment and made a few changes including moving up coastal erosion and dams. Zhantell Lindo, Executive Assistant to Council Member Keani Rawlins-Fernandez mentioned how reservoir failure and wildfire are very high priorities. Alex DeRoode, Energy Commissioner for Maui County agreed to move wildfire up.
July 1, 2020 (Zoom)	This meeting reviewed the Plan development process to date and shared the final schedule for completing the Plan. Discussion focused on completing development of the mitigation strategy and prioritizing mitigation actions. The Planning Team briefed the Steering Committee on how to review the Draft Plan. • Rowena Dagdag-Andaya, Director, Department of Public Works made a comment at this meeting about how the most resilient community members are those that have a network of neighbors and know the land well. New residents and visitors are most vulnerable. • Loren Lapow, Maui Hero Project commented about the need for increased social capacity and how Hawaiians value community and culture. He shared a grant application he developed for NOAA which resulted in the Steering Committee adding a mitigation action. That

Data and Location of Meeting	Topics of Discussion and Key Findings
	action, #31 "Implement the Teen CERT Hero Project and promote the culture of resiliency of youth in Maui County." • Chana Makale'a Dudoit Ane, Environmental Coordinator, Mayor's Office of Economic Development told the group about the Resiliency Hui organized for the following group. Many Steering Committee members joined the Resiliency Hui where they further reviewed the mitigation actions.

Stakeholder Engagement and Coordination with Other Agencies

A2. Does the plan document an opportunity for neighboring communities, local and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development as well as other interests to be involved in the planning process? (Requirement §201.6(b)(2))

a. Does the plan document an opportunity for neighboring communities, local, and regional agencies involved in hazard mitigation activities, agencies that have the authority to regulate development, as well as other interested parties to be involved in the planning process?

b. Does the plan identify how the stakeholders were invited to participate in the process?

Stakeholders were provided multiple opportunities to engage in the mitigation planning process. Beyond the Steering Committee which included representatives from Maui Count government, Maui County Council, nonprofit organizations, utilities, state agencies and private industry the Planning Team reached out to additional agencies for meetings. The information below details some of those efforts.

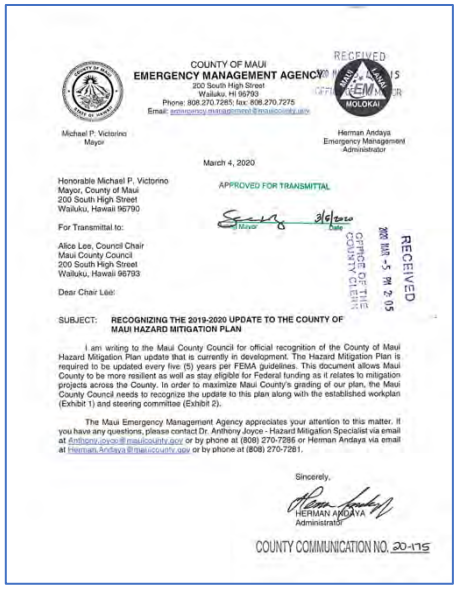
State Hazard Mitigation Committee

James Buika, a Maui County Planner, serves as the Maui County Chair of the State Hazard Mitigation Forum. He was also an active member of the Steering Committee. Mr. Buika arranged for Anthony Joyce to give a presentation to the State Hazard Mitigation Forum on February 11, 2020 in Oahu to update the Forum on the work being done to develop the Hazard Mitigation Plan. This presented an opportunity for

Mr. Joyce to gather feedback from state leaders and from each County regarding the process of developing Maui's mitigation Plan.

Climate Action and Resilience Committee

Herman Andaya and Anthony Joyce were joined by the consulting team at several Climate Action Resilience Committee (CAR) meetings. The CAR meets in the Council Chamber twice a month and has the duty to review issues related to sea level rise, shoreline erosion, managed retreat, deforestation, drought, wetlands, carbon emissions, pollution, and other related contributors to climate change. The CAR works closely with the Maui Emergency Management Agency and assumes operational oversight of grants they administer. Their meetings are open to the public and shown live on public television. The Planning Team gave a video presentation and answered questions from the CAR on three occasions. The agendas for each of these meetings is included in Appendix A. Below are the dates of these meetings with links to video presentations.



COUNTY OF MAUI
EMERGENCY MANAGEMENT AGENCY
200 South High Street
Wailuku, HI 96793
Phone: 808.270.7285; fax: 808.270.7275
Email: emergency.management@mauicounty.gov

Michael P. Victorino
Mayor

Herman Andaya
Emergency Management
Administrator

March 4, 2020

Honorable Michael P. Victorino
Mayor, County of Maui
200 South High Street
Wailuku, Hawaii 96790

APPROVED FOR TRANSMITTAL

For Transmittal to:

Alice Lee, Council Chair
Maui County Council
200 South High Street
Wailuku, Hawaii 96793

Dear Chair Lee:

SUBJECT: RECOGNIZING THE 2019-2020 UPDATE TO THE COUNTY OF MAUI HAZARD MITIGATION PLAN

I am writing to the Maui County Council for official recognition of the County of Maui Hazard Mitigation Plan update that is currently in development. The Hazard Mitigation Plan is required to be updated every five (5) years per FEMA guidelines. This document allows Maui County to be more resilient as well as stay eligible for Federal funding as it relates to mitigation projects across the County. In order to maximize Maui County's grading of our plan, the Maui County Council needs to recognize the update to this plan along with the established workplan (Exhibit 1) and steering committee (Exhibit 2).

The Maui Emergency Management Agency appreciates your attention to this matter. If you have any questions, please contact Dr. Anthony Joyce - Hazard Mitigation Specialist via email at Anthony.Joyce@mauicounty.gov or by phone at (808) 270-7286 or Herman Andaya via email at Herman.Andaya@mauicounty.gov or by phone at (808) 270-7281.

Sincerely,

HERMAN ANDAYA
Administrator

COUNTY COMMUNICATION NO. 20-175

RECEIVED
2020 MAR -5 PM 2:05
OFFICE OF THE COUNTY CLERK

Figure 11. County Council Signed Recognition of Hazard Mitigation Plan and Steering Committee

In addition, the CAR signed a resolution assigning recognizing the update of the Hazard Mitigation Plan along with the established Work Plan and steering committee. The signed recognition is included in Appendix A and shown in the graphic above.

1. January 6, 2020 http://mauicounty.granicus.com/MediaPlayer.php?view_id=1&clip_id=1018
2. February 3, 2020 http://mauicounty.granicus.com/MediaPlayer.php?view_id=1&clip_id=1040
3. June 16, 2020 http://mauicounty.granicus.com/MediaPlayer.php?view_id=1&clip_id=1149

Stakeholder Meetings and Tours

The Planning Team held nearly twenty stakeholder meetings and toured the islands of Moloka'i and Maui. Unfortunately, due to the Covid-19 Pandemic, the trip to Lāna'i was cancelled. The stakeholder meetings provided an opportunity for representatives from the Steering Committee as well as public and private organizations to contribute their expertise toward development of the Hazard Mitigation Plan. The majority of the meetings took place in the field, which enabled the stakeholder to show the Planning Team their area of expertise. The text below lists the meetings/interviews that were held in the order they were held.

Kimberly Masse, Sergeant, Maui Police Department, Lāna'i and Bryan Manlapao, Sergeant, Maui Police Department, Lāna'i (6/17/2020)

- Biggest concern in Lānaʻi is old housing (homes built between 1930-1950) is vulnerable to hurricane winds.
- Shelter space is limited.
- Evacuation prior to a disaster is necessary.
- Island is privately owned by Mr. Ellison. He puts money into erosion, generators for wells and rebuilds old homes when they become vacant.

Zhantell K. Lindo, Executive Assistant, Council Member Keani Rawlins-Fernandez, Moloka'i (2/5/2020)

Sybil Lopez, Department of Planning, Moloka'i (2/5/2020)

- Moloka'i pipeline is vulnerable! Exposed pipe is corroding and doesn't have a retention structure in place.
- Shelter hardening is necessary.
- Puko'o Fire Station is in a flood and tsunami zone.

Paul Haake, Fire Captain, Fire Prevention Bureau (1/24/2020)

- Works directly with updates to state and county fire codes for buildings.
- Biggest concern is agricultural land used to be farmed and now fallow lands are prone to wildfire.

Bridget Velasco, Public Health Planner, Department of Health (1/23/2020)

- Focus is on prevention. Works on messaging and public health education. For instance, what water is safe and don't walk through contaminated water.
- During hurricanes, only the homeless access the shelters.

Chris Reynolds, Incident Commander, Hawaiian Electric (1/17/2020)

- He would like citizens to know more about the work they do at the substation to protect electricity. The power plant is located next to wetlands and at the time it was built tsunami was not on anyone's mind. It is built on a piece of land out of the way of homes and other facilities. They have set up some berms.
- Would like to upgrade power poles on Maui.
- High winds are a big concerns and ice storms at high elevations. Can't underground poles because of undiscovered cultural sites.

Tara Owens, Coastal Hazards Specialist, University of Hawaiʻi Sea Grant Program, works in the Department of Planning with Jim Buika (1/9/2020)

- Would like to see this Plan include information that is digestible to the public.
- Several sea level rise studies in the works or planned. Parks Department and Department of Environmental Management are planning studies.

- Have money in the budget for a feasibility study for retreat along coast in Molokaʻi.
- Referred the Planning Team to the Sea Level Rise Viewer, and the NOAA viewer.
- Long-term sea level rise may not be biggest threat. Heat will become a huge issue and have direct impacts on people and infrastructure.

Jim Buika, Shoreline Planner, Department of Planning, County of Maui and Chair, State Hazard Mitigation Forum (12/12/2019)

- Permit process is cumbersome, time consuming and expensive.
- Would like to see an electronic permitting system developed similar to the one in Washington State. Would also like to see a "rainy day" grant matching fund developed so money is available when grants come through.
- Utilize natural systems to mitigate risk.
- Protect the shoreline through a system of removal, elevation, moving back, hardening, beach nourishment, offshore breakwaters.

Andrea Finkelstein, Operations Officer, Maui Emergency Management Agency (12/12/2019)

- She would like to see a hazard history, with dates, for each Community Planning area.
- Large populations get cut off during disasters, especially the islands of Moloka'i and Lānaʻi. Would like to see improvements made at ports and airports to harden these.
- Would like to see education to develop an increased understanding what County government is capable of providing the public during a disaster.
- Climate change has created more high heat days.

Janet Kuwahara, Executive Director, and Senior Manager of Operations, Maui Visitors and Convention Bureau, and Sherry Duong, Assistant Director (12/11/2019)

- Maui County has between 55,000 -60,000 visitors at any one time. What is the plan for sheltering these people?
- Recommend pre-positioning supplies and developing another route to the west side.

Joyce Kawakami, CEO, Founder, Feed My Sheep, VOAD Leader (12/11/2019)

- Provides food to Maui's poor and homeless. The majority, 82%, are in poverty.
- Joyce recommended using Maui's Public Radio station to get the word out about meetings.

Figure 12. Anthony Joyce, Joyce Kawakami, and Sharon Mielbrecht

Keanu Lau Hee, Shoreline Planner, Department of Planning, and then Special Assistant to the Mayor, Mayor's Office (12/11/2019, 6/26/2020)

- Current permitting process works counter to proactive planning. Should consider planning and permitting for stretches of coastline instead of a parcel at a time.
- Buyouts are unrealistic due to the high property values.
- Biggest vulnerabilities are old infrastructure, remote communities and communication challenges.
- Wants to see this Plan talk more to locals about their vulnerabilities. Would also like to see Benefit Cost Analysis conducted ahead of time so they are ready when funding options become available.

Todd Teraoka, Fire Captain, Maui Fire Department, Keoni Cadman, Fireman (12/11/2019)

- Hawaiian Commercial & Sugar Company (HC&S) ceased farming operations in 2016. Some 41,000 acres were sold to Maui Pono, "a farming venture between Pomona Farming, LLC, a California-based agricultural group, and the Public Sector Pension Investment Board, a long-term investor and one of Canada's largest pension investment managers." (https://www.khon2.com/news/former-hcs-land-on-maui-sold-for-262-million/) With the pull-out of HC&S, controlled burns, fire breaks, personnel, trucks and heavy equipment previously available to assist fire fighters became unavailable.
- Mapping of wildland/urban interface is extremely useful.
- Fires caused by downed branches/trees on electrical lines, sparking transformers, homeless fires, illegal dumping of vehicles, etc.
- Recommended involving Maui Fire Prevention Bureau.

Herman Andaya, Administrator, Maui Emergency Management Agency (initial meeting 12/10/2019)

- Multiple meetings throughout the planning process.

Kathleen Aoki, Division Chief, Department of Planning (12/10/2019)

- All of the Community Plans and the Master Plan have actions, 1213 in total. How do we implement all and make these plans work with each other?

Rowena Dagdag-Andaya, Director, Department of Public Works and Jordan Molina, Deputy Director, Department of Public Works (12/10/2019)

- Biggest hazards of concern: flooding, fire, dam/reservoir break, rockfalls/landslides
- Dams are County owned and some need maintenance
- Working on developing GIS database
- Oversee building codes and permitting.
- Manage vegetation along roadways.
- Seen an increase in frequency and intensity of storms.

Diego Sanchez-Gomez, County Floodplain Manager, Department of Planning (12/10/2019)

- Primary goal is to maintain CRS Category 7. Achieving a Category 6 would require a higher building code.
- Would like to improve technology and outreach capacity. They are inundated in a time-consuming permitting process.
- Kīhei has the worst flooding, because everything is built along the coast and heavy rains create flooding. Also, the riverine systems are dry and prone to overflow and flash flooding.
- Hāna Highway has highest number of rental cars anywhere in the world. They have a very vulnerable bridge system.

Community Outreach and Engagement

A primary goal of the Planning Team and the Steering Committee was to gather broad public participation in the planning process. Maui County has many diverse communities and interests and outreach and engagement to the public helped to ensure these unique interests were included in the Hazard Mitigation Plan. The Community Rating System expands on these requirements by making CRS credits available for optional public involvement activities.

A3. Does the plan document how the public was involved in the planning process during the drafting stage? (Requirement §201.6(b)(1))

a. Does the plan document how the public was given the opportunity to be involved in the planning process?

b. Does the plan document how the public's feedback was incorporated into the plan?

Fact Sheets

For the purpose of enabling outreach and education, the Planning Team developed a project fact sheet. The Fact Sheet was developed to arm the Steering Committee with a tool they could use to solicit support and engagement for the Hazard Mitigation Plan from their departments and constituents. It was also used to engage the public and additional stakeholders in the planning process. The Fact Sheets were distributed with all press releases for public meetings. Copies of the fact sheets are included in Appendix A and an image from the front page of one fact sheet is shown to the left.

County of Maui Hazard Mitigation Plan Update

FACT SHEET

The Maui Emergency Management Agency (MEMA) is developing an update to the County's Hazard Mitigation Plan. The plan serves as an essential strategy for reducing current and future risks to natural hazards and improving the emergency preparedness of the county's three islands. Updates are required every five years. This update is scheduled for completion in Summer 2020.

The Hazard Mitigation Plan Update will focus on the identification, assessment, and mitigation of natural hazards such as wildfires, coastal erosion, and tropical storms. The plan will result in a list of mitigation actions or projects the County can take to save lives and reduce damages. It will also double as a creditable "floodplain management plan" under FEMA's Community Rating System (CRS), helping the County maintain its current CRS rating of Class 7.

Federal Emergency Management Agency (FEMA) Requirements Met
Once approved by FEMA, the plan makes the County eligible for pre- and post-disaster mitigation project grant funding through FEMA's Hazard Mitigation Assistance (HMA) programs and other non-emergency disaster assistance.

Hazard Mitigation Plans
Hazard Mitigation Plans form the foundation for a long-term strategy to reduce disaster losses and break the cycle of disaster damage, rebuilding, and repeated damage.

Steering Committee Representation

Get Involved Today!

Take the Mitigation Planning Survey:

Visit the Project Web Page:

For more information and to get involved, please contact Anthony Joyce, PhD, Hazard Mitigation Specialist, Grants Manager, Maui Emergency Management Agency. Phone: (808) 270-7236. Email:

Figure 13. Hazard Mitigation Plan Fact Sheet

The Fact Sheet includes a summary list of Steering Committee representative organizations as well as the lead contact, Anthony Joyce, for project information. The fact sheet describes what the Hazard Mitigation Plan is and why it is important for the County of Maui to maintain the Plan. Most importantly the Fact Sheet lists multiple ways for the public to engage in the hazard mitigation planning process including taking the survey, visiting the web page, or attending a meeting. The Fact Sheet was updated several times to reflect the most current information about the planning process and opportunities for involvement. The final fact sheet included a statement about the Covid-19 pandemic. That statement is included below.

> **Covid-19 and the Hazard Mitigation Plan**
>
> The Maui County Hazard Mitigation Plan includes consideration of infectious disease and pandemics as part of the Public Health Hazard. In alignment with the State Hazard Mitigation Plan and federal hazard mitigation requirements, public health concerns are addressed at a high level within the mitigation plan, meaning a broad number of public health impacts are recognized as having previous occurred and possible in the future. The Maui County Hazard Mitigation Plan also provides an opportunity for county officials and the public to recommend potential mitigation measures to generally lessen the impacts of these events. This plan is currently under development and will reflect COVID-19 as a new public health hazard to the county.
>
> Maui County Emergency Management (MEMA) addresses infectious disease and pandemic concerns through a number of plans and policies such as the County Emergency Operations Plan. These outline the necessary procedures, personnel and steps to manage emergency situations such as the COVID-19 and other disaster impacts. As each emergency is unique, our procedures are adapted to meet the specific aspects of the event in coordination with local, county, state, and federal officials and partners.

The Fact Sheet was available on the County of Maui government webpage dedicated to the Hazard Mitigation Plan. It was also available on the Council of Maui County webpage. Steering Committee members were encouraged to post and distribute the Fact Sheets. They were also distributed at all public meetings.

Public Meetings

The original Work Plan called for holding a public meeting in each of the eight community planning districts. However, the Covid-19 Pandemic required a change in plans. Four public meetings were held through the planning process. Each meeting included a PowerPoint presentation and ample time for questions and answers. The in-person meetings included an opportunity for people to review maps of their community and identify high hazard areas and opportunities for mitigation projects. The Zoom meeting included a discussion and the opportunity to type into the chat box for questions.

Figure 14. Public Meeting Participants in Hāna Identifying High Hazard Areas

1. Central Maui, February 4, 2020
2. Moloka'i February 5, 2020
3. Hāna, February 6, 2020
4. Zoom, June 30, 2020

Zoom, June 30, 2020

Dick Mayer, Coordinate Alliance Community Association, Joseph Pluta, West Maui and Dennis Terpin, Disaster Professional and West Maui Tax Payer Association each joined the public meeting on June 30, 2020 and requested to be added to the Steering Committee. Theis public meeting included many questions about Covid-19 and how the mitigation plan would better prepare the County for future pandemics. Mr. Pluta mentioned the importance of reviewing the After Action Report from the Lahaina wildfires for lessons learned. The public had many questions that related to emergency operations and the Planning Team reminded them about the scope of hazard mitigation plans.

For each of the public meetings a flyer and press release were distributed, and a sign-in sheet was collected. These are all included in Appendix A. The press release and flyers were distributed in multiple ways to attract participation. The Maui County public affairs office sent out the press releases to their list of contacts (this list is not shared). In addition, the press releases and flyers were distributed via the following channels:

- Maui County Hazard Mitigation Plan Webpage https://www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan
- Maui County Council Announcements Page http://mauicounty.us/category/general-announcements/

- Khon2 Television
- Newspaper
- Facebook
- Calendarmaui.com
- Hawai'i Public Radio

Mitigation Planning Survey

The Planning Team developed a Hazard Mitigation Plan survey with guidance from the Steering Committee. The survey was used to gauge household preparedness for natural hazards and the level of knowledge of tools and techniques that assist in reducing risk and loss from natural hazards. This survey was designed to help identify areas vulnerable to one or more natural hazards. The answers to the 25 questions helped guide the Steering Committee in affirming goals and objectives and in the development of mitigation strategies. Multiple methods were used to solicit survey responses:

- A web-based version of the survey was made available by way of a link on the Maui County Emergency Management Agency website and the Maui County Council website.
- Attendees at the public meetings were asked to complete a survey.
- Multiple press releases were distributed to local media urging residents to participate.

Complete results of the survey are included in Appendix A. A summary of key results follows:

A total of 494 individuals completed the survey, the majority of which are full-time residents (96%) and homeowners (74%) who have lived in Maui County for over 10 years (52%). In the past 20 years respondents have been personally impacted by all hazards, in particular: High Winds (64%) and Hurricanes (51%), followed by Climate Change (44%), Drought (40%) and Extreme Heat (37%). Accordingly, the majority of survey respondents (50+%) were most apprehensive of the following hazards: Hurricanes/Tropical Storms, Fires, High Windstorm, and Climate Change (Figure 5). In an open-ended question, respondents specifically cited Honoapiilani Hwy - especially the Lahaina stretch of this highway - and the communities of Kahului, Kīhei, and Hāna, as areas at risk for hazards.

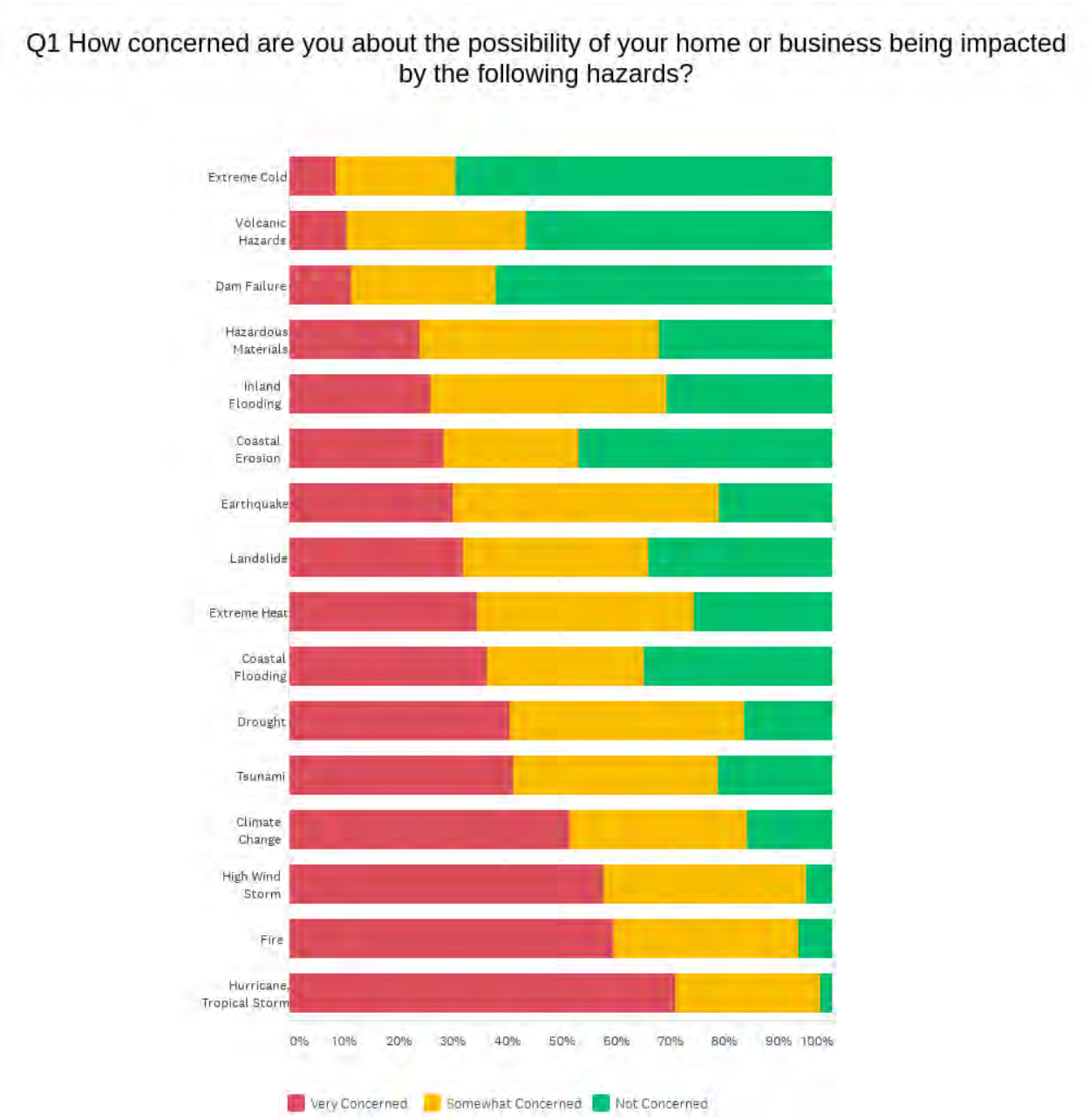


Figure 15. Hazard Risk

Respondents supported (50+%) all suggested mitigation actions and strategies (with the exception of "using tax dollars to compensate land owners for not developing in areas of natural hazards" at 25% approval), and they determined the protection of critical facilities (98% support) and the protection of utilities (91%) as the most important actions. The majority of surveyed individuals (65+%) support community projects, outreach and education, improving warning and response systems, technical assistance, and strengthening regulations and codes to address hazards.

Additionally, there is strong support (75+%) from respondents for policies addressing climate change in Maui County. In response to an open-ended question, respondents cited drought, temperature increases, fires, erosion, and sea level rise as the primary climate changes they had seen. A respondent stated they have, *"Been in my house 10 years and the heat during summers has become increasingly unbearable in the past few years,"* and other respondents noted concerns such as, " *I noticed driving to Lahaina that the ocean is washing over the road when it used to be a lot farther away from the road about 40 years ago,"* and *"Living without AC is no longer a safe option. Summers and high heat/humidity months are longer and have been brutal the last two years."* One respondent summarized their concerns: *"If you were born and raised on Maui with heritage of born and raised on Maui, just walking out your front door shows climate change in every way possible."*

The surveyed community is relatively prepared, with 50% or more of respondents having prepared a disaster supply kit and/or two weeks of supplies, developed an Emergency Plan, and put smoke detectors in their homes (Figure 2). Fewer residents (30+%) have mitigated risks to their homes through tree removal, purchasing a generator, or attending a mitigation workshop. Approximately half (54%) of respondents have hurricane insurance, and only 26% have flood insurance (Figure 6), due to expense or decreased risk.

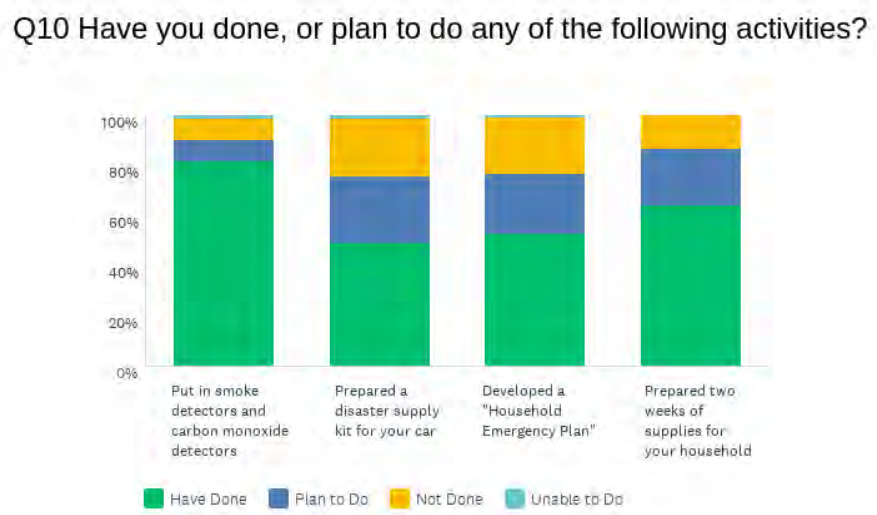


Figure 16. Personal Preparedness

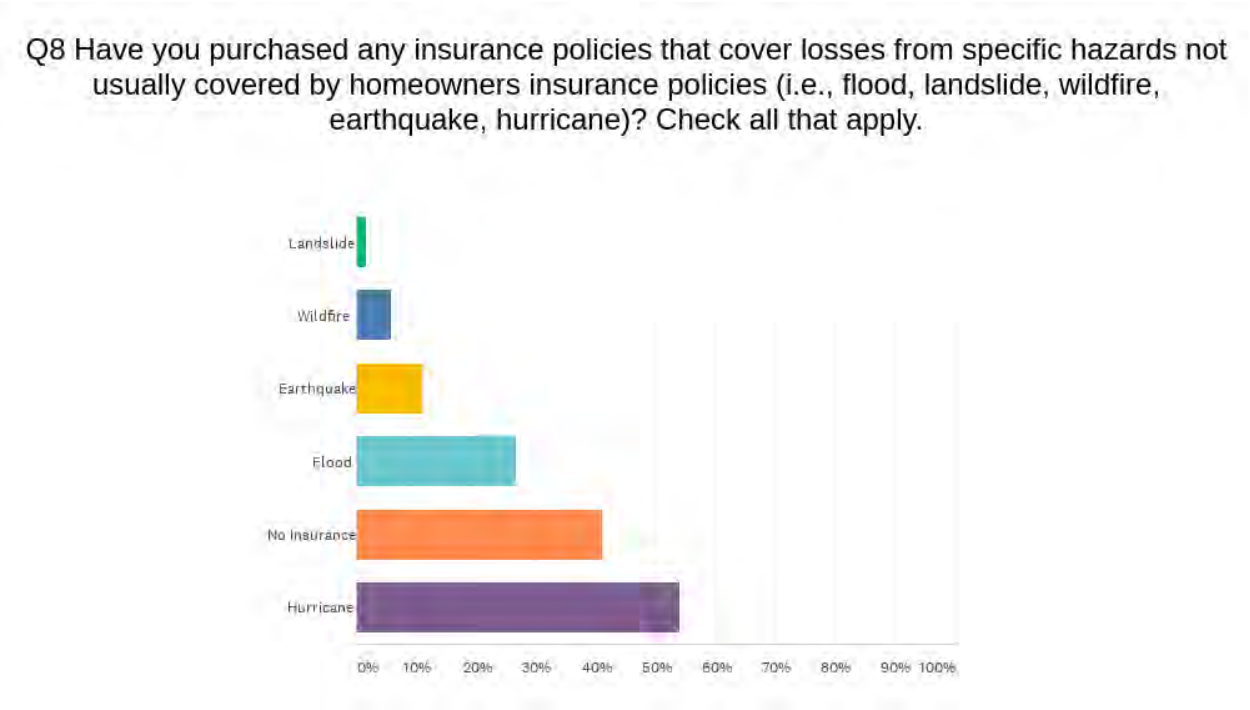


Figure 17. Insurance Policies

Community Capability Assessment Survey

In an effort to highlight the unique circumstances of the eight planning areas in the County, the Planning Team developed a survey to gather specific information regarding each of these communities. The hope was to have the Steering Committee members distribute the survey to community leaders and residents. While well intended, the distribution of the survey did not go well and only 21 responses were collected. In addition, Covid-19 had just started to become a problem so most responses directly relate to pandemic response and planning. The goal was to gather information especially from Moloka'i, Lānaʻi, and Hāna. Thirty-eight percent were from Lānaʻi and 1% were from Moloka'i. The information from Lānaʻi was especially helpful since the Planning Team was unable to host a Steering Committee or Public Meeting there.

Some of the information learned from the survey, specifically about Lānaʻi that informed the development of the Hazard Mitigation Plan:

- Lānaʻi is isolated and access to medical personnel is extremely limited.
- Outreach and education regarding hazards are conducted by way of the monthly newspaper, social media, website and fliers.
- The slow permitting process may cause food from the hydroponic farm to go to waste instead of distributing it to people on island.

Plan Review

Digital copies of the draft Hazard Mitigation Plan Update were available for review in August 2020 on the Maui County Hazard Mitigation Plan webpage (https://www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan) webpage. The Steering Committee reviewed the Plan initially and then the Plan was available for public review. A Google Form was available to collect comments. The availability of the draft Plan for review was publicized via a press release and flyer distributed by the Mayor's Office and the County Council. A copy of the press release and flyer are available in Appendix A. An email announcement was also sent directly to the following state and local agencies:

- Climate Action and Resilience Committee
- Hāna Emergency Preparedness Team
- Molokaʻi Emergency Preparedness Team
- Maui American Red Cross
- State Hazard Mitigation Committee

Comments made by the public are included below:

Chapter 4. Risk and Vulnerability Assessment

Introduction

Assessing risks is the second step in the four-step mitigation plan process. The risk assessment step includes four parts: identify hazards, profile hazard events, inventory assets, and estimate losses. Conducting a risk assessment is a way of asking and answering "what if . . ." questions. For instance, what if the county receives several days of heavy rain?

The risk assessment answers questions regarding history, location, frequency, probability, and impact for each hazard. These answers are used in the third step of mitigation planning: developing a mitigation plan. They provide essential data to determine and prioritize mitigation measures.

The risk assessment update is formatted to meet the Federal Emergency Management Agency's (FEMA)'s hazard mitigation planning regulations as found in C.F.R. 44 201. FEMA requires Maui County to include all possible natural hazard events, to assess vulnerability and to estimate potential losses. Each hazard must be profiled to include a description of the hazard, location, historical occurrences, extent (or magnitude), and vulnerability. In addition, all assets must be assessed. The identified hazards and hazard profile details are described below.

Sources of Information

Hazard Data

Hazard information was collected for all hazards under consideration using hazard studies, GIS data, and descriptions of previous events. This information is cited throughout the plan. Table 10 shows the data used to assess each hazard.

Table 10. Sources of Hazard Data.

Hazard Data	Source	Description
Coastal Erosion		
Coastal Erosion Hazard Exposure Areas	Pacific Islands Ocean Observing System (PacIOOS); Hawai'i Climate Commission; University of Hawai'i	Spatial data showing coastal erosion hazard exposure areas on sandy shores. Combines historical shoreline change data with a model of beach profile response to sea level rise (SLR). Data includes the current vegetation line, and modeled polygons for four SLR scenarios (2030, 2050, 2075, 2100).
Coastal Erosion Intensity zones	U.S. Geological Survey (USGS) Coastal & Marine Geology (CMG)	Spatial line data depicting coastal erosion zones.
Dams and Reservoirs		

Hazard Data	Source	Description
Dam inundation Areas	Maui Emergency Management Agency (MEMA)	Spatial data depicting inundation and evacuation areas dams in Maui County. Shows dams within the National Inventory of Dams (NID).
Dam Locations	Hawai‘i State GIS portal	Spatial data showing NID dam locations and hazard ranking.
Earthquake		
Scenarios	USGS, Hazus	Depicts shakemaps for earthquake scenarios.
Fault zones	Hawai‘i State GIS portal	Depicts USGS fault zones in the State of Hawai‘i.
Flood		
Riverine and Coastal	FEMA	Spatial data showing flood hazard areas (1% and 0.2% annual chance flooding).
King Tide Flooding	Sea Grant	Spatial data showing the location of king tide occurrences. Photos of events are provided.
SLR (aggregated impacts)	PacIOOS; Hawai’i Climate Commission; University of Hawai’i	Spatial data depicting aggregated coastal flooding due to the combined impacts of passive flooding from SLR, annual high wave flooding, and coastal erosion modeled for years 2030, 2050, 2075 and 2100.
Coastal High Wave Intensity zones	USGS CMG	Spatial line data showing the locations of coastal high wave hazard areas.
Landslide		
Landslide Susceptibility	USGS	Spatial data showing locations susceptible to landslide formation. Areas are shown as being in moderate, high, or very high hazard areas.
Hurricane		
Storm Surge Estimation	National Oceanic and Atmospheric Administration (NOAA)	Raster data depicting Sea, Lake, and Overland Surges from Hurricanes (SLOSH) model outputs for hurricane categories 1 through 4.
Coastal Storm Intensity zones	USGS CMG	Spatial line data showing the locations of coastal storm hazard areas.
Tsunami		
Tsunami Evacuation Zones	State of Hawai’i; Maui County; University of Hawai’i	Spatial data showing evacuation zones for tsunami and extreme tsunami scenarios.
Wildfire		
Wildfire Risk Areas	Hawai’i Department of Land and Natural Resources (DLNR)	Spatial data depicting wildfire risk areas for major populated areas. Risk areas are categorized as low, medium, or high, and are based of the wildland-urban interface.[56]

[56] Wildfire Risk Areas Metadata. Hawai’i State GIS Portal. Retrieved from http://files.Hawai’i.gov/dbedt/op/gis/data/FireRisk.pdf.

Hazard Data	Source	Description
Wildfire Ignition Density Maps	University of Hawai‘i	Data from the Pacific Fire Exchange depicting the number of wildfire ignitions per square mile per year from 2000 to 2012.[57]
Historic Fires	University of Hawai‘i	Data from the Pacific Fire Exchange showing historic wildfire perimeters in Maui County between 1999-2019.
Hazardous Materials Incidents		
Fixed Site	EPA	Spatial data showing the locations of U.S. Environmental Protection Agency (EPA) designated Toxic Release Inventory (TRI) sites.
Mobile	Hawai‘i State GIS portal	Roads considered vulnerable to hazardous materials incidents, including major roads (e.g. arterials) and highways. Bridges within the National Inventory of Bridges considered vulnerable to hazardous materials incidents.
Volcano		
Lava flow hazards	USGS	Static data depicting lava flow hazard areas.

Local sources used in the risk and vulnerability assessment include:

- Information gleaned from interviews and meetings with Maui County officials and the public
- County reports, studies, and plans, including the Maui County General Plan and the 2015 Maui County Hazard Mitigation Plan Update
- County geospatial data
- Local news sources
- University of Hawai‘i studies, maps, and geospatial data

State sources used in the risk and vulnerability assessment include:

- 2018 State of Hawai‘i Hazard Mitigation Plan Update
- Hawai‘i state agency studies, reports, web tools, and webpages applicable to the planning area
- Hawai‘i state geospatial data

Federal sources used in the risk and vulnerability assessment include:

- Agency studies, geospatial data, web tools, and reports applicable to the planning area, including but not limited to those from FEMA, the U.S. Department of Agriculture (USDA) Forest Service, NOAA National Centers for Environmental Information (NCEI) Storm Events Database, the National Weather Service (NWS), the U.S. Drought Monitor, the Centers for Disease Control and Prevention, U.S. Global Change Research Program, and the US Geological Survey (USGS).

[57] Trauernicht, C. and M.P. Lucas (2016). *Wildfire Ignition Density Maps for Hawai'i.* University of Hawai'i at Manoa Pacific Fire Exchange. Retrieved from https://www.pacificfireexchange.org/research-publications/category/wildfire-ignition-density-maps-for-Hawai'i?rq=ignition%20density.

Requirement 201.6(c)(2)(ii)(A): [The plan should describe vulnerability in terms of the] types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas.

Structure Data

Building footprints for Maui County were provided by Maui County officials. Parcel data, along with building improvement values, were also provided. Type of use (e.g., residential, commercial, industrial) information was not available. Therefore, all structures for assumed to be residential for exposure analysis purposes. Content value was estimated at approximately half of the improvement value in alignment with federal methods (e.g., Hazus). The table below presents the number of parcels, buildings, and associated value (improvement and content) within each Maui County community planning area. The number of improved parcels is greater than the building count. This is common in planning areas as condominiums are aggregated into one building footprint but hold a unique parcel identification number for tax purposes. Of note, the building value presented here (Table 11) is not synonymous with insured or replacement value. It does not include the value of the land.

Table 11. Buildings, Parcel, and Value Data for Maui County Community Planning Areas.

Community Planning Area	Total number of parcels	Total number of improved parcels	Total number of buildings	Total value of buildings
Hāna	2,075	937	1,958	$327,599,126
Kīhei-Mākena	18,196	16,292	8,678	$16,970,909,888
Lānaʻi	1,468	1,206	1,812	$1,043,683,080
Makawao-Pukalani-Kula	9,656	7,574	12,964	$4,196,114,298
Molokaʻi	6,116	3,176	2,511	$1,214,983,500
Pāʻia-Haʻikū	5,261	3,728	7,390	$2,017,821,429
Wailuku-Kahului	17,938	15,569	16,946	$8,745,963,305
West Maui	18,119	15,757	6,441	$19,332,962,000
Total	**78,829***	**64,239**	**58,700**	**$53,850,036,625**

*There are 78,804 parcels total in Maui County. The total presented in the table is slightly higher, as parcels with a significant portion of land in two community planning areas were considered to be in both community planning areas.

Critical Facilities

Critical facilities and infrastructure are those facilities essential to maintaining public safety. During and after a hazard event, these facilities are often vital to a community's ability to effectively respond and recover. Critical facilities generally include emergency operations systems, hospitals and healthcare facilities, police and fire stations, and schools. Critical infrastructures can include roads, bridges, communication's infrastructure, water and wastewater facilities, and electric utility infrastructure.

According to FEMA guidance, critical facilities are those that must continue to operate during and following a disaster to reduce the severity of impacts and accelerate recovery.[58] Maui County has identified several additional critical facilities due to their economic significance.

Maui County critical facilities were identified by Maui County officials. In all, 296 critical facilities were identified for inclusion in the risk assessment, which includes both public and privately-owned facilities. At the time of this plan, value data was not available for Maui County critical facilities. Critical facilities were categorized into the following sectors:

- **Commercial Facilities** – Defined as critical for this risk assessment include hardware and home improvement stores. These facilities sell important materials needed by home and business owners to prepare for and make repairs after a natural hazard.
- **Communications Facilities** – Includes communications infrastructure, such as broadband equipment.
- **Emergency Services** – These facilities are critical for providing first response services during a disaster, and include emergency operations centers, emergency medical services, fire stations, and police stations.
- **Energy –** These facilities are critical to providing electricity and fuel during a disaster, including Maui Electric Company facilities and substations, fuel pumps, and baseyards.
- **Food and Agriculture** – Includes facilities critical to providing and storing food during a disaster.
- **Government Facilities** – Includes government offices and services critical to government operation, such as planning, public works, and correctional centers.
- **Healthcare and Public Health** - Includes healthcare facilities such as laboratories, hospitals, clinics, long-term care facilities, and morgues.
- **Mass care** – Includes facilities critical for sheltering during hazard events. In Maui County, schools, community centers, hotels, churches, and gymnasiums may be used for mass care.
- **Transportation** – Critical transportation systems may include airports, harbors, baseyards, and their associated assets.
- **Water and Wastewater Systems** - These facilities are integral to providing safe drinking water and sanitation services, and can include water and wastewater treatment plants, reclamation facilities, pump stations, wells, and water storage.

Table 12 shows the number of critical facilities within each of these categories by community planning area. Figure 18 presents the distribution of critical facilities throughout Maui County. Maui Emergency Management Agency has a complete list of critical facilities.

[58] Federal Emergency Management Agency, Local Mitigation Planning Handbook, Washington, Federal Emergency Management Agency, 2013. Available at: http://www.fema.gov/hazard-mitigation-planning-resources

Table 12. Maui County Critical Facilities.

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Commercial Facilities	0	0	0	0	0	0	2	0	**2**
Communications Facilities	1	2	1	2	1	0	1	0	**8**
Emergency Services	3	5	3	3	6	3	9	5	**37**
Energy	2	0	0	0	1	0	2	0	**5**
Food and Agriculture	1	1	0	0	0	0	1	0	**3**
Government Facilities	0	0	0	0	2	0	12	0	**14**
Healthcare and Public Health	1	3	4	3	3	2	26	6	**48**
Mass care	3	9	5	12	12	6	18	10	**75**
Transportation	1	0	3	0	4	0	15	4	**27**
Water and Wastewater Systems	2	13	0	7	3	5	20	27	**77**
TOTAL	**14**	**33**	**16**	**27**	**32**	**16**	**106**	**52**	**296**

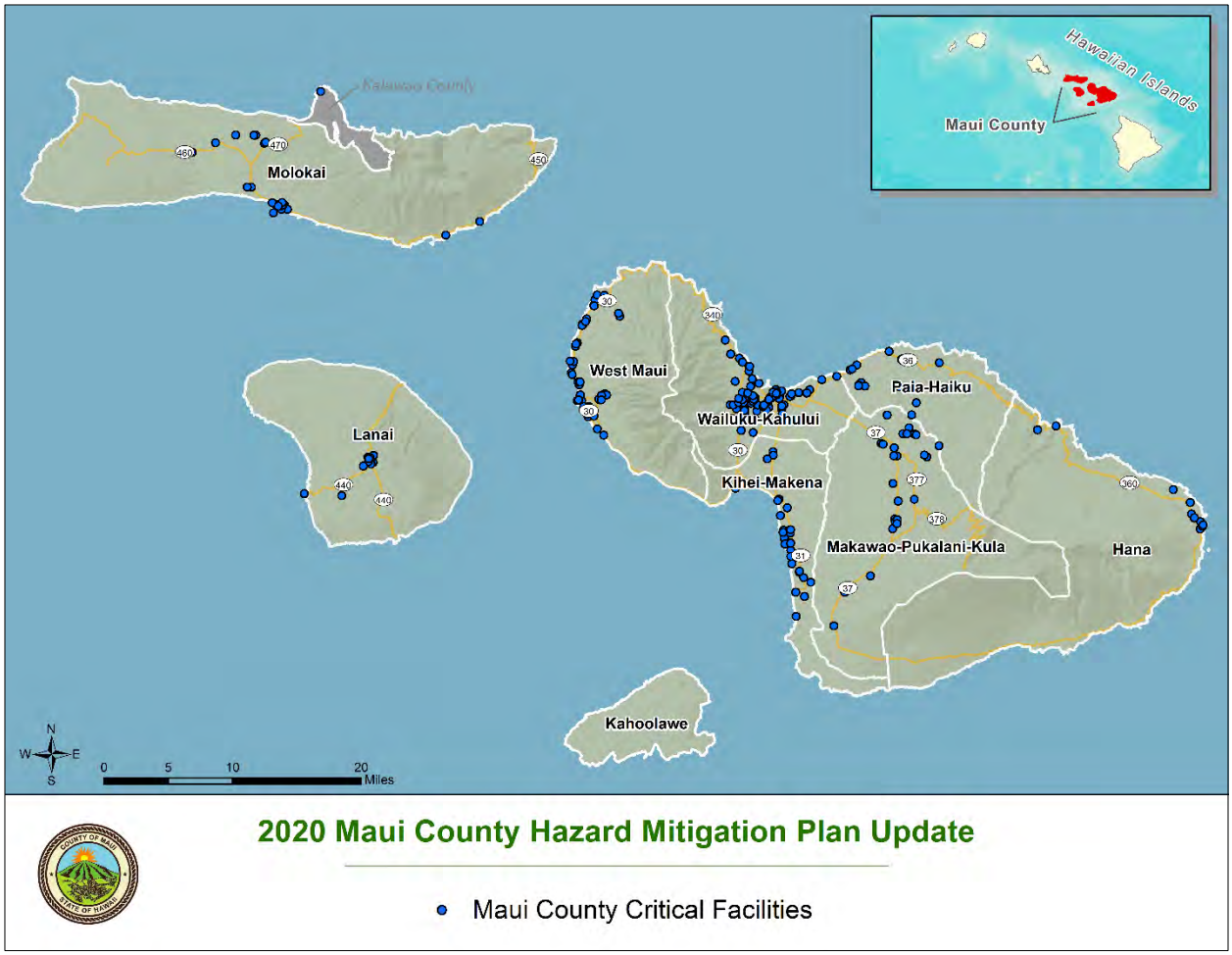


Figure 18. Maui County Critical Facilities.

Road Data

As described above, roads provide vital ingress and egress during a hazard event and are therefore considered critical infrastructure. Maui County owns and maintains hundreds of roads throughout the county. As many areas of Maui County can only be accessed by a single route, roads are considered critical infrastructure in order to maintain accessibility. The figures below show county-owned roads within Maui County.

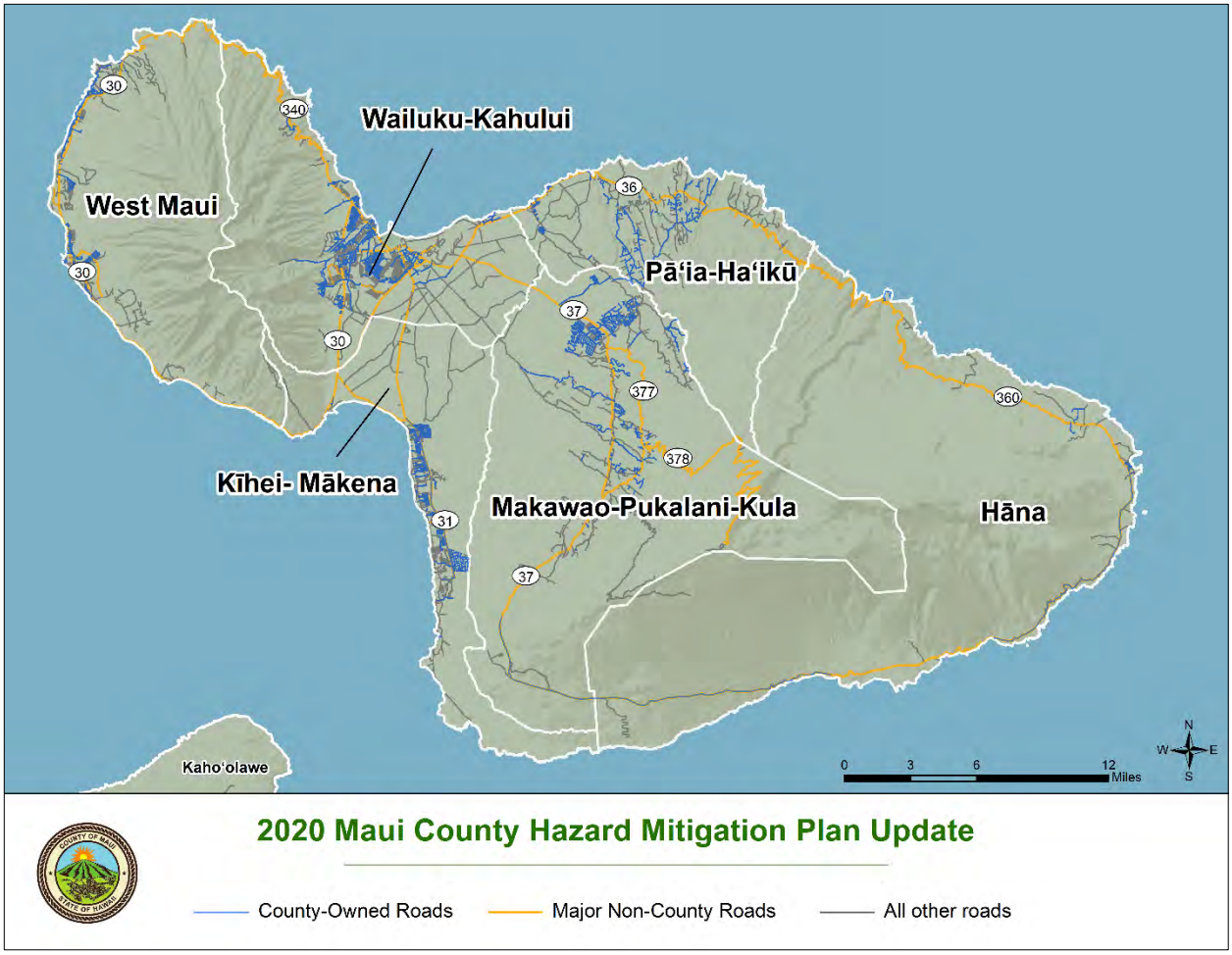


Figure 19. Roads on the Island of Maui.

Figure 20. Roads on the Island of Moloka'i.

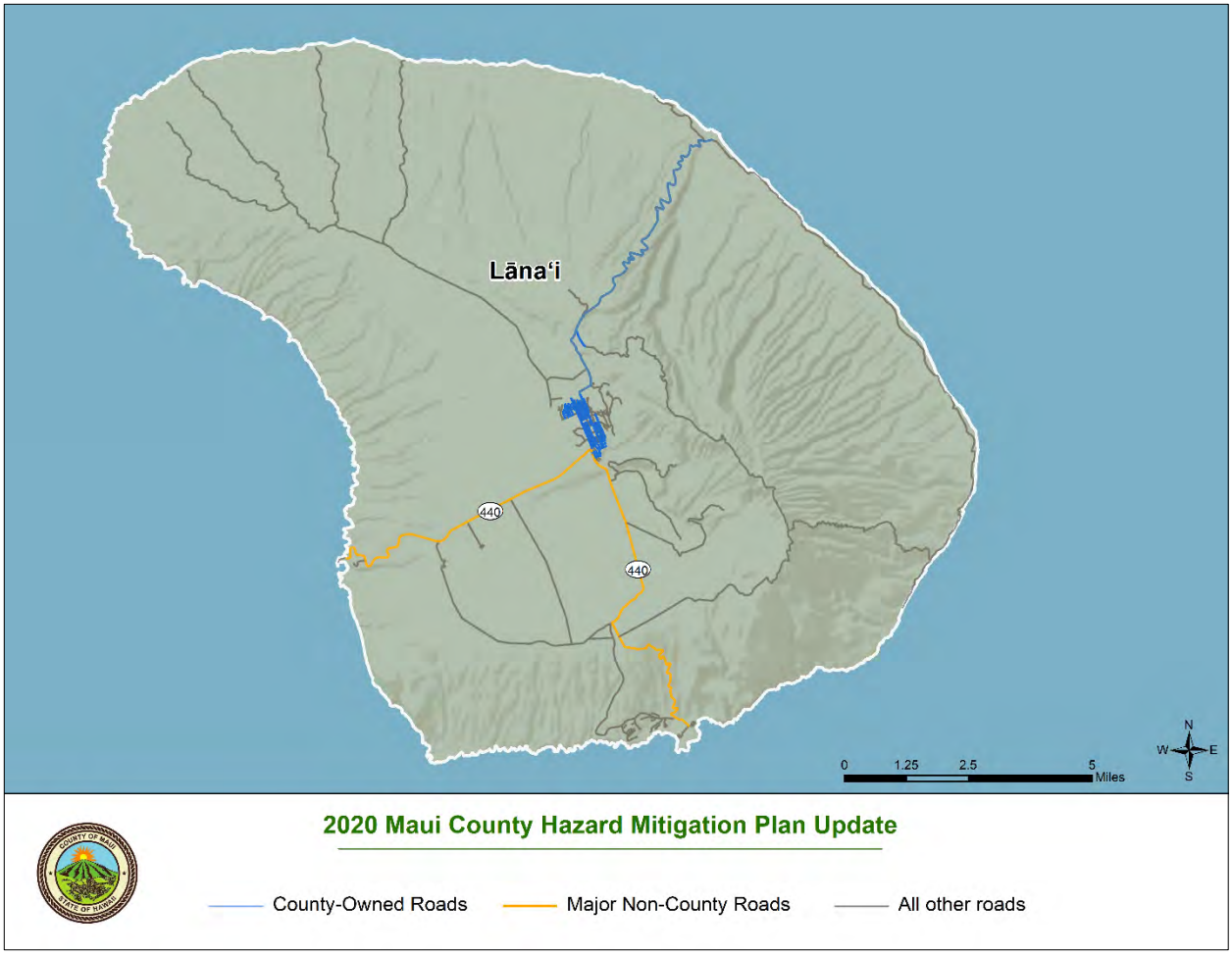


Figure 21. Roads on the Island of Lānaʻi.

Bridge Data

Impacts on bridges within the county are similar to roads; the closure of one bridge can impact entire routes and impact residents' ability to move between home, work, and other destinations, as well as their ability to evacuate. Bridge data in Maui County was obtained through the Hawaiʻi State GIS Portal, and includes bridges included in the National Bridge Inventory (NBI). The figures below show bridges within Maui County by island. There are no data for bridges on the Island of Lānaʻi. Table 13 presents the number of bridges in each community planning area. Bridges not included in the NBI are not represented in the figures and table below.

Table 13. Number of NBI Bridges in Maui County Community Planning Areas.

Community Planning Area	Number of (NBI) Bridges
Hāna	57
Kīhei-Mākena	12
Lānaʻi	0
Makawao-Pukalani-Kula	20
Molokaʻi	17
Pāʻia-Haʻikū	11
Wailuku-Kahului	26
West Maui	15
TOTAL	**158**

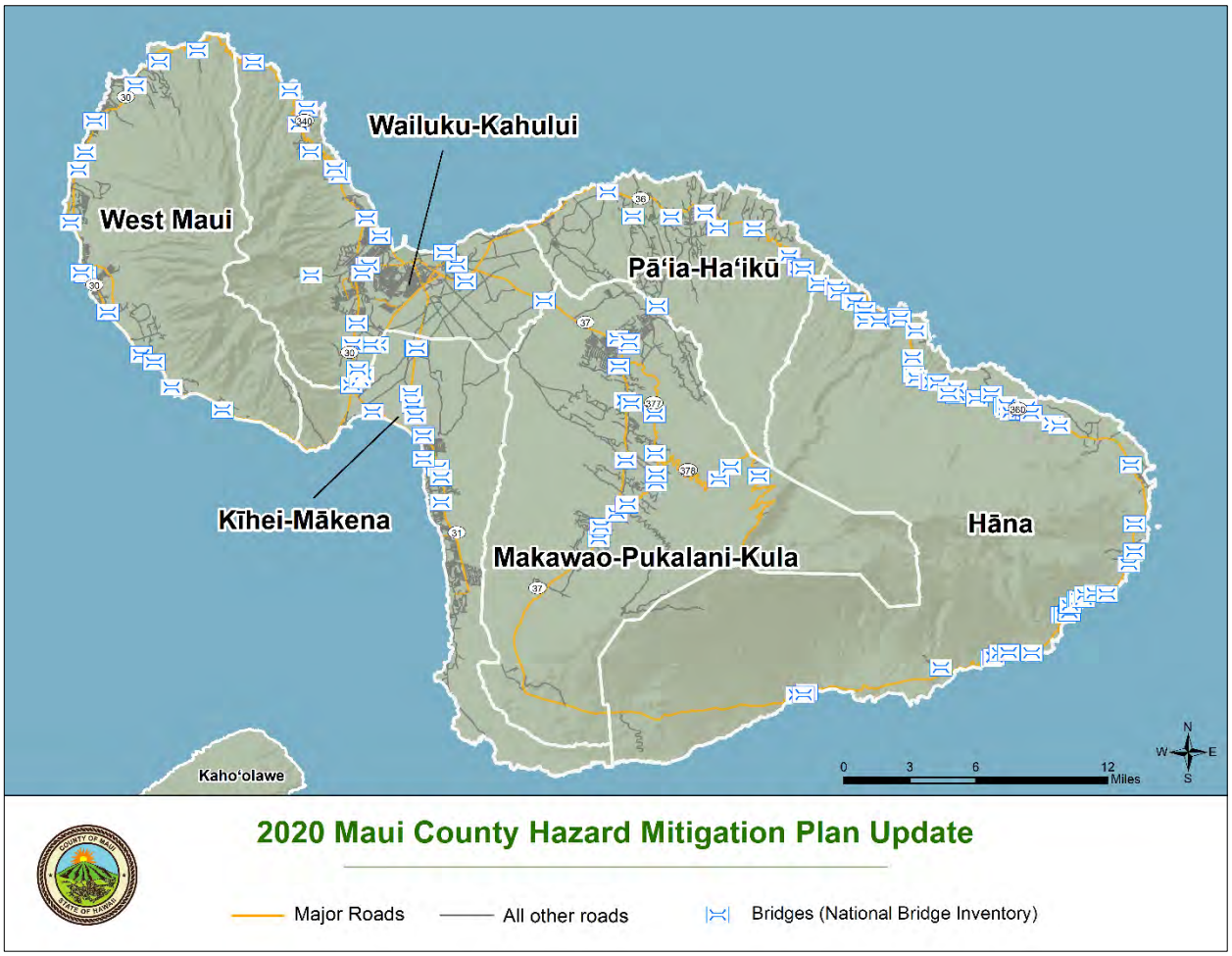


Figure 22. Bridges on the Island of Maui.

Figure 23. Bridges on the Island and of Moloka‘i.

Population and Social Vulnerability

Social vulnerability provides visibility into the underlying socioeconomic and societal factors that predispose a population to the negative impacts of disasters. A social vulnerability index (SVI) was developed as a mechanism to assess the relative social vulnerability of Maui’s community planning areas to specific hazards. The assessment measures relative vulnerability using an adaptation of the Center for Disease Control and Prevention and the Agency for Toxic Substances and Disease Registry’s (CDC/ATSDR) Social Vulnerability Index.[59,60] Population data for Maui County used to develop the SVI were collected for Maui County at the Census Tract level from the US Census American Community Survey (ACS) 5-year Estimates, 2014-2018.

[59] Flanagan, B., E. Gregory, E. Hallisey, J. Heitgerd, and B. Lewis, 2011. “A Social Vulnerability Index for Disaster Management.” *Journal of Homeland Security and Emergency Management 8(1)*.

[60] Flanagan, B., E. Hallisey, E. Adams, A. Lavery. “Measuring Community Vulnerability to Natural and Anthropogenic Hazards: The Centers for Disease Control and Prevention's Social Vulnerability Index.” *Journal of Environmental Health; Denver Vol. 80, Iss. 10, (Jun 2018): 34-36*.

Unique aspects of vulnerability in Maui County are represented by five sub-components:

1. **Household Composition**: Measures elements of household and family structure that increase vulnerability to negative hazard impacts and outcomes, relating to mobility, dependency, and access to finances. Indicators include single parenting, disabled populations, and dependent populations based on age (children and elderly).
2. **Socioeconomic Status**: Measures the proportion of the population that is less likely to have the necessary economic resources to adequately prepare for or recover from a natural disaster. Indicators include income, poverty, public assistance program beneficiaries, unemployment, and educational attainment.
3. **Access to Information**: Measures the population's ability to receive, comprehend and appropriately act on complex messaging with regard to natural disasters. Indicators include English language proficiency, and access to communication/information mediums such as telephone and internet.
4. **Housing Characteristics**: A measure of housing quality and living conditions that increase susceptibility to hazards, and places population at greater risk. Indicators include multi-unit housing, housing built before 1950, crowding, and populations residing in group quarters.
5. **Access to Lifelines**: Measures the population's access to critical services such as access to transportation routes and medical services. Indicators includes vehicle access, road density, and health insurance.

More information regarding social vulnerability index results in Maui County can be found in the *Social Vulnerability* section of this risk assessment.

Risk Assessment Process and Tools

This risk assessment was conducted by using a two-fold, qualitative and quantitative approach. The quantitative assessment utilizes a geographic information system (GIS)-based analysis. The qualitative approach draws on previous impacts in and near the planning area, as well as professional judgement to determine vulnerability in the region and jurisdictions. Further, two indices were used to assess risk within Maui County. The SVI was developed to provide information regarding socially vulnerable populations within each community planning area. The Priority Risk Index (PRI) tool was used to prioritize and categorize identified hazards in Maui County for each unique community planning area. More information on each approach and index is described below.

Quantitative Analysis

Geographic Information Systems

When possible, the vulnerability assessment for each hazard was completed utilizing a GIS-based analysis. Hazards that have specified geographic boundaries permit analysis using GIS. These hazards include:

- Coastal Erosion
- Dam Failure
- Flood (coastal, riverine, high wave, sea level rise)
- Hurricane
- Landslides
- Tsunami
- Wildfire
- Hazardous Material Incidents

The objective of the GIS-based analysis was to determine the estimated vulnerability of critical facilities and buildings for the identified hazards in Maui County using best available geospatial data. ESRI® ArcGIS™ 10.5 was used to assess hazard vulnerability utilizing digital hazard data, such as FEMA Flood Insurance Rate Maps (FIRMs), building footprints, and building values based on insurance information. Digital data was collected from local, regional, state, and national sources for hazards. Using these data layers, hazard vulnerability can be assessed by estimating the number and of type of assets, as well as potential dollar losses, determined to be located in identified geographic hazard area boundaries.

FEMA's Hazus-MH

FEMA's Hazus-MH uses ESRI's ArcGIS platform for the flood and earthquake hazards. Hazus-MH ("Hazus") is a standardized loss estimation software program developed by FEMA. It is built upon an integrated GIS platform to conduct analysis at a regional level or structure-specific level. The Hazus risk assessment methodology is parametric, in that distinct hazard and inventory parameters (e.g., wind speed and building types) can be modeled using the software to determine the impact (i.e., damages and losses) on the built environment.

The Maui County Risk and Vulnerability Assessment utilized Hazus-MH to produce hazard damage loss estimations. At the time this analysis was completed, Hazus-MH 4.2 was used to estimate potential damages from earthquake and flood hazards using the Hazus-MH methodology.

Qualitative Analysis

A qualitative approach was employed for hazards that generally have the potential to impact, or occur within, the entire planning area. It was also used for such hazards that lack a geographic boundary or

sufficient data to perform a reliable spatial analysis. This includes hazards considered atmospheric, including drought, extreme temperatures, extreme winds, and health risks. Many of the hazards listed above have the potential to affect all current and future buildings and all populations. Qualitative analyses were performed by using available research, data, and risk expertise to draw conclusions on probability and potential impacts across the entire planning area rather than applying a structure-specific approach.

Social Vulnerability Index

The SVI was developed to provide Maui County stakeholders with a repeatable, data-driven approach for assessing and communicating social vulnerability in support of the 2020 update to the County Hazard Mitigation Plan. Results can be used to help anticipate challenges before, during, and after a disaster; as well as to prioritize actions and identify potential leverage points to support sustainability.

The assessment measures relative vulnerability using an adaptation of the CDC/ATSDR SVI[61,62]. The assessment leverages the CDC/ATSDR methods for US Census indicator selection, combined with contextual knowledge of social vulnerability in Maui County, and Pacific Disaster Center's methodology for modeling relative vulnerability. The resulting indicator set captures specific aspects of vulnerability within Maui County using the best available data from the US Census American Community Survey (ACS). Indicators of vulnerability include those associated with household composition, socioeconomic status, access to information, housing characteristics, and access to lifelines.

Data and Methodology

Raw data were collected for Maui County at the Census Tract level from the ACS 5-year Estimates, 2014-2018. Though some indicators were available at the block group level via ACS, some critical data themes (such as income, poverty, language, populations living in group quarters) were not available, due in part to lower sampling rates and data suppression (for the protection of survey respondents' identity). The ACS 5-year survey product represents a rolling sample, collected between 2014 and 2018, and is the most recent and comprehensive socioeconomic dataset available to assess social vulnerability at the sub-county level. Geospatial data representing Maui County roads were gathered from the State of Hawai'i's Office of Planning, Statewide GIS office (2018). Complete data descriptions and sources are provided in Appendix B.

Data Aggregation

To provide a meaningful scale for county hazard mitigation planning, vulnerability indicators were aggregated to the community planning area level. While most of Maui County's 35 populated census

[61] Flanagan, B., E. Gregory, E. Hallisey, J. Heitgerd, and B. Lewis, 2011. "A Social Vulnerability Index for Disaster Management." *Journal of Homeland Security and Emergency Management 8(1)*.

[62] Flanagan, B., E. Hallisey, E. Adams, A. Lavery. "Measuring Community Vulnerability to Natural and Anthropogenic Hazards: The Centers for Disease Control and Prevention's Social Vulnerability Index." *Journal of Environmental Health; Denver Vol. 80, Iss. 10, (Jun 2018): 34-36*.

tracts closely aligned with the community planning area boundaries, some census tracts spanned across multiple planning areas. These cases were evaluated using an ancillary 30-meter gridded population dataset from Facebook[63], as well as aerial imagery from Google Maps to determine where and how census tract data needed to be weighted for aggregation. Only two census tracts on the island of Maui (Tract 304.04 in the area of Makawao and Haʻikū-Pauwela to the north, and Tract 320 spanning Māʻalaea and Olowalu to the west) exhibited significant population distribution across multiple Planning Areas. These areas are highlighted in the figure below.

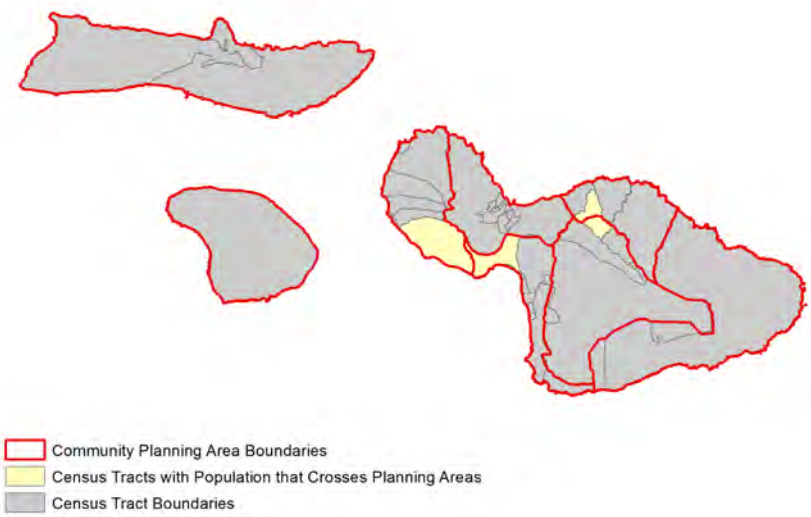


Figure 24. Maui Census Tract and Community Planning Area Boundary Comparisons.

To appropriately aggregate the population indicators for the two census tracts, population density was evaluated using Facebook's gridded population. The census tracts were intersected with the community planning areas and ArcGIS zonal statistics were used to estimate the proportion of the census tract population living in each planning district. These proportions were then used to weight the census counts and aggregate these values into the associated community planning area. Census Tract aggregation to the community planning area Level is summarized in Appendix B. Data are presented as both raw counts (e.g. population in poverty) and standardized as rates (e.g. % population in poverty) to support various aspects of mitigation planning. All indicators are provided both in their original tract-level scale and at the aggregated community planning area level.

Index Construction

The composite index approach for vulnerability assessment provides stakeholders a scalable, repeatable framework for understanding the multidimensional nature of disaster vulnerability, allowing for

[63] Facebook, 2019. "United States: High Resolution Population Density Maps + Demographic Estimates." Accessed via *Humanitarian Data Exchange*, URL: https://data.humdata.org/dataset/united-states-high-resolution-population-density-maps-demographic-estimates

meaningful comparisons across the various socioeconomic themes that affect disaster outcomes in the community planning areas.

All indicators were first standardized as percentage values or rates and evaluated for skewness. Datasets with skew > 1 were normalized using natural log transformation to reduce skewness. Datasets were evaluated, and where appropriate, statistically reflected to ensure consistent directionality (e.g., higher values indicated higher vulnerability). For example, road density, an indicator of Access to Lifelines, was reflected before index aggregation, as higher densities correlate with lower vulnerabilities. Indicators were subsequently re-scaled between 0 and 1 using min-max scaling:

Scaled Value = (Observed Value - Minimum Value) / (Maximum Value - Minimum Value)

Scaled Indicators were then thematically aggregated into vulnerability subcomponents. Subcomponent scores were calculated by averaging scaled indicators for each theme. Indicator descriptions for each vulnerability subcomponent are available in Appendix B (Note: Raw counts were not included as indicators for index construction). The final Vulnerability Index was calculated by averaging the five subcomponent scores:

Vulnerability Index = (Household Composition Score + Socioeconomic Status Score + Access to Information Score + Housing Characteristics Score + Access to Lifelines Score) / 5

Vulnerability Index and Subcomponent Index Scores range in value from 0 to 1, with 1 representing highest vulnerability. Social Vulnerability Index values are represented in the *Social Vulnerability* section of this risk assessment.

Priority Risk Index

The prioritization and categorization of identified hazards for Maui County is based principally on the PRI, a tool used to measure the degree of risk for identified hazards in a particular planning area. The PRI was used to assist the Maui County Mitigation Planning Team in identifying hazards that pose the most significant threat to the county and its assets.

The PRI results provide a numerical value for each hazard, allowing hazards to be ranked against one another (i.e. the higher the PRI value, the greater the hazard risk). PRI values are obtained by assigning varying degrees of risk to five categories for each hazard: probability, impact, spatial extent, warning time and duration. Each degree of risk has been assigned a value (1 to 4) and a weighting factor.

To calculate the PRI value for a given hazard, the assigned risk value for each category is multiplied by the weighting factor. The sum of all five categories equals the final PRI value, as demonstrated in the example equation below:

PRI VALUE = [(PROBABILITY x .30) + (IMPACT x .30) + (SPATIAL EXTENT x .20) + (WARNING TIME x .10) + (DURATION x .10)]

According to the weighting scheme applied, the highest possible PRI value is 4.0. Table 14 shows the weighting schemes for each category. By determining a value for each hazard that can be compared to other hazards threatening the planning area, hazards can be ranked with greater ease.

Many of the PRI categories are described within the hazard profiles. PRI results were calculated for each Community Planning District in Maui County. The final PRI results, including the calculated values for each hazard threatening Maui County, are found at the end of this section in the "Summary of Hazard Risk."

Table 14. Priority Risk Index Scoring Criteria.

PRI Category	DEGREE OF RISK			Assigned Weighing Factor
	Level	Criteria	Index Value	
Probability	Unlikely	Less than 1% annual probability	1	30%
	Possible	Between 1 and 10% annual probability	2	
	Likely	Between 10 and 90% annual probability	3	
	Highly likely	90%+ annual probability	4	
Impact	Minor	Only minor property damage and minimal disruption to government functions and services. No shutdown of critical facilities.	1	30%
	Limited	Minor injuries are possible. More than 10% of buildings damaged or destroyed. Temporary shutdown of critical facilities (less than one week).	2	
	Critical	Multiple deaths/injuries possible. More than 25% of buildings damaged or destroyed. Complete shutdown of critical facilities for more than one week.	3	
	Catastrophic	High number of deaths/injuries possible. More than 50% of buildings damaged or destroyed. Complete shutdown of critical facilities for 30 days or more.	4	
Spatial Extent	Negligible	Limited to one specific area.	1	20%
	Small	Small areas affected.	2	
	Moderate	Large areas affected.	3	
	Large	All areas affected.	4	
Warning Time	More than 24 hours	Self-explanatory	1	10%
	12 to 24	Self-explanatory	2	

	hours			
	6 to 12 hours	Self-explanatory	3	
	less than 6 hours	Self-explanatory	4	
Duration	less than 6 hours	Self-explanatory	1	10%
	6 to 12 hours	Self-explanatory	2	
	12 to 24 hours	Self-explanatory	3	
	More than 24 hours	Self-explanatory	4	

Data Limitations

Although many different sources of data and information were collected, limitations in analysis did exist. Limitations include those associated with data availability specific to Maui County, loss estimates, and unreported or underreported events, as described below.

Data Availability

Although Maui County has a wealth of available data, data limitations do constrict the risk analysis at certain points. Data limitations include:

- Building footprint data are not linked to parcel data containing improvement values; therefore, building value was assigned to buildings on a parcel using area weighted calculations. Buildings less than 250 feet were excluded from the analysis.
- Many parcels have multiple parcel identification numbers (and therefore many values). These were assumed to be condominium or multi-unit buildings. Value data was aggregated for these parcels before being assigned to buildings located on the parcel.
- Building footprints obtained from the county may not include new structures. For instance, several parcels that did not have a building footprint had an improvement value. For these parcels, a “representative building” was created using a point and buffer on a parcel’s centroid.
- Certain building features, such as use, building material, first-floor elevation, and number of stories was unavailable for building footprint data. Residential use was assigned to all structures for loss estimation purposes. Residential use assumes a content value of half of the improvement value.
- Previous occurrences for many hazards were gathered from the NOAA National Centers for Environmental Information Storm Events Database, which is not all-inclusive. Therefore, the

occurrences of certain hazards are likely under-reported. Additional sources for previous occurrences were considered when available.

- Not all hazards have identified geographic boundaries therefore, a GIS Intersection analysis could not be performed to identify vulnerable buildings, infrastructure, and populations. In this case, it was assumed that all current and future buildings and populations are at risk.
- Future conditions resulting from climate change and variability (e.g., emissions, radiative forcing effects) are difficult to predict, and there is a known uncertainty associated with climate projections and models. Uncertainty differs for hazards; for instance, temperature models are considered more certain than precipitation models. For certain hazards, climate impacts were not available or were inconclusive.
- In developing the Social Vulnerability Index, data a could not be assessed at the Census block level (smallest geographic area for which the Census collects data), as critical data themes (such as income, poverty, language, populations in group quarters) are not available, due in part to lower sampling rates and data suppression (for the protection of survey respondents' identity). Therefore, data at the tract level was used.

Exposure Analysis

Exposure, including estimated parcels, buildings (and associated value), and infrastructure provided in this vulnerability assessment are based on best available data and methodologies. The results are an approximation of risk. These estimates should be used to understand relative risk from hazards and potential losses. Uncertainties are inherent in any loss estimation methodology, arising in part from incomplete scientific knowledge concerning natural hazards and their effects on the built environment. Uncertainties also result from approximations and simplifications that are necessary for a comprehensive analysis (e.g., incomplete inventories, non-specific locations, lack of demographic information or economic parameters).

Unreported Events

In calculating annual probability estimates used in the PRI, it should be noted that not all events for each hazard are reported, which can impact the probability assigned to each hazard, which in turn can affect index values.

Social Vulnerability

Social vulnerability refers to the socioeconomic factors that affect community resilience. Communities with disproportionate populations that are socially vulnerable are more likely to realize the negative impacts of disasters, and less equipped for a timely, meaningful recovery.

As detailed in the *Risk Assessment Process and Tools* section of this chapter, a Social Vulnerability Index (SVI) was developed using Census tract-level data to examine five components that contribute to social

vulnerability: household composition, socioeconomic status, access to information, housing characteristics, and access to lifelines. Census data used to inform these values are detailed in Appendix B. Descriptions of each component and examples of high-level planning considerations for vulnerable populations are described below.

Household Composition

Household composition examines elements of household and family structure that increase vulnerability to negative hazard impacts and outcomes, relating to mobility, dependency, and access to finances. Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty with mobilizing and evacuating in a timely fashion. Further, the deaf or hard of hearing may not hear audible hazard alerts. Once evacuated, these populations will require additional services and care considerations in the response aftermath and during recovery. Special accommodations for these populations must be considered in disaster planning processes.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a natural disaster. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate preparedness actions such as stocking extra food and supplies, support recovery actions such as repairing of homes after a disaster, or fund mitigation actions that would protect their homes and property from future hazard impacts.

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon urgent hazard warning information. Additionally, those who do not speak English well, may not comprehend hazard warning information to the extent that enables them to make timely decisions and take life-saving actions.

Housing Characteristics

Populations living in housing built before 1950, and prior to the enactment of modern building codes, are more susceptible to damages and losses due to structural damage as a result of hazard impacts. In addition, higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences as a result of hazard exposure.

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges during an evacuation, and have difficulty accessing needed supplies and services before, during and after a hazard event. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

Figure 25 shows overall SVI results for community planning areas within Maui County. Figure 26 shows vulnerability subcomponent index maps for each community planning area.

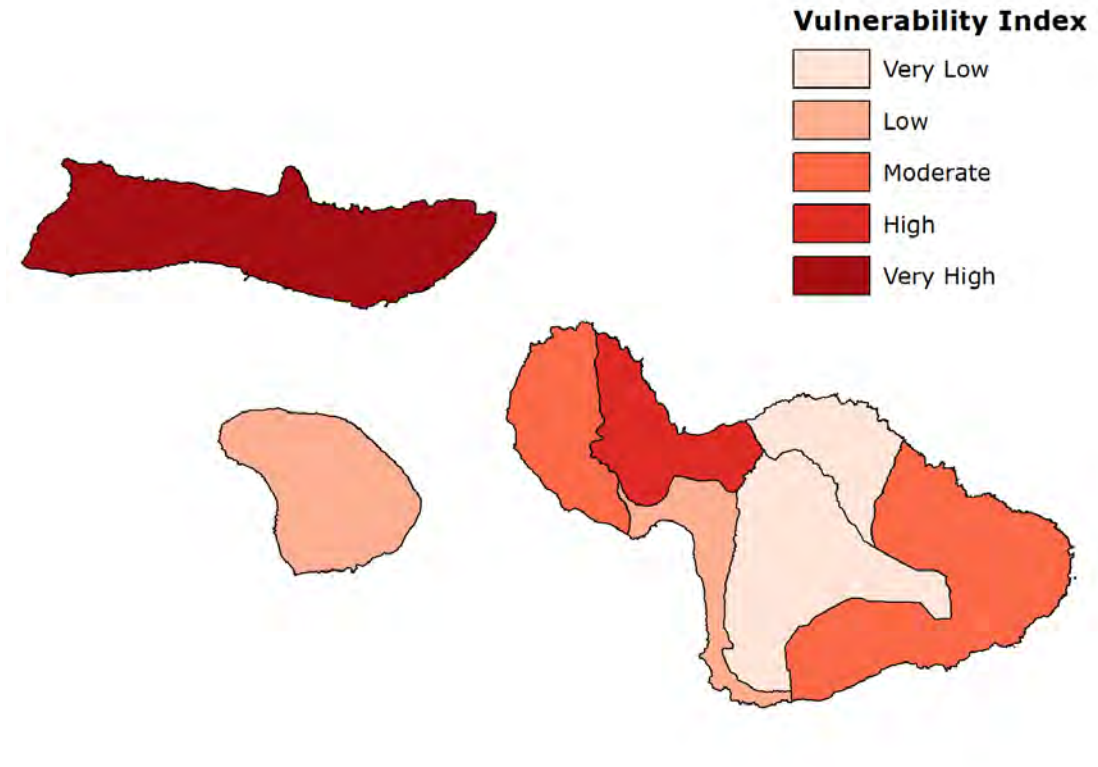


Figure 25. SVI Rankings for Maui County by Community Planning Area.

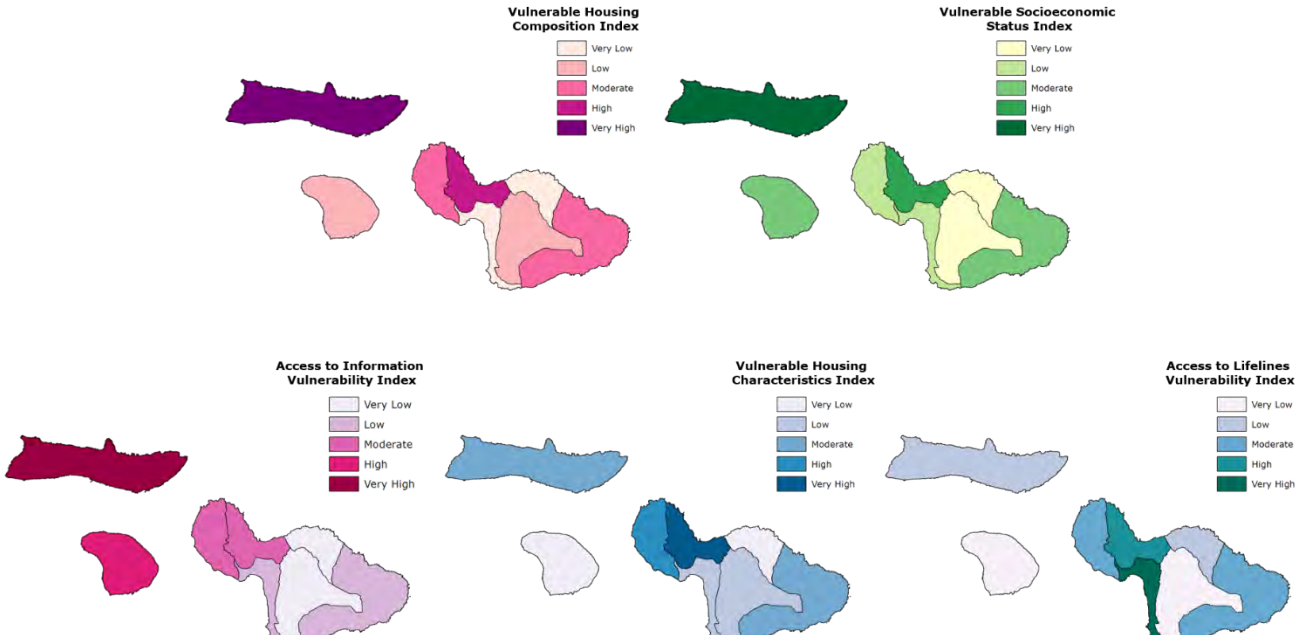
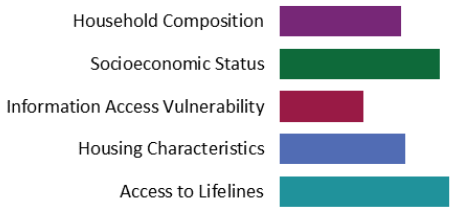


Figure 26. SVI Subcomponent Index Maps for Maui County by Community Planning Area.

Summaries of social vulnerability for each Community Planning Area based on the analysis are provided below.

Vulnerability in Hāna Community Planning Area

Vulnerability Rank: 4 of 8 Community Planning Areas[64] (Score: 0.447) The chart (right) indicates the socioeconomic themes contributing to overall Vulnerability in Hāna. Vulnerability in Hāna is influenced by moderate scores in Access to Lifelines Vulnerability and Vulnerable Socioeconomic Status.



	Household Composition	**20.04%** Population 65 and Older	**19.91%** Population Under 18	**12.3%** Disabled Population	**6.43%** Single-Parent Households with Children at Home	
	Socioeconomic Status	**12.0%** Poverty Rate	**7.22%** Unemployment Rate (Civilian Labor Force)	**4.85%** Adults (aged 25+) without HS Diploma	**$27,178** Per Capita Income	**11.24%** Households Receiving Financial Public Assistance, Food Stamps, or SNAP benefits
	Access to Information	**0.32%** Population Speaks English "Not Well" or "Not at all"	**1.2%** Households Without Telephone Service	**30.52%** Households Without Internet		
	Housing Characteristics	**0%** Housing in Structures with 10+ Units	**0%** Population living in Group Quarters	**18.27%** Crowded Housing (>1 Person per Room)	**10.51%** Housing Built Before 1950	
	Access to Lifelines	**5.72%** Population without Health Insurance	**2.41%** Households without Vehicle	**0.35** Road Density (per Sq. Mi)		

Discussion

The Hāna Community Planning Area's population is relatively isolated, having the lowest road network density in Maui County. This relative isolation is also evident in reduced access to communications, with

[64] Maui County has a total of nine Community Planning Areas, including the island of Kahoʻolawe. Because Kahoʻolawe is unpopulated it was not included in the vulnerability analysis.

nearly 31% of households lacking internet service. Nearly 6% of the population does not have health insurance, representing reduced health care access. Limited access to lifelines, including transportation and health care, can prevent or inhibit life-saving actions such as evacuation and seeking medical care.

The Hāna Community Planning Area also exhibits socioeconomic constraints, having the second highest poverty rate (12%), the third highest public assistance rate (11%) and the second lowest per capita income in the county ($27,178). Additionally, Hāna had the highest rate of crowded housing of all the Community Planning Areas, over 18%. Economic constraints pose individual, household, and community-wide limitations on available financial resources to invest in disaster preparedness and hazard mitigation. Communities with fewer financial assets often require external support to facilitate short- and long-term recovery following disasters.

Vulnerability in Kīhei-Mākena Community Planning Area

Vulnerability Rank: 6 of 8 Community Planning Areas (Score: 0.364) The chart (right) indicates the socioeconomic themes contributing to overall Vulnerability. Vulnerability in Kīhei-Mākena is influenced primarily by a moderate score in Access to Lifelines Vulnerability.

	Household Composition	**17.6%** Population 65 and Older	**19.12%** Population Under 18	**11.34%** Disabled Population	**6.36%** Single-Parent Households with Children at Home	
	Socioeconomic Status	**8.75%** Poverty Rate	**4.79%** Unemployment Rate (Civilian Labor Force)	**5.11%** Adults (aged 25+) without HS Diploma	**$39,601** Per Capita Income	**8.55%** Households Receiving Financial Public Assistance, Food Stamps, or SNAP benefits
	Access to Information	**2.53%** Population Speaks English "Not Well" or "Not at all"	**3.05%** Households Without Telephone Service	**7.4%** Households Without Internet		
	Housing Characteristics	**36.62%** Housing in Structures with 10+ Units	**0.62%** Population living in Group Quarters	**7.54%** Crowded Housing (>1 Person per Room)	**0.99%** Housing Built Before 1950	

Access to Lifelines	**6.9%** Population without Health Insurance	**5.1%** Households without Vehicle	**2.14** Road Density (per Sq. Mi)

Discussion

The Kīhei-Mākena Community Planning Area ranks third in Access to Lifelines Vulnerability, driven by the highest percentage of uninsured population in Maui County (7%), and fourth highest percentage of households without a vehicle (5%). These limitations represent disparities in access to health care and reduced personal mobility, creating challenges for disaster preparedness and response.

Despite having the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%, Kīhei-Mākena has a relatively low overall Vulnerable Housing Characteristics score.

Vulnerability in Lānaʻi Community Planning Area

Vulnerability Rank: 5 of 8 Community Planning Areas (Score: 0.432) The chart (right) indicates the socioeconomic themes contributing to overall Vulnerability. Vulnerability in Lānaʻi is primarily influenced by a high score in Access to Information Vulnerability.

Household Composition	**23.32%** Population 65 and Older	**17.98%** Population Under 18	**13.69%** Disabled Population	**5.07%** Single-Parent Households with Children at Home	
Socioeconomic Status	**4.63%** Poverty Rate	**3.65%** Unemployment Rate (Civilian Labor Force)	**12.65%** Adults (aged 25+) without HS Diploma	**$29,318** Per Capita Income	**6.82%** Households Receiving Financial Public Assistance, Food Stamps, or SNAP benefits
Access to Information	**4.54%** Population Speaks English "Not Well" or "Not at all"	**1.66%** Households Without Telephone Service	**35.87%** Households Without Internet		
Housing Characteristics	**5.7%** Housing in Structures with 10+ Units	**0.14%** Population living in Group Quarters	**3.59%** Crowded Housing (>1 Person per Room)	**29.23%** Housing Built Before 1950	

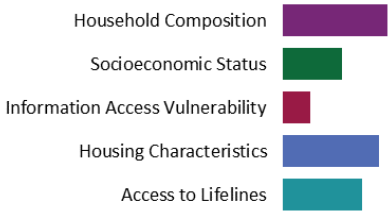
Access to Lifelines	**3.64%** Population without Health Insurance	**4.55%** Households without Vehicle	**0.78** Road Density (per Sq. Mi)

Discussion

The Lānaʻi Community Planning Area has the second highest Access to Information Vulnerability in Maui County, driven by the highest proportion of households without internet service (36%) and the third highest percentage of non-English speakers (4.5%). Limitations in information access can impede a population's ability to receive, understand, and take action during hazard events. Emergency communications must consider the unique information access constraints on the island of Lānaʻi and should contain clear and simple information to ensure an appropriate response to save lives and reduce losses. Additionally, nearly a third (29%) of housing in Lānaʻi was built before 1950. Buildings predating modern building codes are more susceptible to hazards including high wind and earthquakes.

Vulnerability in Makawao-Pukalani-Kula Community Planning Area

Vulnerability Rank: 7 of 8 Community Planning Areas (Score: 0.249) Though overall Vulnerability in Makawao-Pukalani-Kula is relatively low, the chart (right) indicates slight elevations in Vulnerable Household Composition and Housing Characteristics.



Household Composition	**17.74%** Population 65 and Older	**19.74%** Population Under 18	**10.71%** Disabled Population	**7.46%** Single-Parent Households with Children at Home	
Socioeconomic Status	**10.88%** Poverty Rate	**3.98%** Unemployment Rate (Civilian Labor Force)	**4.63%** Adults (aged 25+) without HS Diploma	**$37,539** Per Capita Income	**7.56%** Households Receiving Financial Public Assistance, Food Stamps, or SNAP benefits
Access to Information	**0.91%** Population Speaks English "Not Well" or "Not at all"	**1.12%** Households Without Telephone Service	**12.43%** Households Without Internet		
Housing Characteristics	**1.03%** Housing in Structures with 10+ Units	**1.52%** Population living in Group Quarters	**5.49%** Crowded Housing (>1 Person per Room)	**7.82%** Housing Built Before 1950	

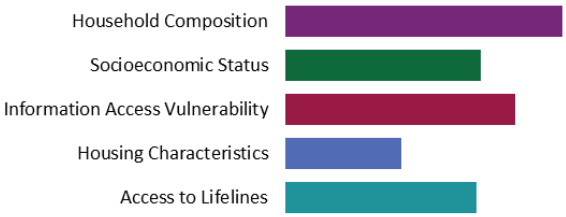
Access to Lifelines	**4.27%** Population without Health Insurance	**1.98%** Households without Vehicle	**1.27** Road Density (per Sq. Mi)

Discussion

The Makawao-Pukalani-Kula Community Planning Area exhibits the third highest poverty rate in Maui County at nearly 11% despite a very low overall Vulnerability score in relation to the rest of Maui County. It also has the third highest per capita income in the County of $37,539, indicating disparity of income across the planning area. Considering variations in income along with Vulnerable Household Composition – including elderly populations, children, and single parent households, Makawao-Pukalani-Kula may have some residents that are unable to adequately prepare for or recover from the negative impacts of a natural disaster.

Vulnerability in Molokaʻi Community Planning Area

Vulnerability Rank: 1 of 8 Community Planning Areas (Score: 0.686) Vulnerability in Molokaʻi is influenced primarily by very high scores in Vulnerable Household Composition, Access to Information Vulnerability, and Vulnerable Socioeconomic Status, as shown in the chart (right).



Household Composition	**22.66%** Population 65 and Older	**24.84%** Population Under 18	**17.77%** Disabled Population	**8.45%** Single-Parent Households with Children at Home	
Socioeconomic Status	**16.93%** Poverty Rate	**3.32%** Unemployment Rate (Civilian Labor Force)	**6.46%** Adults (aged 25+) without HS Diploma	**$21,152** Per Capita Income	**23.07%** Households Receiving Financial Public Assistance, Food Stamps, or SNAP benefits
Access to Information	**2.28%** Population Speaks English "Not Well" or "Not at all"	**5.45%** Households Without Telephone Service	**35.4%** Households Without Internet		
Housing Characteristics	**13.97%** Housing in Structures with 10+ Units	**0.26%** Population living in Group Quarters	**8.96%** Crowded Housing (>1 Person per Room)	**12.96%** Housing Built Before 1950	

Access to Lifelines	**4.2%** Population without Health Insurance	**6.42%** Households without Vehicle	**0.62** Road Density (per Sq. Mi)

Discussion

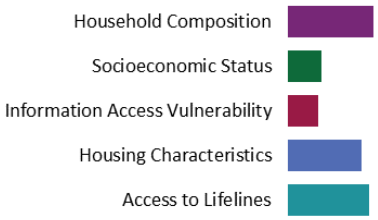
The Molokaʻi Community Planning Area exhibits the highest overall Vulnerability in Maui County. Assessment results indicate significant vulnerabilities in Household Composition, with the second highest percentage of elderly (23%) and the highest percentage of children under the age of 18 (25%) within the county. The island also has the highest prevalence of disability in Maui County at nearly 18%. Given the significant numbers of dependent populations, special consideration is needed during preparedness and response in order to adequately anticipate and meet the needs of these residents.

The planning area has the highest poverty rate (nearly 17%) in the county, and the highest rate of people receiving public assistance and social benefits (23%). It also has the lowest per capita income ($21,152) of all planning areas within the county. These socioeconomic factors will have bearing on the ability of residents to prepare for and recover from a disaster.

Over a third of Molokaʻi's population (35%) does not have Internet access, and more than 5% of residents do not have telephone service, considerably limiting the population's ability to receive timely alerts and warnings of hazard events. The planning area has the highest Access to Information Vulnerability score for the entire county. Another contributor to the island's relative isolation is its limited road network, with the second lowest road density in the county. Over 6% of households on Molokaʻi do not have a vehicle. Limited access to lifelines such as transportation can prevent or delay life-saving actions such as evacuation and obtaining critical medical care.

Vulnerability in Pāʻia-Haʻikū Community Planning Area

Vulnerability Rank: 8 of 8 Community Planning Areas (Score: 0.205) Though overall Vulnerability in Pāʻia-Haʻikū is very low, the chart (right) indicates slight elevations in Vulnerable Household Composition and Access to Lifelines Vulnerability.



Household Composition	**16.5%** Population 65 and Older	**21.53%** Population Under 18	**8.1%** Disabled Population	**7.06%** Single-Parent Households with Children at Home

	Socioeconomic Status	**8.69%** Poverty Rate	**3.07%** Unemployment Rate (Civilian Labor Force)	**6.45%** Adults (aged 25+) without HS Diploma	**$39,563** Per Capita Income	**6.86%** Households Receiving Financial Public Assistance, Food Stamps, or SNAP benefits
	Access to Information	**0.68%** Population Speaks English "Not Well" or "Not at all"	**0.35%** Households Without Telephone Service	**11.06%** Households Without Internet		
	Housing Characteristics	**0.68%** Housing in Structures with 10+ Units	**0.35%** Population living in Group Quarters	**4.97%** Crowded Housing (>1 Person per Room)	**12.62%** Housing Built Before 1950	
	Access to Lifelines	**4.38%** Population without Health Insurance	**2.74%** Households without Vehicle	**1.67** Road Density (per Sq. Mi)		

Discussion

The Pāʻia-Haʻikū Planning Area exhibits the lowest overall Vulnerability in Maui County, particularly in terms of Socioeconomic Status and Access to Information. Pāʻia-Haʻikū has the highest per capita income in the county ($39,563). However, the planning area has the third highest proportion of housing built before 1950 (nearly 13%). Homes that significantly predate modern building codes may be more susceptible to hazards including high wind events and earthquakes.

Vulnerability in Wailuku-Kahului Community Planning Area

Vulnerability Rank: 2 of 8 Community Planning Areas (Score: 0.551) Vulnerability in Wailuku-Kahului is influenced by a very high score in Vulnerable Housing Characteristics and high scores in Socioeconomic Status and Housing Composition, as shown in the chart (right).

	Household Composition	**15.43%** Population 65 and Older	**24.32%** Population Under 18	**10.77%** Disabled Population	**9.05%** Single-Parent Households with Children at Home

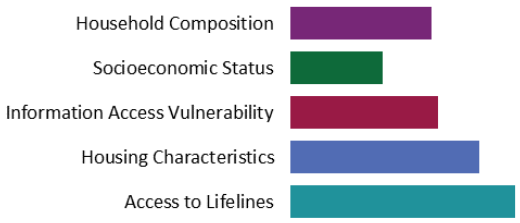
	Socioeconomic Status	**9.95%** Poverty Rate	**4.95%** Unemployment Rate (Civilian Labor Force)	**10.73%** Adults (aged 25+) without HS Diploma	**$28,967** Per Capita Income	**14.39%** Households Receiving Financial Public Assistance, Food Stamps, or SNAP benefits
	Access to Information	**4.61%** Population Speaks English "Not Well" or "Not at all"	**2.83%** Households Without Telephone Service	**14.29%** Households Without Internet		
	Housing Characteristics	**11.4%** Housing in Structures with 10+ Units	**2.8%** Population living in Group Quarters	**14.38%** Crowded Housing (>1 Person per Room)	**7.46%** Housing Built Before 1950	
	Access to Lifelines	**4.57%** Population without Health Insurance	**6.96%** Households without Vehicle	**2.73** Road Density (per Sq. Mi)		

Discussion

The most populous Community Planning Area in Maui County, Wailuku-Kahului (Population: 62,817), also exhibits a high concentration of vulnerable groups. The Planning Area has the second highest percentage of children (under 18) at 24% and the highest percentage of single-parent households (9%). The public assistance rate is the second highest in the County at over 14%. Finally, Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. Provisions must be made to plan for and reduce impacts to these vulnerable groups, who may lack the socioeconomic assets to prepare for and mobilize during a disaster.

Vulnerability in West Maui Community Planning Area

Vulnerability Rank: 3 of 8 Community Planning Areas (Score: 0.540) Vulnerability in West Maui is influenced by a very high score in Access to Lifelines Vulnerability, a high score in Vulnerable Housing Characteristics, and moderate scores in Household Composition Vulnerability and Information Access Vulnerability as shown in the chart (right).



	Household Composition	**16.24%** Population 65 and Older	**22.53%** Population Under 18	**9.7%** Disabled Population	**8.98%** Single-Parent Households with Children at Home	
	Socioeconomic Status	**7.9%** Poverty Rate	**4.07%** Unemployment Rate (Civilian Labor Force)	**9.52%** Adults (aged 25+) without HS Diploma	**$37,047** Per Capita Income	**8.85%** Households Receiving Financial Public Assistance, Food Stamps, or SNAP benefits
	Access to Information	**5.89%** Population Speaks English "Not Well" or "Not at all"	**2.19%** Households Without Telephone Service	**9.85%** Households Without Internet		
	Housing Characteristics	**39.1%** Housing in Structures with 10+ Units	**1.58%** Population living in Group Quarters	**16.0%** Crowded Housing (>1 Person per Room)	**1.71%** Housing Built Before 1950	
	Access to Lifelines	**6.04%** Population without Health Insurance	**6.7%** Households without Vehicle	**1.28** Road Density (per Sq. Mi)		

Discussion

The West Maui Community Planning Area has the third highest Vulnerability score in the county. It exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. These factors may affect the ability of those living within the planning area to access needed services such as health care. Also influencing West Maui's Vulnerability score is its high Vulnerable Housing Characteristics score. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%).

Notably, the Community Planning Area has the highest rate of Non-English speakers in all of Maui County, nearly 6%. This may limit the population's ability to receive, understand, and take expedient action during hazard events. Given that much of the population in the planning area lives near the coast, this has implications for disaster response actions such as evacuation during a tsunami. Finally, West Maui has the second highest percentage of single parent households, nearly 9%, which may increase susceptibility to negative hazard impacts due to limitations in mobility and dependency.

Hazard Identification

> *Requirement 201.6(c)(2)(i): A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.*

Hazard identification is the process of identifying the types of natural hazards that can affect the mitigation plan study area – Maui County. Hazards were identified by reviewing the 2015 Maui County Hazard Mitigation Plan Update and the effective State of Hawai'i Hazard Mitigation Plan. Input from the Maui Steering Committee, along with previous disaster declarations, were gathered to discern hazards that should be added or removed for this plan update. Four additional hazards were identified for inclusion in this plan update that were not in the 2015 Maui County hazard Mitigation Plan, including:

- Hazardous Materials Incidents (Fixed-Site and Mobile)
- Health Risks
- Extreme Cold
- Extreme Heat

The table below indicates a complete list of hazards identified for the 2020 Maui County Hazard Mitigation Plan Update. The table includes whether each hazard was recognized in the effective State of Hawai'i Hazard Mitigation Plan and/or the 2015 Maui County Hazard Mitigation Plan. All hazards from the 2018 Sate of Hawai'i Hazard Mitigation Plan are included in this plan update.

Table 15. Relevant State and County Hazard Mitigation Plan Identified Hazards.

2020 Maui County Hazard Mitigation Plan Update Identified Hazards	2018 Hawai'i SHMP Identified Hazard?	2015 Maui County HMP Identified Hazard?
Natural Hazards		
Climate Change (included for each hazard)	Yes	Yes
Coastal Erosion		Yes
Drought	Yes	Yes
Earthquake	Yes	Yes
Extreme Cold	No	No
Extreme Heat	No	No
Flood (Inland and Coastal)	Yes	Yes
High Windstorms	Yes	Yes
Hurricane (including Tropical Storms and Kona storms)	Yes	Yes

2020 Maui County Hazard Mitigation Plan Update Identified Hazards	2018 Hawai'i SHMP Identified Hazard?	2015 Maui County HMP Identified Hazard?
Landslides	Yes	Yes
Tsunami	Yes	Yes
Wildfire	Yes	Yes
Volcanic Hazards	Yes	Yes
Non-Natural Hazards		
Dam Failure	Yes	Yes
Hazardous Materials Incidents	Yes	No
Health Risks	Yes	No

Disaster Declarations

Federal disaster declarations can be used to inform the types of hazards that impact Maui County. From 1957 to 2020, 21 disasters were declared for Maui County, details for which are presented in the table below.[65]

Table 16. Historic Presidential Disaster Declarations for Maui County.

Date(s)	Disaster Number	Description	Region	Estimated Damages
3/16/1957	DR-71	Tidal Wave	Kahului-Wailuku	$5,000,000
8/16/1959	DR-94	Hurricane Dot	Maui (all)	$150,000
5/25/1960	DR-101	Tidal Waves	Maui (all)	N/A
4/24/1963	DR-152	Heavy Rains and Flooding	Maui (all)	N/A
9/13/1968	DR-251	Heavy Rains and Flooding	Maui (all)	N/A
2/6/1980	DR-613	Severe Storms, High Surf and Flooding	Maui (all)	N/A
4/22/1982	DR-656	Heavy Rains and Flooding	Maui (all)	N/A
9/11/1992	DR-961	Hurricane Iniki	Maui (all)	N/A
10/28 – 11/2/2000	DR-1348	Severe Storms and Flooding	Maui (all)	N/A
9/1 – 9/6/2006	FM-2673	Ma'alaea Fire	South Maui	$440,667
10/15/2006	DR-1664	Earthquake	Maui (all)	$28,151,256
6/27 – 7/4/2007	FM-2701	Olowalu Fire	West Maui	$269,310

[65] Disaster declarations provided by Maui County Emergency Management.

Date(s)	Disaster Number	Description	Region	Estimated Damages
12/4 –12/7/2007	DR-1743	Severe Storms, High Surf, Flooding, and Mudslides	Maui (all)	$2,629,570
8/29 – 9/7/2009	FM-2834	Kaunakakai Fire	Molokaʻi	$601,282
6/8 – 6/13/2010	FM-2844	Māʻalaea Fire	South Maui	$242,747
3/11/2011	DR-1967	Tsunami Waves	South Maui; West Maui	$6,369,092
3/3 – 3/11/2012	DR-4062	Severe Storms, Flooding, and Landslides	Maui (all)	$3,179,371
8/7 – 8/9/2014	DR-4194	Tropical Storm Iselle	Upcountry	$4,910,440
9/11 – 9/14/2016	DR-4282	Hawaiʻi Severe Storms, Flooding, Landslides, and Mudslides	Central Maui; West Maui; North Maui; East Maui	$3,927,063
8/22 – 8/29/2018	DR-4395	Hawaiʻi Hurricane Lane	West Maui	$6,486,714
10/22/2019	FM-5294	Hawaiʻi Kahana Ridge Fire	West Side	N/A

Hazard Profiles

Requirement 201.6(c)(2)(i): A description of the type, location, and extent of all natural hazards that can affect the jurisdiction. The plan shall include information on previous occurrences of hazard events and on the probability of future hazard events.

Requirement 201.6(c)(2)(ii): A description of the jurisdiction's vulnerability to the hazards described in paragraph (c)(2)(i) of this section. This description shall include an overall summary of each hazard and its impact on the community. All plans approved after October 1, 2008 must also address NFIP insured structures that have been repetitively damaged by floods. The plan should describe vulnerability in terms of:

a. The types and numbers of existing and future buildings, infrastructure, and critical facilities located in the identified hazard areas;

> *b. An estimate of the potential dollar losses to vulnerable structures identified in paragraph (c)(2)(ii)(A) of this section and a description of the methodology used to prepare the estimate; and*
>
> *c. A general description of land uses and development trends within the community so that mitigation options can be considered in future land use decisions.*

Each identified hazard is profiled separately to describe the hazard and potential impacts to Maui County and the populations and assets within. The profile for each hazard includes:

- Hazard description: A scientific explanation of the hazard including potential magnitude (or severity) and impacts;
- Location: Geographical extent of the hazard;
- Previous occurrences: The number of previous impacts from the hazard on Maui County;
- Extent (or magnitude): The severity of the hazard in the past and potential severity in the future. Measures may include wind speed, wave height, or property damage;
- Probability of future events: The likelihood of future events impacting Maui County. Given an exact probability is often difficult to quantify, this characteristic is categorized into ranges used in hazard profiles:
    - Unlikely: Less than 1% annual probability
    - Possible: Between 1% and 10% annual probability
    - Likely: Between 10+% and 90% annual probability
    - Highly Likely: Greater than 90% annual probability
- Vulnerability Assessment and Estimated Losses: The vulnerability assessment addresses conditions that may increase or decrease vulnerability, such as topography, soil type, land use, and development trends. Potential impacts to hazards from climate change are also addressed in this section, including potential changes in hazard frequency, duration, and/or intensity. Estimated losses to assets are calculated using available data and resources. Methods utilized include GIS analysis and hazard modeling. The number of structures and critical facilities at risk, as well as bridges and roads at risk, are analyzed using GIS analysis when possible. Impacts on buildings, infrastructure, life safety, evacuations and warnings, public health, socially vulnerable populations, and the local economy are addressed in this section.

Coastal Erosion

Description

Coastal erosion is the process in which rocks, soils, and sands along a coastline are worn away by wave energy. In the U.S., coastal erosion causes approximately $500 million in property loss annually.[66] Coastal erosion effects all shorelines but impacts and rates of erosion are highly localized. In Maui County, 85% of beaches are eroding, compared to 70% of beaches statewide.

Generally, coastal erosion is measured as the rate of change in the position or horizontal displacement of a shoreline and can be chronic or episodic. Coastal erosion is a naturally occurring process that is caused by storm surges, coastal storms/hurricanes, and high waves (such as king tides). A healthy shoreline will naturally recover from erosion events over time. However, it may take months or years for a shoreline to recover from a significant episodic erosion event. When shorelines do not recover quickly enough, they retreat inland, potentially damaging buildings, infrastructure, and natural areas. The extent and severity of naturally occurring coastal erosion is accelerated by global sea level rise.

Types of coastal erosion that occur in Maui County include the following:

Beach erosion occurs when sand is carried from a beach and deposited on sandbars further from shore. On a healthy beach, sand is returned to the beach over time though tidal cycles. Sea level rise, multiple storms over a short period, and/or a shoreline disrupted by hardening can result in shoreline retreat or the narrowing of a beach.

Dune erosion occurs when sand or sediment from areas not typically touched by normal tidal cycles is carried from the mainland and deposited offshore. Often caused by storm surge from severe coastal storms, dune erosion can result in the reshaping of the shoreline when more sand and sediment is removed than can be replenished by regular tidal cycles. This process increases the probability of overwash, or the likelihood that a future storm surge will overtop of dune crest.[67] As dunes provide protection for the lands behind them, dune erosion can ultimately make buildings and infrastructure behind impacted dunes more vulnerable to coastal storms and flooding.

Human activities, such as shoreline hardening, dune leveling, sand mining and canalization, may exacerbate coastal erosion if the following ways:

[66] Coastal Erosion. U.S. Climate Resilience Toolkit. Retrieved from https://toolkit.climate.gov/topics/coastal-flood-risk/coastal-erosion.
[67] USGS. Coastal Change Hazards Portal. Retrieved from https://marine.usgs.gov/coastalchangehazardsportal/ui/info/item/CD5XG5a.

Shoreline hardening, also called coastal armoring, includes structures built along a shoreline (e.g., bulkheads, seawalls, retaining walls) or perpendicular to a shoreline (e.g., jetties, groins). While hardening projects can prevent coastal erosion by protecting land directly behind the structure from wave energy, shoreline hardening can also disrupt natural patterns of sand movement and deposition, hindering replenishment of sands and sediment. Hardening can also cause scouring to occur outside of the hardening structure, accelerating coastal erosion on the seaward side of the structure. Often, hardening structuring may protect land (and structures) at the expense of losing beaches (and habitat). The figure below shows an example of normal beach retreat compared to retreat occurring with a constructed seawall.

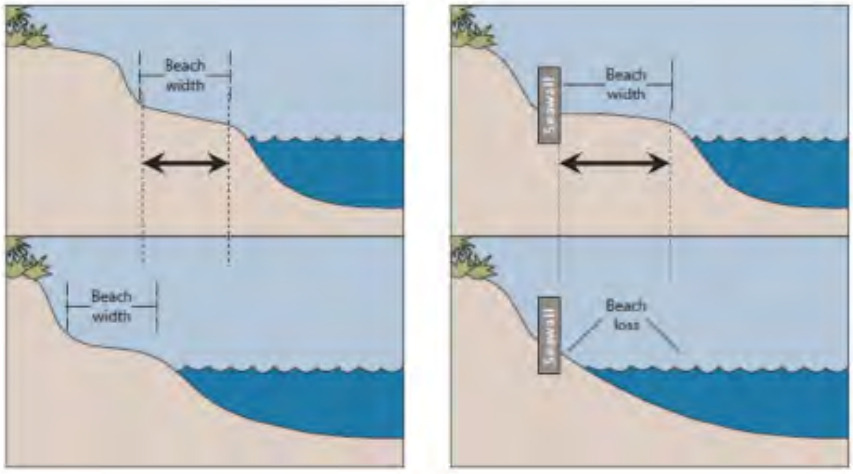


Figure 27. Beach Loss Due to Hardening Structures.

Dune leveling or grading is the processes in which coastal dunes are flattened to create grass lawns or build structures. Coastal dunes are essential to maintaining beaches and providing protection from high waves, rising sea levels and strong storms. Further, dunes are important for storage of sand. Flattened dunes fail to provide this critical protection. While dune grading has occurred historically in Maui County, it is currently prohibited through a dune grading ordinance.

While no longer legal, **sand mining** was historically practiced on the Island of Maui to mine lime to be used as building material. In past decades, sand mining has been largely responsible for the retreat of both the vegetation line and the beach foreshore on affected beaches. In addition to loss of vegetation and beach foreshore, sand mining degrades beaches by decreasing sand volumes, steepening the morphology of the shoreline, and reducing the ability of beach profiles to respond to seasonal wave stresses.[68]

Canalization is the process in which many of the intermittent Hawaiian streams that flow from the mountains to the coast have been contained in concrete canals to control flash flooding during heavy rainfall events. Where canals open onto the coast, sand tends to get trapped in the channel mouths as it moves along the shoreline. This trapped sand increases the upstream flood hazard and creates a sand

[68] 2018 State of Hawai'i Hazard Mitigation Plan, Section 4.3.

deficiency on the adjacent beach. Often, accumulated sand is trucked off-site for other uses. When cleared sand is taken off-site rather than being returned to the immediate beach, long-term impacts are similar to those of sand mining and can result in chronic erosion. However, when placing sands cleared from channel mouths onto adjacent beaches, it is important to be aware of prevailing sediment transport patterns so that returned sand can provide nourishment.[69]

In addition to the above actions, coral reef degradation can contribute to coastal erosion. Coral reefs provide a natural buffer to protect coastlines from waves, storms, floods. When reefs are degraded, the absence of a natural offshore barrier exposes shorelines to wave energy and violent storms.[70] Coral reefs can be degraded by water pollution, turbidity (sediment in water that blocks sunlight from reaching coral), and warming ocean temperatures.

Location

All of Maui County's shorelines are susceptible to some degree of coastal erosion. The National Assessment of Shoreline Change, conducted using aerial imagery, shows that approximately 85% of beaches on the Island of Maui are eroding.[71] However, some shorelines on the island are more susceptible to erosion than others, such as beaches with the West Maui, Kīhei-Mākena, and Wailuku-Kahului community planning areas.

The islands of Maui and Molokaʻi largely protect the Island of Lānaʻi from erosion to the north and northeast. Therefore, the majority of erosion on Lānaʻi occurs on the southwest side of the island. On the Island of Molokaʻi, coastal erosion impacts the southern shoreline, characterized by scarped dunes, fallen trees, and outcrops of basalt rock. Coral reefs, which can provide protection against coastal erosion, can be found offshore of all the islands within Maui County. However, Molokaʻi has the most extensive coral reef within the county.

The figure below presents coastal erosion hazard intensity zones developed by USGS from historic erosion rates, showing the location of Maui County shorelines experiencing the most intense coastal erosion.

[69] 2018 State of Hawai'i Hazard Mitigation Plan, Section 4.3.
[70] NOAA (2019). *How do coral reefs protect lives and property?*. Retrieved from https://oceanservice.noaa.gov/facts/coral_protect.html.
[71] Fletcher, C.H. et al (2011). National Assessment of Shoreline Change. USGS. Retrieved from https://pubs.usgs.gov/of/2011/1051/pdf/ofr2011-1051_report_508_rev052512.pdf.

Figure 28. Coastal Erosion Hazard Intensity Areas in Maui County.

Previous Occurrences

Coastal erosion is an ongoing process. Therefore, previous occurrences are typically defined by areas experiencing high rates of coastal erosion over a period of time rather than singular historic events. However, certain events, such as tsunamis, can drastically change shorelines. Data from the Hawai'i Shoreline Study, conducted by the University of Hawai'i at Manoa's Coastal Geology Group, and information from the 2015 Maui County Hazard Mitigation Plan Update were used to determine coastal erosion previous occurrences. In Maui County, shorelines along West Maui, North Maui/Kahului Harbor, and the Kīhei coast have experienced notable erosion and shoreline movement.

Historically, the West Maui shoreline has been subject to varying rates of coastal erosion. From Lahaina to Papalua, the Honoapiilani Highway (State Highway 30) runs along the shoreline. Revetments and other armoring constructed to protect the highway have interfered with natural erosion and

replenishment processes. Figure 29 shows seawall construction along Honoapiilani Highway in 2012. In addition, degradation of the Māʻalaea Coral Reef in the last several decades has contributed to coastal erosion. Coral cover on the Māʻalaea Coral Reef has declined from 50-75% coverage in 1993 to just 8% in 2015.

Figure 29. Honoapiilani Highway seawall construction at Ukumehame.

Kanaha Beach in northern Maui, located between Kahului Harbor and the Town of Pāʻia, has experienced severe erosion since 1950. Historic sand mining and construction of Kahului Harbor in 1910 are likely to have contributed to increased erosion rates. A revetment constructed in the 1970s to protect the wastewater facility, and another constructed at Baldwin Beach, have caused a loss of beach on the seaward side of these structures. Further, the general area is exposed to high wind and wave energy. Figure 30 shows summer erosion and high wave flooding at the Baldwin Beach Pavilion in 2016.

Figure 30. Coastal erosion and high wave flooding at Baldwin Beach Pavilion.

In the Kīhei area, varying rates of erosion have impacted shorelines. Coastal armoring has contributed to severe coastal erosion in the Kalama Park/Halama Street area. In addition, several beaches along the Kīhei Coast were subject to severe erosion during the 1980 and 1982 Kona storms.

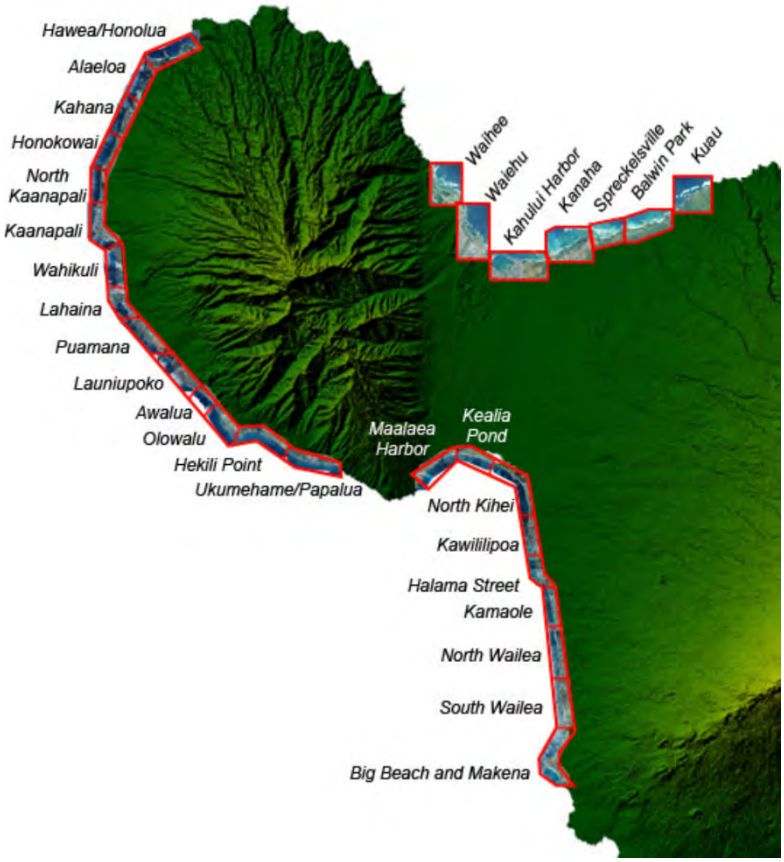


Figure 31. Maui Shoreline Study Erosion Areas.

The University of Hawai'i at Manoa's Coastal Geology Group conducts the Hawai'i Shoreline Study to provide publicly available shoreline change data to assist in decision-making.[72] Erosion maps generated through the study provide annual erosion hazard rates, provided at 20-meter intervals, as well as historic shorelines. The table below describes historic coastal erosion within study areas, organized by community planning district (applicable planning districts include Kīhei-Mākena, Wailuku-Kahului, and West Maui). Study areas are presented west-east and north-south, as shown in Figure 31.

Table 17. Maui Shoreline Study Erosion Areas.

Study Area	Average Annual Erosion Hazard Rate (feet/year)	Description
Kīhei-Mākena		
Mā'alaea Harbor	-0.9	The harbor was built in 1952. The area has experienced moderate erosion over time and the average beach width within this area decreased 11% between 1949 and 1997.

[72] Coastal Geology Group (2016). Hawai'i Coastal Erosion Website. Retrieved from http://www.soest.Hawai'i.edu/coasts/erosion/index.php.

Study Area	Average Annual Erosion Hazard Rate (feet/year)	Description
Kealia Pond	-0.7	This area is comprised of Māʻalaea Bay Beach and salt marshes. It has experienced light to moderate erosion over time and the average beach width within this area has increased by 5% between 1949 and 1997.
North Kīhei	-0.9	This area includes Māʻalaea Bay Beach to the north and Maipoina Oe lau Beach Park to the south, bisected by Kīhei Pier. The area has experienced moderate erosion over time, and average beach width decreased by 28% between 1949 and 1997.
Kawililipoa	-1.0	This area has experienced moderate erosion over time, and average beach width decreased by 21% between 1949 and 1997.
Halama Street	-1.5	This area has experienced significant construction along the shoreline, including a groin, seawalls, and revetments. The groin was constructed at the northern end of the study area in the 1960s, which has caused sediment to collect on the southern side. The southern portion of the study area has experienced significant erosion and the average beach width in the study area decreased 34% between 1949 and 1997. Historic coastal erosion in this area is shown in Figure 32.
Kamaole	-0.7	This area is comprised of three prominent beaches and several pocket beaches and the area has experienced light to moderate erosion over time.
North Wailea	-1.1	This area is characterized by sandy shoreline, pocket beaches, and basaltic headlands. It has experienced moderate erosion since 1912 and the average beach width has varied over time, but overall decreased by 30% between 1949 and 1997.
South Wailea		This area is characterized by basalt headlands and four major white sand beaches and the average beach width decreased 17% within the study area between 1949 and 1997.
Big Beach and Mākena	-0.7	This area has experienced moderate erosion since 1912 and average beach width decreased by 10% between 1949 and 1997.
Wailuku-Kahului		
Waiheʻe	-0.8	This area is characterized by hardened shoreline, cobble and sandy beaches. The area has experienced moderate erosion since

Study Area	Average Annual Erosion Hazard Rate (feet/year)	Description
		1912 and the average beach width decreased 17% within the study area between 1949 and 1997.
Waiehu	-0.6	This area is characterized by hardened shoreline, cobble and sandy beaches. The area has experienced light erosion over time and the average beach width decreased 32% between 1960 and 2002.
Kahului Harbor	-1.6	This area is comprised of sandy beach, hardened shoreline, and structures. The area experienced moderate to severe erosion since 1899 and the average beach width decreased 20% between 1960 and 2002. Historic coastal erosion in this area is shown in Figure 34.
Kanaha	-1.5	This area is comprised of a white sand beach broken by 11 boulder groins that were constructed prior to 1950. The area has experienced moderate to severe erosion over time, but the area is highly variable due to the presence of groins. The average beach width increased 25% between 1960 and 2002. Historic coastal erosion in this area is shown in Figure 33.
Spreckelsville	-1.7	This area is characterized by a sandy shoreline and headland structures. It has experienced moderate to high erosion since 1912 and the Average beach width has remained relatively stable (an approximate 2% decrease) between 1960 and 2002. Historic coastal erosion in this area is shown in Figure 36.
Baldwin Park	-1.6	This area is characterized by sandy beach broken by revetments. The area has experienced moderate to high erosion and average beach width decreased by 7% between 1960 and 2002. Historic coastal erosion in this area is shown in Figure 35.
Kuau	-1.0	This area is comprised of sandy pocket beaches separated by rocky headlands. It has experienced light to moderate erosion over time. The tsunami of April 1946 significantly altered the natural features of the area – white sand beaches were lost and seawalls were constructed to protect property. The average beach width has remained fairly stable between 1960 and 2002.
West Maui		

Study Area	Average Annual Erosion Hazard Rate (feet/year)	Description
Hawea and Honolua	-0.4	This area is comprised of several bays and pocket beaches. It has experienced light to moderate erosion since 1912 and the average beach width within this area decreased 22% between 1949 and 1997.
Alaeloa	-0.9	This area is characterized by a series of bays and coves with pockets of white sand or cobble beaches. The area as a whole has experienced moderate to high erosion since 1912 and the average beach width has decreased by 38% between 1949 and 1997.
Kahana	-0.7	This area is characterized by white sand beaches. The south and central sections are comprised of Kahana Beach, a white sand beach segmented by revetments. The area has experienced moderate erosion since 1912 and the average beach width decreased by 23% between 1949 and 1997.
Honokōwai	-0.9	This area is characterized by a narrow white sand beach backed by hardened shoreline and seawalls. The area has experienced moderate erosion since 1912 and the average beach width has decreased by an average of 36% between 1949 and 1997.
North Kāʻanapali	-0.3	This area is comprised of a long white sand beach. The area has experienced light erosion since 1912and the average beach width decreased by 19% between 1949 and 1997.
Kāʻanapali	-0.6	This area of coastline is comprised of a dynamic white sand beach subject to kona storms and seasonal swell events. Since 1912, the area has experienced moderate erosion and the average beach width decreased by 29% on average between 1949 and 1997.
Wahikuli	-0.7	This area is characterized by hardened shoreline interspersed with white sand beaches to the north and narrow cobble beaches to the south. The shoreline has experienced major alterations over the last century. It has experienced moderate erosion since 1912 and the average beach width decreased by 22% between 1949 and 1997.
Lahaina	-1.0	This area is characterized by pocket beaches interspersed with hardened shoreline. In the southern portion, seawalls have been constructed north of Lahaina Boat Harbor. The area has

Study Area	Average Annual Erosion Hazard Rate (feet/year)	Description
		experienced moderate erosion over time and the average beach width decreased by 26% between 1949 and 1997.
Puamana	-1.0	This area is comprised of sandy and cobble beaches broken by hardened shorelines. Coastal armoring was first introduced in this area in 1949. The area has experienced moderate to severe erosion over time and the average beach width decreased by 29% between 1949 and 1997.
Launiupoko	-0.7	This area is comprised of sandy and cobble beaches broken by hardened shorelines. Coastal armoring was first introduced in this area around 1960. The area has experienced moderate erosion since 1912 and the average beach width decreased by 34% between 1949 and 1997.
Awalua	-0.3	This area is characterized by black sand, coral rubble, and cobble beaches. The area has experienced light erosion over time and the average beach width decreased by 22% between 1949 and 1997.
Olowalu	-0.4	This area is comprised of black sand and cobble beaches. The area has experienced light to moderate erosion over time and the average beach width has decreased little over time (approximately 3% between 1949 and 1997).
Hekili Point	-0.7	This area is comprised of sandy and cobble beaches. The area has experienced moderate erosion over time and the average beach width decreased by 35% between 1949 and 1997.
Ukumehame /Papalua	-1.0	This area is comprised of sandy and cobble beaches with sections of hardened shoreline. The area has experienced moderate to high erosion over time and the average beach width decreased by 8% between 1949 and 1997.

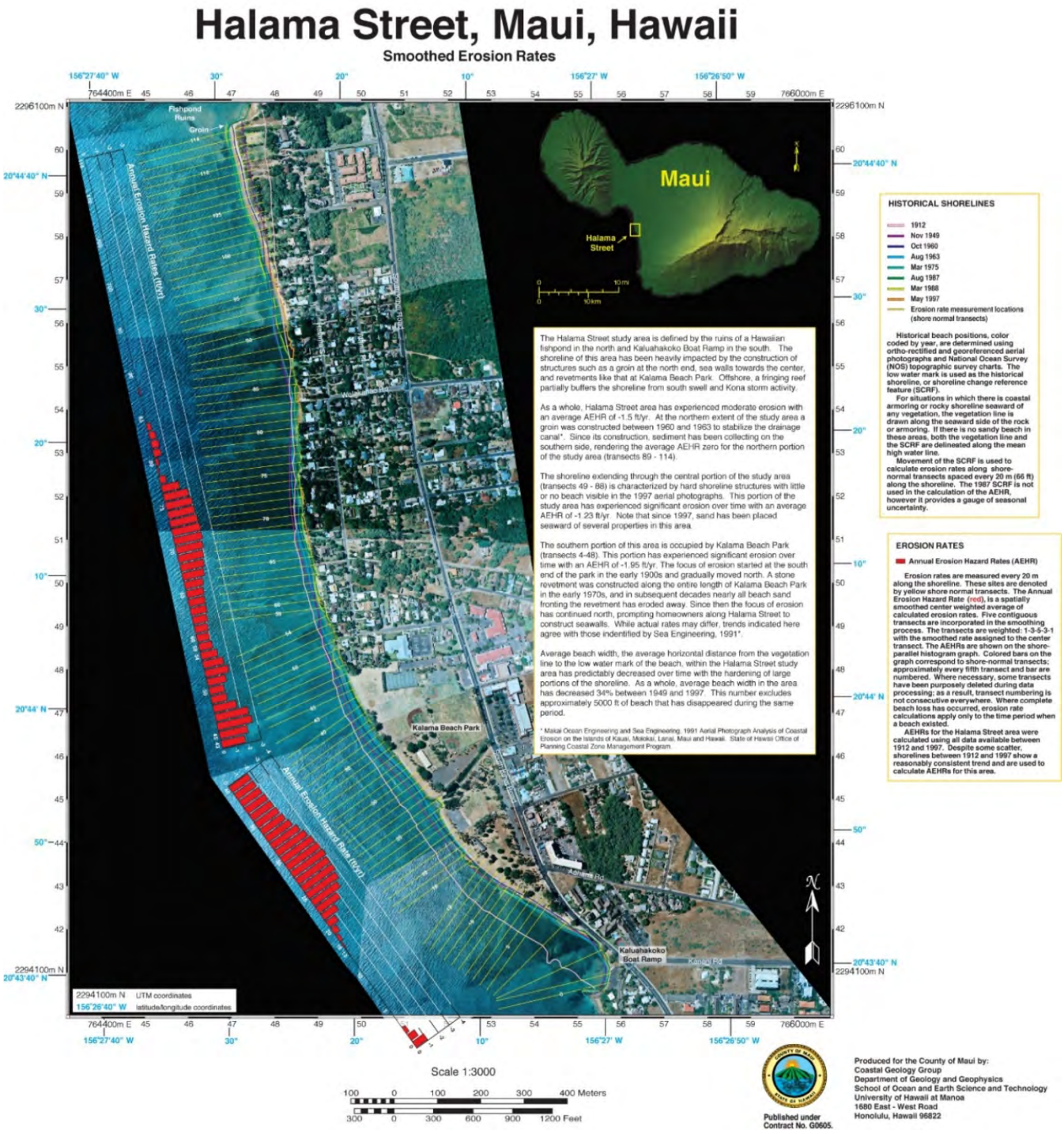


Figure 32. Coastal Erosion Map of Hamala Street.

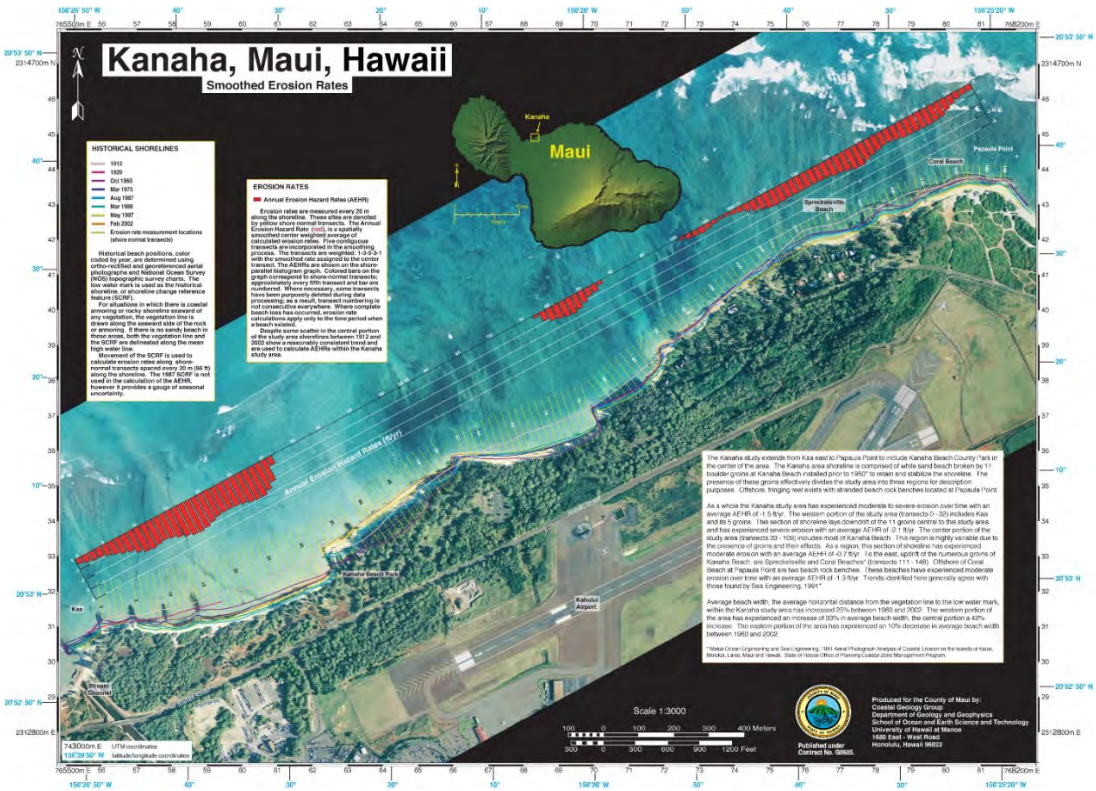


Figure 33. Coastal Erosion Map for Kanaha.

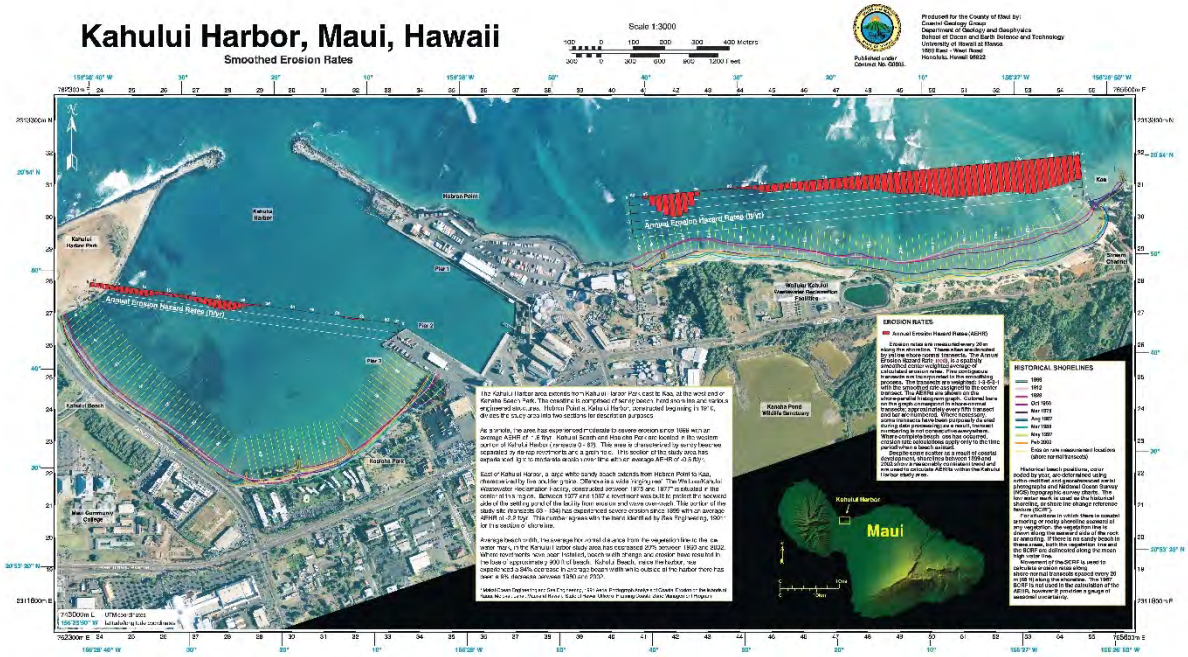


Figure 34. Coastal Erosion Map for Kahului Harbor.

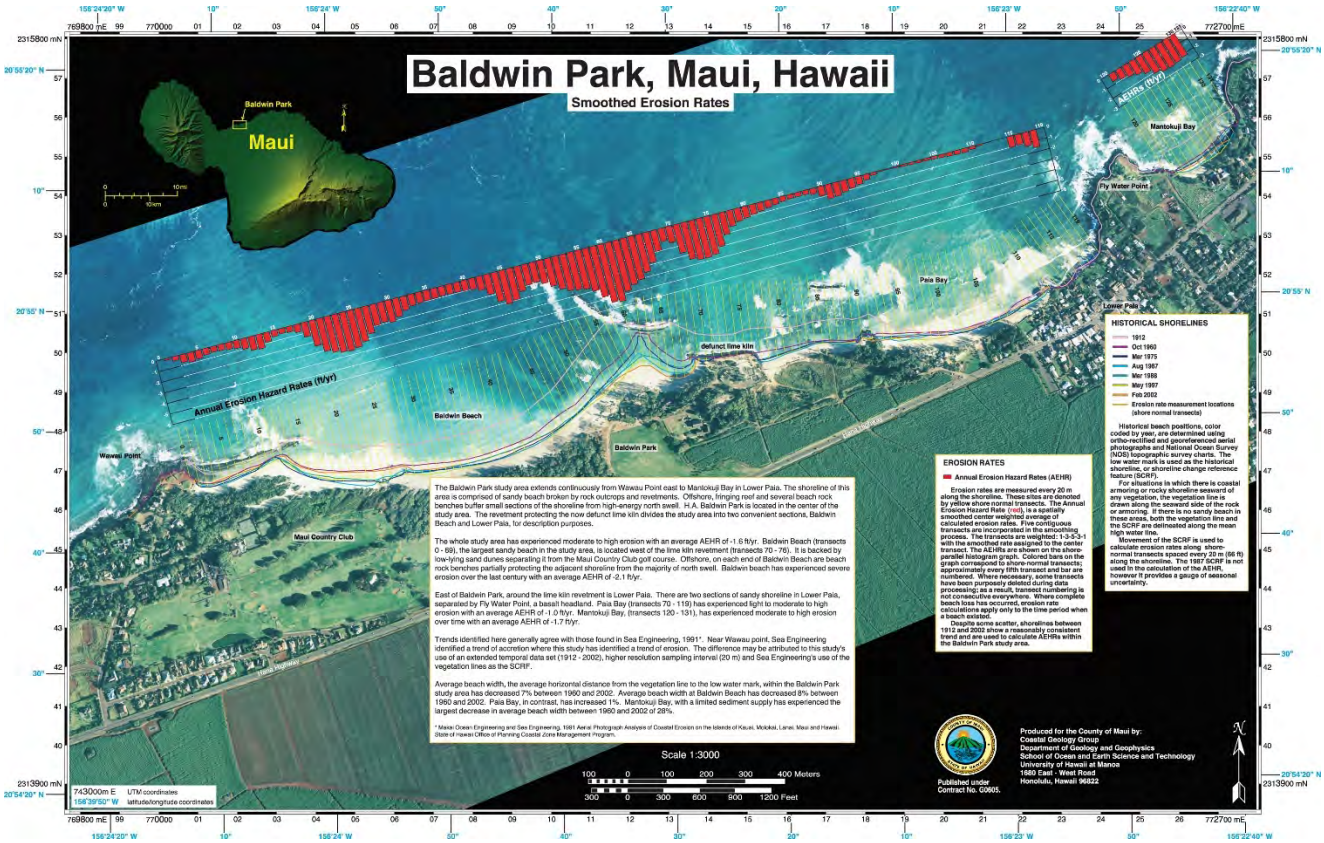


Figure 35. Coastal Erosion Map for Baldwin Park.

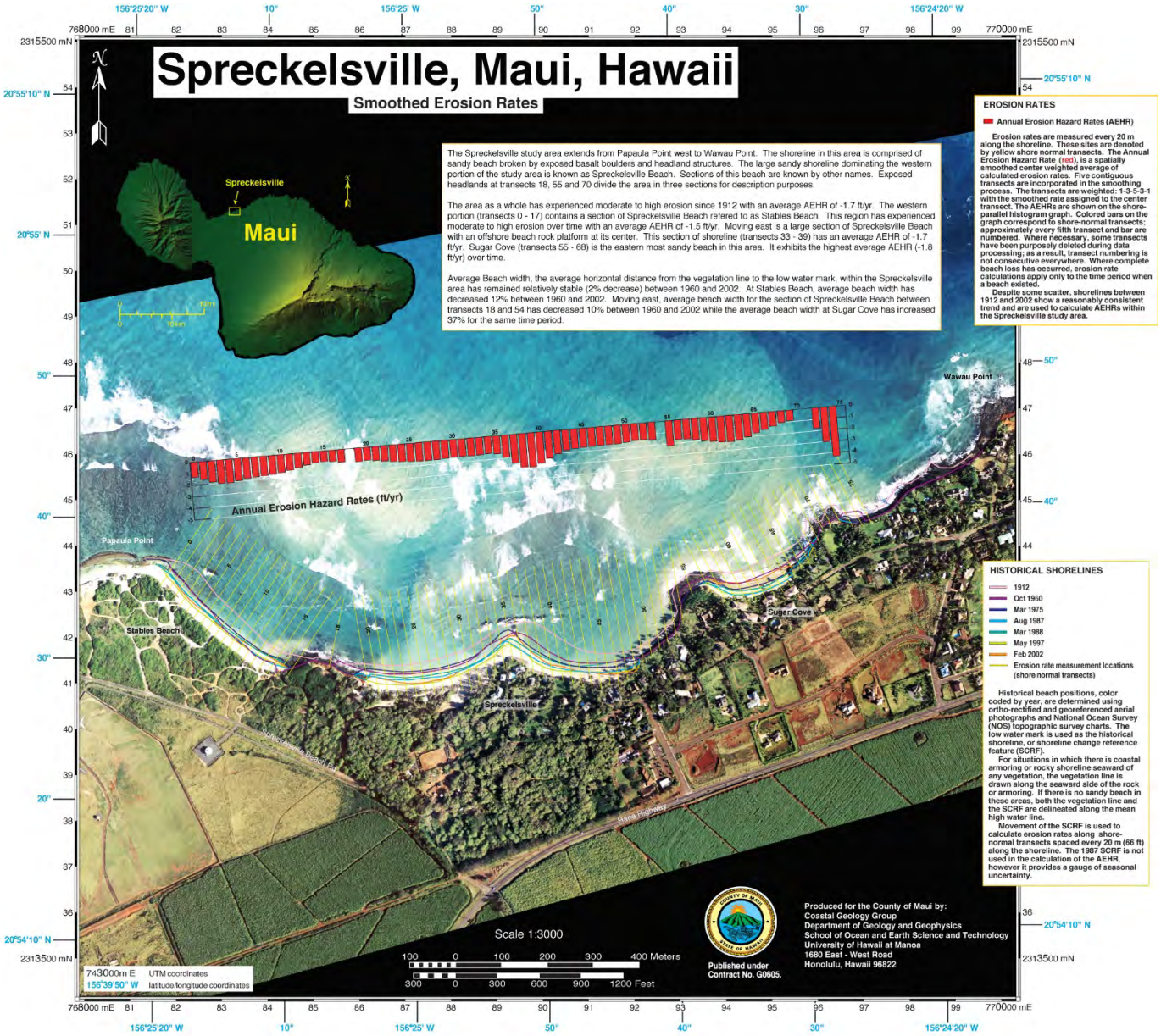


Figure 36. Coastal Erosion Map for Spreckelsville.

Extent

The extent, or severity, of coastal erosion can be measured in several ways, one of which is the rates of erosion experienced in specific areas. Based on the study conducted by the Coastal Geology Group, the Spreckelsville area in Wailuku-Kahului is experiencing the most severe erosion within the county, with

an average annual erosion hazard rate of -1.7 feet per year.[73] Further, it can be expected that sea level rise associated with a changing climate will exacerbate coastal erosion rates by causing shorelines to retreat farther inland. One study found that historically, coastal erosion on the Hawaiian Islands has been two orders of magnitude higher than sea level rise.[74] Coastal erosion projected from sea level rise is further described in the *Vulnerability Section* of this hazard's profile.

Coastal erosion severity may also be measured in terms of the percentage of shoreline within the county experiencing erosion. According the 2015 Maui County Hazard Mitigation Plan Update, over the long term, the Island of Maui can expect 85% of its beaches to erode within only a 14% accretion (sediment deposit) rate.

Probability

As coastal erosion is a continuous process, an exact probability is difficult to quantify. Short term changes to the shoreline can be seasonal. In winter, large swells in the north Pacific affect northern and western exposed shorelines. In summer, swells in the southern hemisphere affect exposed southern and western shorelines. Winter storms, hurricane winds, and Kona storms also cause shoreline erosion, as can extended periods of high trade wind waves from the east to northeast.[75]

According to data from the Hawai'i Shoreline Study, many sections of shoreline within the county experience negative average annual erosion hazard rates. Further, sea level rise associated with climate change may increase the likelihood that a shoreline experiences long-term erosion. Within Maui County, certain community planning areas are more likely to experience coastal erosion than others. The table below presents coastal erosion probabilities for each community planning area.

Table 18. Coastal Erosion Probabilities for Maui County Community Planning Areas.

Community Planning Area	Coastal Erosion Probability
Hāna	Likely (10% to 90% annual chance)
Kīhei-Mākena	Highly Likely (greater than 90% annual chance)
Lāna'i	Likely (10% to 90% annual chance)
Makawao-Pukalani-Kula	Unlikely (less than 1% annual chance)
Moloka'i	Likely (10% to 90% annual chance)

[73] Hyper-localized stretches of beach (e.g., at 20-meter intervals) within the county may have a higher annual erosion hazard rate, as shown by Hawai'i Shoreline Erosion Studies Maps, accessed at http://www.soest.Hawai'i.edu/coasts/erosion/maui/.

[74] Romine et al (2013). Are beach erosion rates and sea-level rise related in Hawai'i?. Journal of Global and Planetary Change. pp. 108, 149-157. Retrieved from http://lumahai.soest.Hawai'i.edu/coasts/publications/Romine%20et%20al%202013%20Beach%20Erosion%20and%20SLR%20in%20HI.pdf.

[75] Romine et al (2013).

Community Planning Area	Coastal Erosion Probability
Pāʻia-Haʻikū	Highly Likely (greater than 90% annual chance)
Wailuku-Kahului	Highly Likely (greater than 90% annual chance)
West Maui	Highly Likely (greater than 90% annual chance)

Based on historic data and information regarding future conditions, a probability of "highly likely" (greater than 90% annual probability) was assigned to the coastal erosion hazard for Maui County.

Vulnerability

All current and future buildings, infrastructure, and populations in current and future coastal erosion hazard areas are considered at risk to coastal erosion. Specific impacts to buildings, infrastructure, socially vulnerable populations, life safety, public heath, and the economy from coastal erosion are described below. Climate-related impacts to coastal erosion are also described.

Building and Infrastructure Impacts (including Critical Facilities)
All current and future buildings and infrastructure, including critical facilities, located within coastal erosion hazard areas are considered at risk to coastal erosion. Erosion can undermine buildings and infrastructure, such as water treatment facilities and roads, causing structure failure and/or flooding. PacIOOS has performed a study to model and map coastal erosion exposure zones in Hawaiʻi using historic shoreline change data and sea level rise projections.[76] The study identifies coastal erosion hazard areas for sea level rise scenarios estimated for the years 2030, 2050, 2075, and 2100.[77] The islands of Lānaʻi and Molokaʻi were not included in the coastal erosion study. GIS analysis was used to determine buildings and infrastructure within coastal erosion hazard zones, using PacIOOS exposure data, building footprints, critical facilities data, and parcel data from county tax assessor records.

For buildings, the determination of assessed value at-risk (exposure) was calculated by summing the total assessed building values for building footprints that were confirmed to be located within or partially within an identified coastal erosion hazard area. The number of parcels, building footprints, and their associated value are presented by community planning district in Table 19. This is an approximate analysis for planning purposes. This analysis does not account for building elevations, seawalls, or backshore armoring.

[76] Sea level rise projections used in the PacIOOS study utilize representative concentration pathway (RCP) 8.5. Representative concentration pathways represent different radiative forcing scenarios through the year 2100. These scenarios are tied to concentrations of greenhouse gases in the atmosphere, which are the drivers of climate change. RCP8.5 represents a scenario in which greenhouse gas emissions continue to rise sharply through 2050 and stabilize around 2100.
[77] Scenarios are based on estimates that present some level of uncertainty. Current trends show the impacts associated with these scenarios may occur earlier than presented.

Table 19. Potentially At-Risk Parcels, Buildings, and Improvement Value in Coastal Erosion Hazard Areas.

SLR Scenario	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Caroline - Hāna								
2030	0	0%	0	0%	$0	$0	$0	0%
2050	0	0%	0	0%	$0	$0	$0	0%
2075	0	0%	0	0%	$0	$0	$0	0%
2100	0	0%	0	0%	$0	$0	$0	0%
Kīhei-Mākena								
2030	2,253	12.4%	99	1.1%	$665,208,761	$332,604,381	$997,813,142	5.9%
2050	2,836	15.6%	142	1.6%	$776,974,779	$388,487,390	$1,165,462,171	6.9%
2075	3,102	17.0%	219	2.5%	$1,126,910,530	$563,455,265	$1,690,365,796	10.0%
2100	3,980	21.9%	291	3.4%	$1,360,009,189	$680,004,595	$2,040,013,790	12.0%
Lānaʻi								
n/a								
Makawao-Pukalani-Kula								
2030	0	0%	0	0%	$0	$0	$0	0%
2050	0	0%	0	0%	$0	$0	$0	0%
2075	0	0%	0	0%	$0	$0	$0	0%
2100	0	0%	0	0%	$0	$0	$0	0%
Molokaʻi								
n/a								
Pāʻia-Haʻikū								
2030	45	0.9%	17	0.2%	$5,829,013	$2,914,507	$8,743,520	0.4%
2050	50	1.0%	31	0.4%	$15,866,700	$7,933,350	$23,800,050	1.2%
2075	58	1.1%	43	0.6%	$17,610,554	$8,805,275	$26,415,829	1.3%
2100	65	1.2%	58	0.8%	$21,665,696	$10,832,844	$32,498,540	1.6%
Wailuku-Kahului								
2030	487	2.7%	41	0.2%	$39,090,938	$19,545,467	$58,636,405	0.7%
2050	494	2.8%	57	0.3%	$62,175,715	$31,087,855	$93,263,570	1.1%
2075	519	2.9%	84	0.5%	$77,927,918	$38,963,957	$116,891,875	1.3%
2100	538	3.0%	102	0.6%	$88,289,997	$44,144,999	$132,434,996	1.5%
West Maui								
2030	7309	40.4%	178	2.8%	$1,993,275,533	$996,637,767	$2,989,913,299	15.5%
2050	7392	40.8%	230	3.6%	$2,246,250,058	$1,123,125,030	$3,369,375,088	17.4%
2075	7734	42.7%	321	5.0%	$2,549,622,711	$1,274,811,357	$3,824,434,068	19.8%

SLR Scenario	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
2100	7945	43.9%	443	6.9%	$2,960,894,750	$1,480,447,377	$4,441,342,127	23.0%
MAUI COUNTY TOTAL								
2030	**10,094**	**13%**	**335**	**1%**	**$2,703,404,245**	**$1,351,702,121**	**$4,055,106,366**	**8%**
2050	**10,772**	**14%**	**460**	**1%**	**$3,101,267,252**	**$1,550,633,626**	**$4,651,900,878**	**9%**
2075	**11,413**	**14%**	**667**	**1%**	**$3,772,071,713**	**$1,886,035,857**	**$5,658,107,570**	**11%**
2100	**12,528**	**16%**	**894**	**2%**	**$4,430,859,632**	**$2,215,429,816**	**$6,646,289,448**	**12%**

The data in the table above indicates that several community planning areas have greater vulnerability to coastal erosion in terms of building exposure. West Maui has the greatest amount of exposure, with approximately 7% of all buildings, which compromise 23% of total estimated building value, located in the hazard area associated with the year 2100. It should be noted that it is expected that the percentage of total building value at-risk to coastal erosion is higher than the percentage of total buildings, as some of the most expensive buildings in the planning area (e.g., resorts, condominium buildings) are located along the beachfront. The Kīhei-Mākena community planning area also has a relatively high proportion of buildings in projected hazard areas, with 3.4% of all buildings and 23% of all building value estimated to be at-risk to coastal erosion in the year 2100. It should be noted that value refers to improvement value, which is not synonymous with insured or replacement value. The figures below show building exposure within coastal erosion hazard areas by community planning area, as applicable.

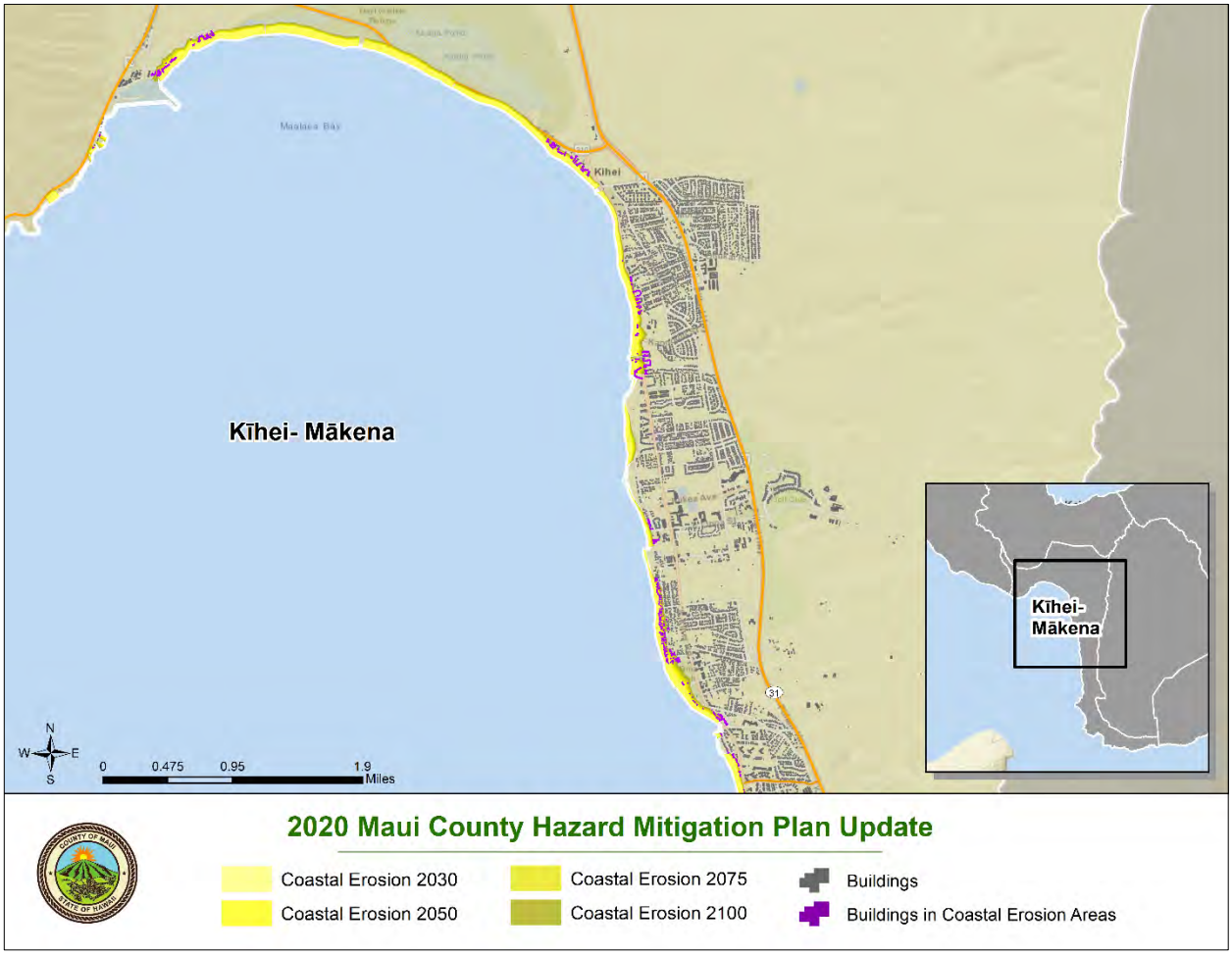


Figure 37. Buildings in Coastal Erosion Areas in the Northern Kīhei-Mākena Community Planning Area.

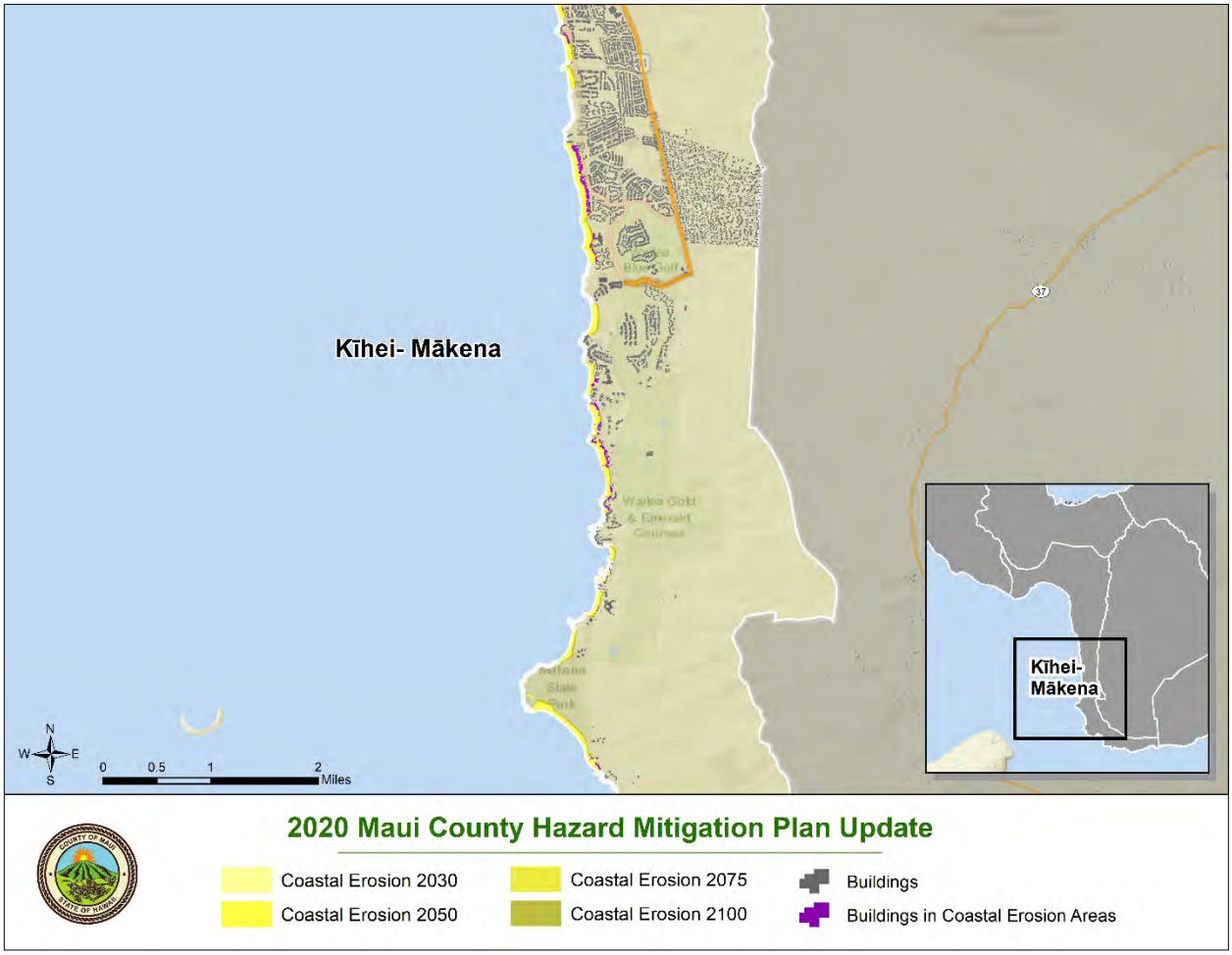


Figure 38. Buildings in Coastal Erosion Areas in the Southern Kīhei-Mākena Community Planning Area.

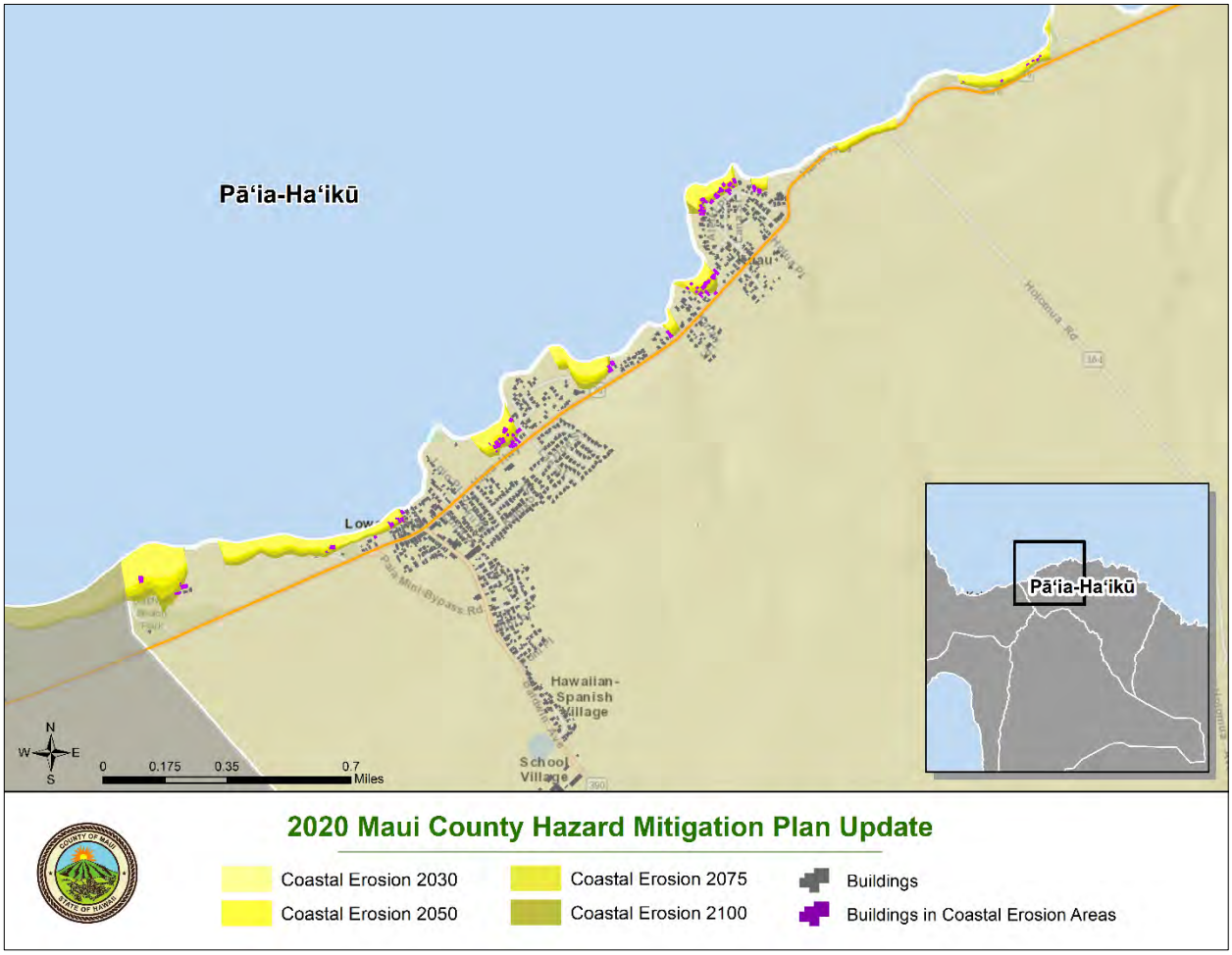


Figure 39. Buildings in Coastal Erosion Areas in the Pāʻia-Haʻikū Community Planning Area.

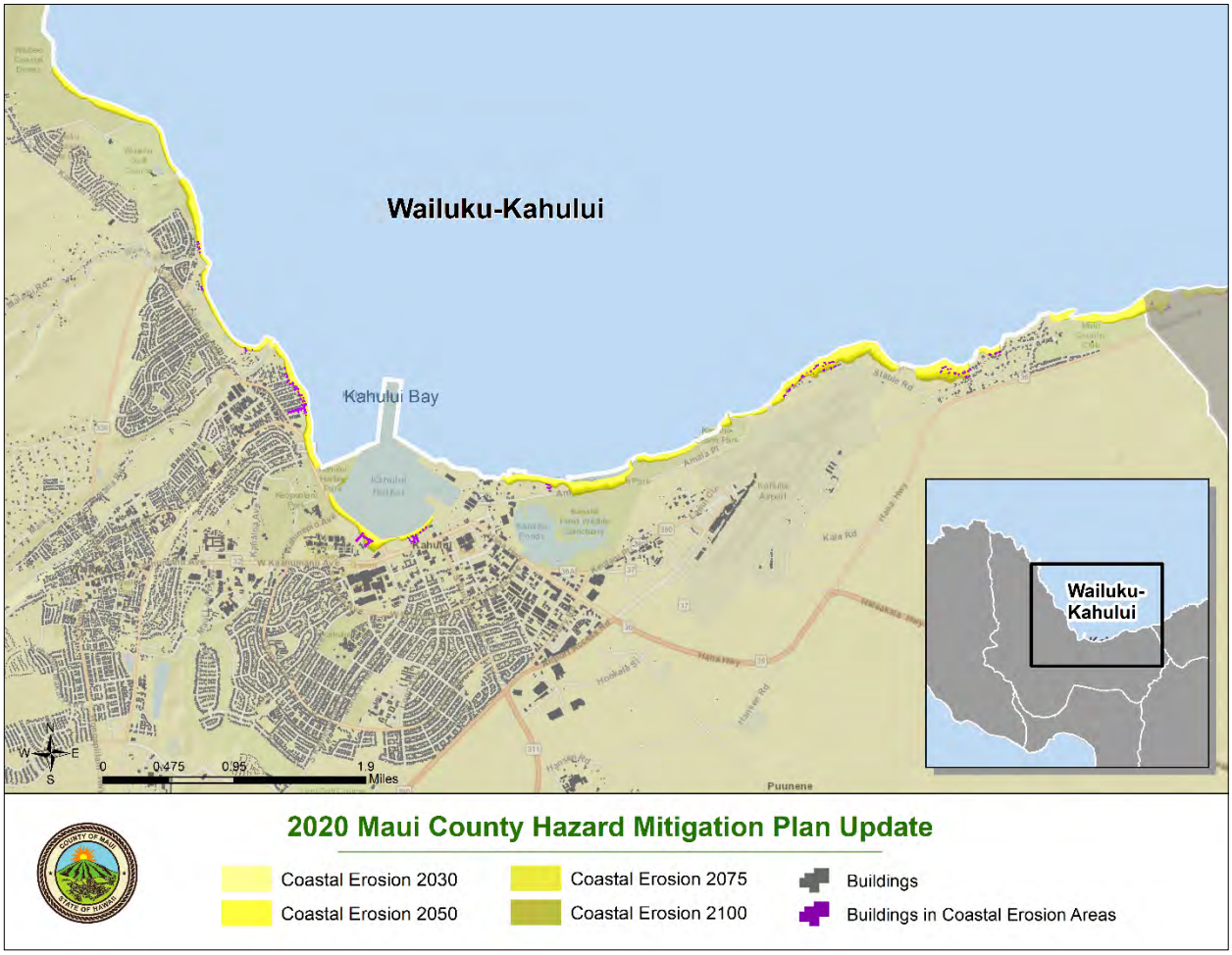


Figure 40. Buildings in Coastal Erosion Areas in the Wailuku-Kahului Community Planning Area.

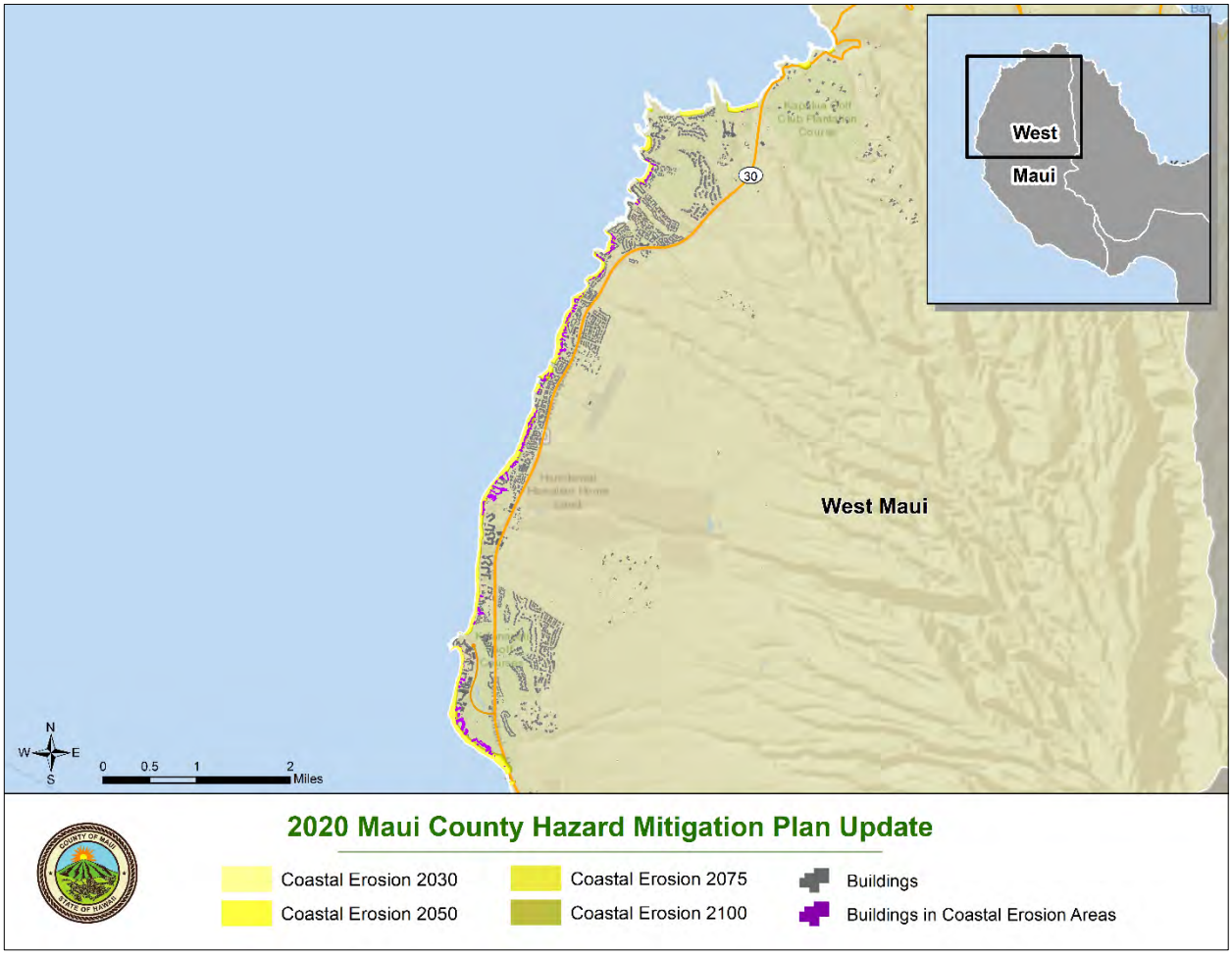


Figure 41. Buildings in Coastal Erosion Areas in the Northern West Maui Community Planning Area.

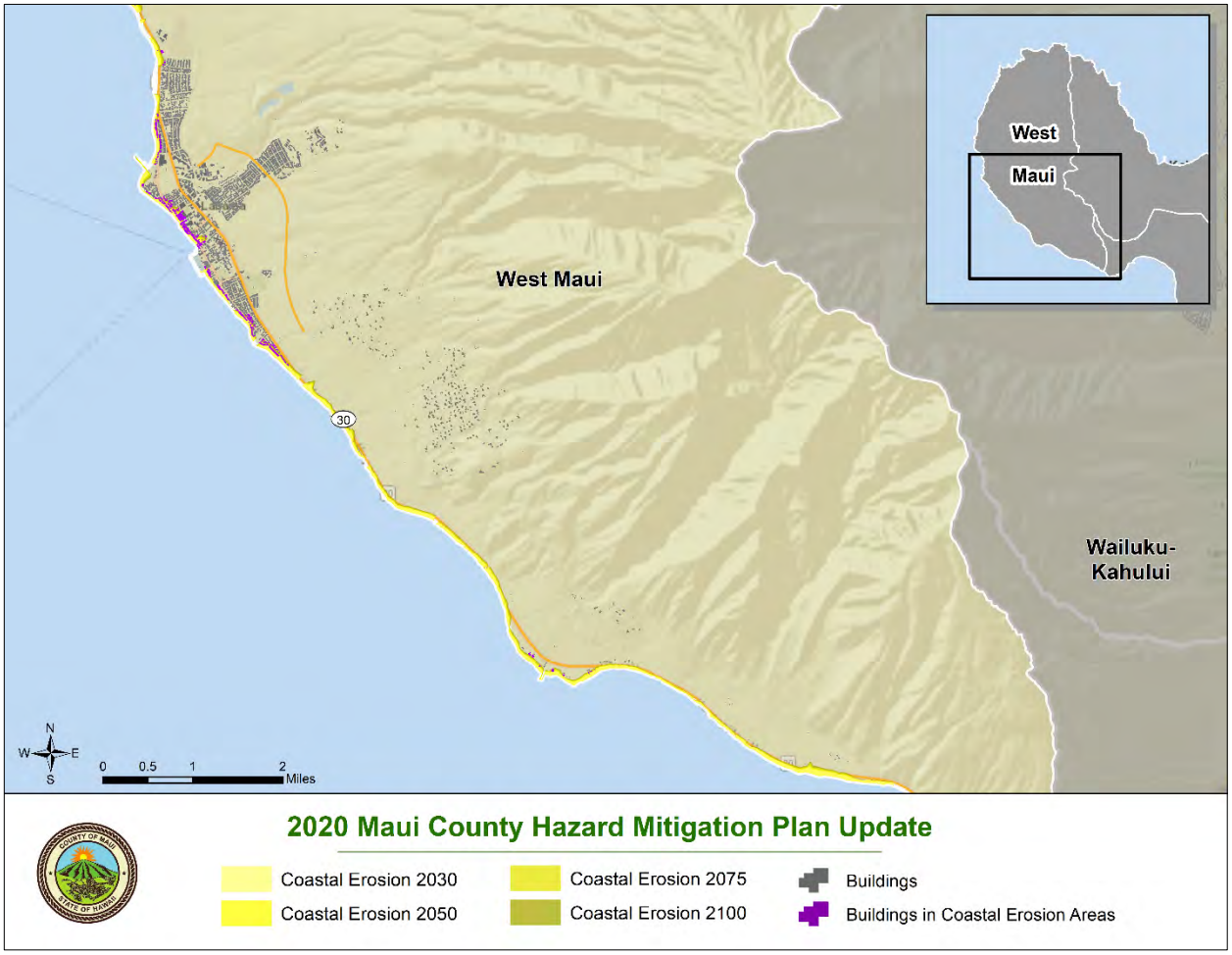


Figure 42. Buildings in Coastal Erosion Areas in the Southern West Maui Community Planning Area.

GIS analysis was used to determine number of critical facilities within coastal erosion hazard areas. Overall, there are seven critical facilities (approximately 6%) within coastal erosion hazard areas in Maui County, including:

- One emergency service critical facility in the Kīhei-Mākena Community Planning Area
- One water, waste, and wastewater system facility in the Wailuku-Kahului Community Planning Area
- Two emergency services critical facilities and three water, waste, and wastewater system facilities in the West Maui Community Planning Area

These critical facilities are shown in the figures below.

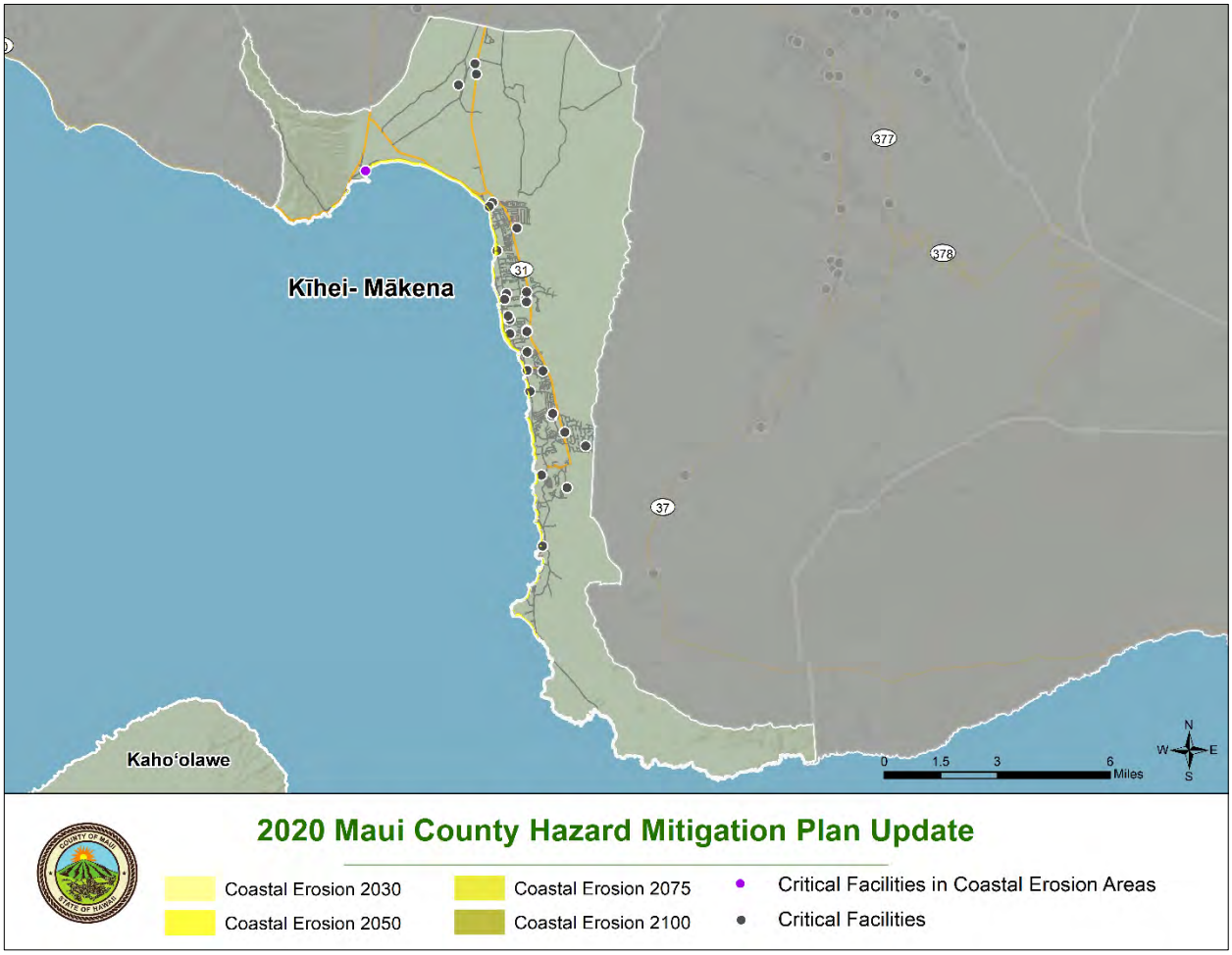


Figure 43. Critical Facilities in Coastal Erosion Areas in the Kīhei-Mākena Community Planning Area.

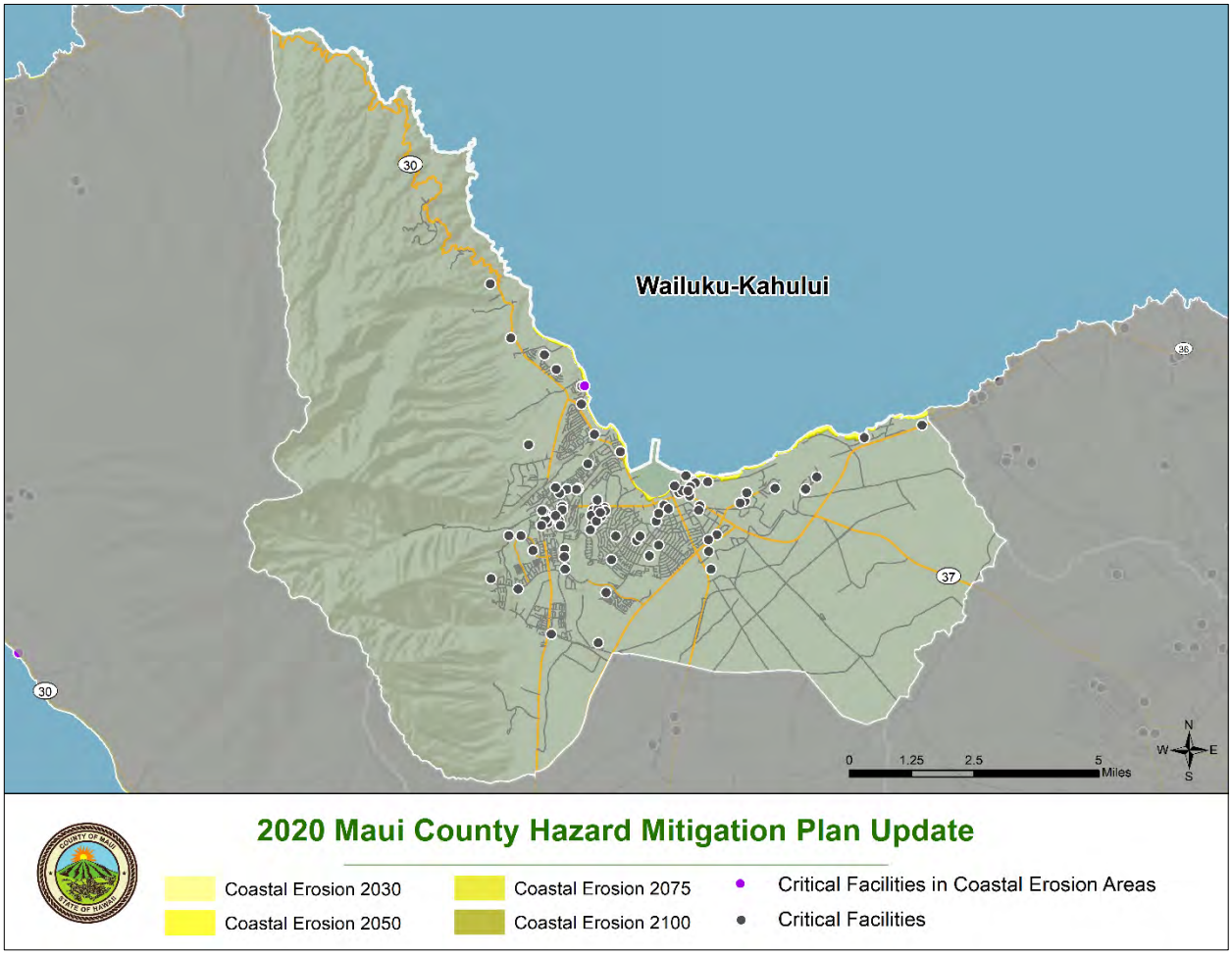


Figure 44. Critical Facilities in Coastal Erosion Areas in the Wailuku-Kahului Community Planning Area.

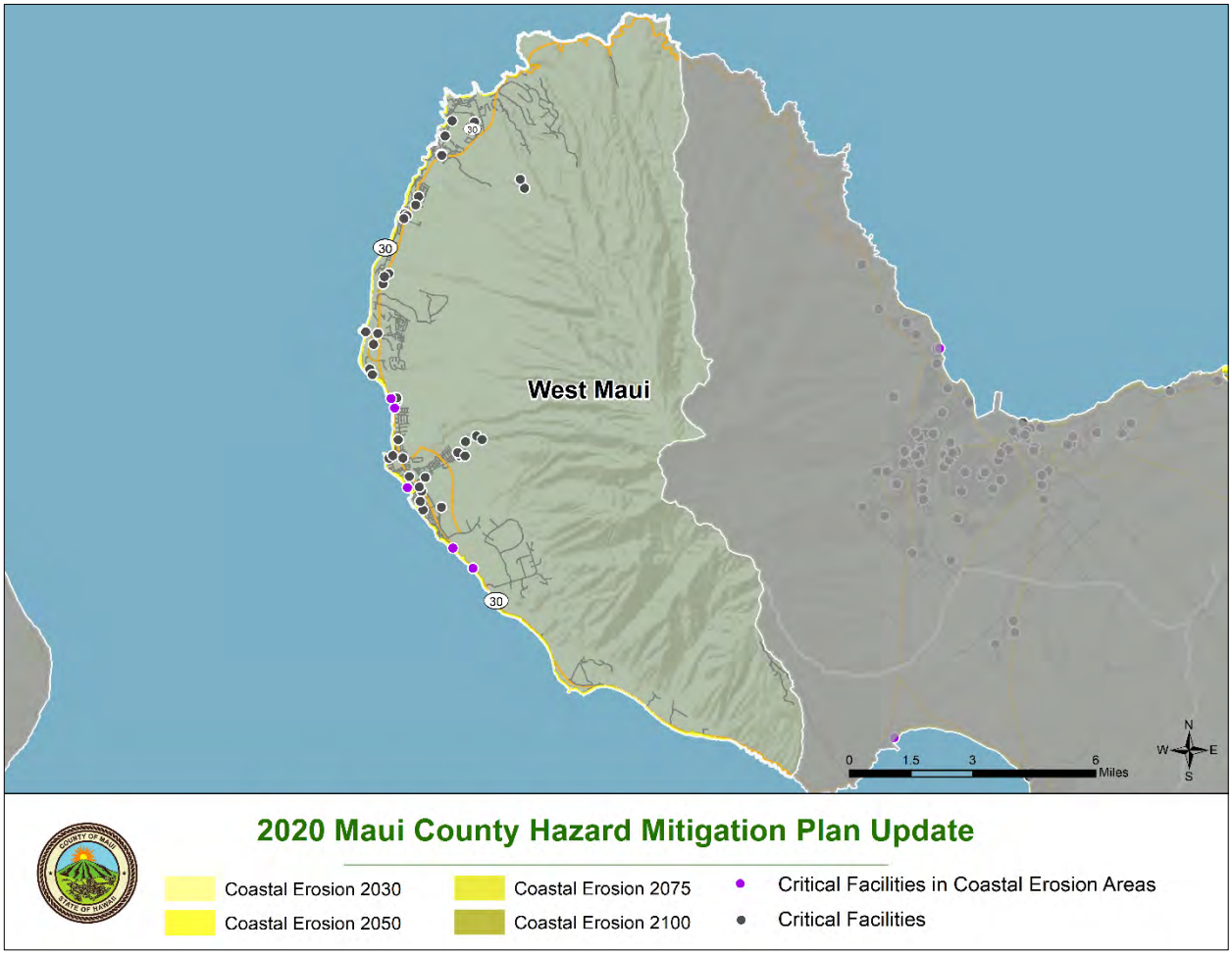


Figure 45. Critical Facilities in Coastal Erosion Areas in the West Maui Community Planning Area.

In addition to buildings and identified critical facilities, utility lines, roads, and bridges are vulnerable to coastal erosion. Erosion can undermine roads, scour bridges, and expose underground utilities. Severe erosion may destabilize and/or damage infrastructure. When utility lines are damaged by erosion, functionality of water, sewer, gas, and electricity systems may be compromised. Because of their geographic extent, roads and utility lines can have a greater chance of being impacted by coastal erosion events and are difficult to move out of hazard areas. Further, if any section of a road or utility line is damaged, the entire system may be impacted. For instance, coastal erosion that results in one area of a road or a bridge being impassible may block accessibility to other roads or locations.

There are three bridges from the NBI that are in coastal erosion areas, all of which are in the West Maui Community Planning Area. These bridges are shown in the figure below.

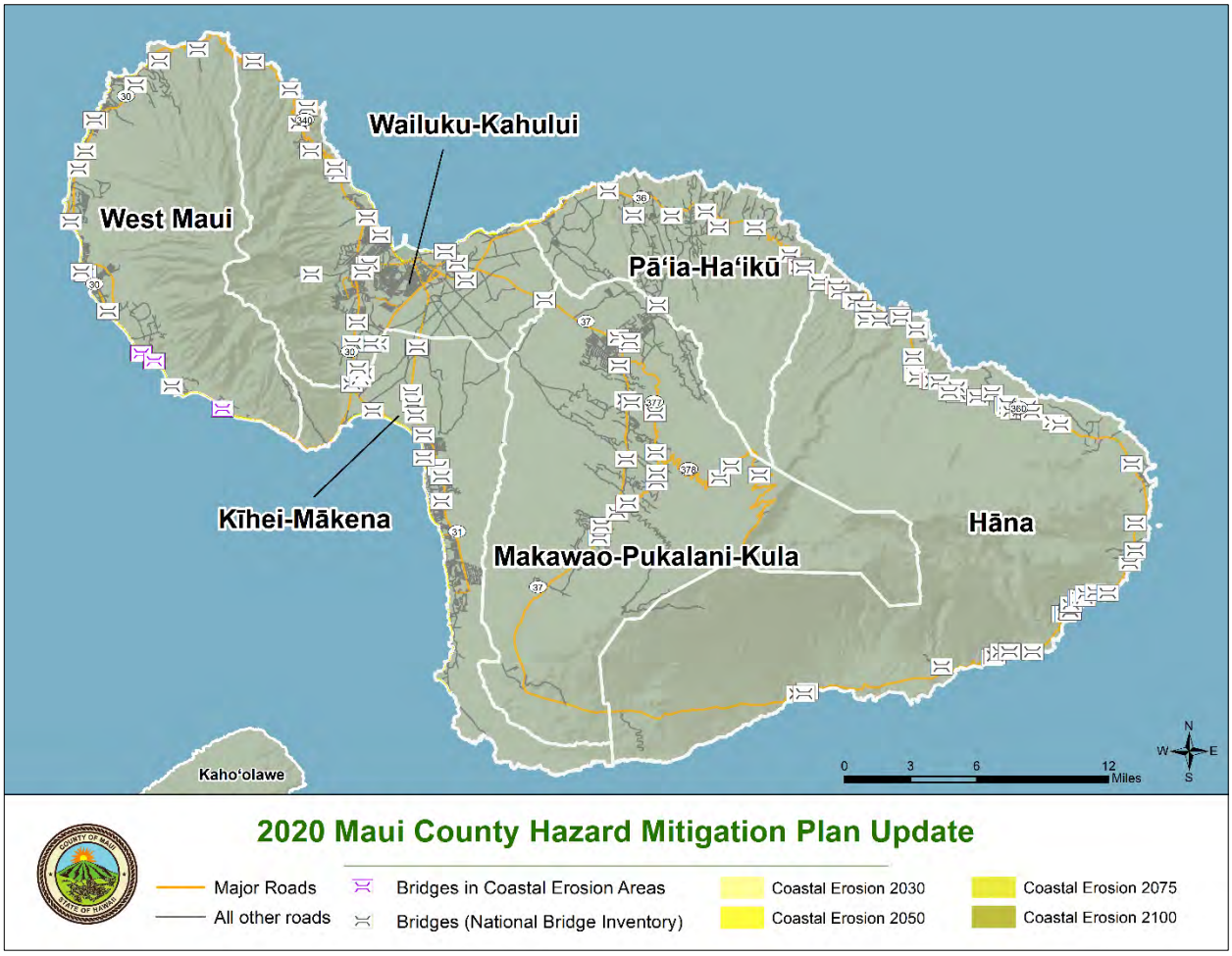


Figure 46. Bridges in Coastal Erosion Areas on Maui Island.

Several major roads in Maui County are within coastal erosion hazards areas, as many of Maui's highway hug the shoreline. For instance, in the West Maui community planning area, Honoapiilani Highway is within coastal erosion hazard areas south of Lahaina. Similarly, sections of Lower Honoapiilani Road, which is county-owned, are within coastal erosion areas near Kahana. Portions of Kahului Beach Road in the Wailuku-Kahului community planning area, as well as sections of North and South Kīhei Road in the Kīhei-Mākena community planning are also in coastal erosion areas.

Life Safety, Health, Warning, and Evacuation Impacts

All populations and/or future populations within coastal erosion hazard areas are considered at risk to coastal erosion. Eroded beaches and dunes may result in structures, and the people inside of them,

being susceptible to coastal flooding and storm surges. As coastal erosion causes shoreline retreat over time, the risk of coastal flooding may impact buildings previously believed to be not at-risk. While coastal erosion itself is unlikely to result is warning and evacuation orders, the impact of it exposing an increasing number of people to coastal flooding may result in households farther and farther inland from the current shoreline being required to evacuate during hurricanes and coastal storm events.

Public Health Impacts

Coastal erosion can lead to coastal flooding, which can have many negative impacts on public health. These impacts are similar to the public health issues associated with flooding (see this section's equivalent under the *Flood* hazard profile). In particular, having water and wastewater treatment facilities within coastal erosion hazard areas results in vulnerability to sewage spills and water contamination.

Impacts to Vulnerable Populations

While all populations within coastal erosion hazard areas are considered at risk to coastal erosion, those living along shorelines within the West Maui, Kīhei-Mākena, and Wailuku-Kahului Community Planning Areas are particularly susceptible to coastal erosion impacts based on available hazard information. Wailuku-Kahului has the second highest overall Vulnerability Index score within Maui County. West Maui has the third highest overall vulnerability, and Kīhei-Mākena is ranked sixth. Populations exhibiting constraints related to household composition, socioeconomic status, and housing characteristics may be most susceptible to negative consequences as a result of coastal erosion. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are described below.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty with mobilizing and evacuating in a timely fashion. Further, the deaf or hard of hearing may not hear audible hazard alerts. While time-critical evacuation for coastal erosion is unlikely, it may be required as a result of other hazards impacting areas of severe coastal erosion, such as coastal flooding, high surf or storm surge. Once evacuated, vulnerable populations will require additional services and care considerations in the response aftermath and during recovery. Special accommodations for these populations must be considered in disaster planning processes.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population

and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a natural disaster. Those living within areas prone to coastal erosion could potentially face the permanent loss of their homes and property. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would support recovery actions such as repairing of homes after a disaster, or fund mitigation actions that would protect their homes and property from the impacts of coastal erosion.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon urgent hazard warning information. Additionally, those who do not speak English well, may not comprehend hazard warning information to the extent that enables them to make timely decisions and take life-saving actions.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living in housing built before 1950 and prior to the enactment of modern building codes and setback regulations are more susceptible to structural damages and even permanent losses to homes and property as a result of coastal erosion. Higher

density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences due to coastal erosion, resulting in displacement of numerous individuals and families.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%. Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges during an evacuation, and have difficulty accessing needed supplies and services before, during and after a hazard event. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Molokaʻi households also do not have access to a vehicle.

Economic Impacts

Loss of sandy beaches due to coastal erosion can negatively impact tourism, as visitors tend to avoid shrinking, narrow beaches due to crowding. Further, coastal erosion may cause beachfront property values to decline as the beach is lost and the building itself becomes at risk to flooding or structural damage. Declining property values may impact the county's tax base. Additionally, the county may need to allocate increasing amounts of funding toward beach renourishment or hardening structures to protect beaches, roads, and structures as the shoreline retreats inward.

Climate Change Impacts

As demonstrated throughout the hazard profile, sea level rise attributed to climate change is expected to increase the frequency and intensity of coastal erosion. Studies estimate that sea level rise will increase coastal erosion by two orders of magnitude. Figures shown in the *Building and Infrastructure Impacts* subsection of this profile show how areas at-risk to coastal erosion will increase with rising sea level over time.

In addition, warmer oceans resulting from climate change are contributing to increased coral bleaching episodes, and ocean acidification is expected to further reduce coral growth and health.[78] As coral reefs provide valuable offshore protection against wave and storm action, coastal erosion is expected to increase in places where coral reefs experience further degradation.

Dam and Reservoir Failure

Description

A dam is an artificial barrier constructed across a stream channel or a man-made basin for the purpose of storing, controlling or diverting water. Dams typically are constructed of earth, rock, concrete or mine tailings. The area directly behind the dam where water is impounded or stored is referred to as a reservoir.

A dam failure is the partial or total collapse, breach or other failure of a dam that causes flooding downstream. Dam failures can result from natural events such as a flood event, earthquakes or landslides, human-induced events such as improper maintenance, or a combination of both. In the event of a dam failure, the people, property and infrastructure downstream could be subject to devastating damage.

Dam failures can result from one or more of the following:

- Prolonged periods of rainfall and flooding (the cause of most failures);
- Inadequate spillway capacity resulting in excess flow overtopping the dam;
- Internal erosion caused by embankment or foundation leakage;
- Improper maintenance (including failure to remove trees, repair internal seepage problems, maintain gates, valves and other operational components, etc.);
- Improper design (including use of improper construction materials and practices);
- Negligent operation (including failure to remove or open gates or valves during high flow periods);
- Failure of an upstream dam on the same waterway;

[78] U.S. Global Change Research Program. *Hawai'i and the Pacific Islands*. Retrieved from https://www.globalchange.gov/explore/hawai%CA%BBi-pacific-islands.

- Landslides into reservoirs which cause surges that result in overtopping of the dam;
- High winds which can cause significant wave action and result in substantial erosion; and
- Earthquakes which can cause longitudinal cracks at the tops of embankments that can weaken entire structures.

The potential for catastrophic flooding due to dam failures led to passage of the National Dam Safety Act (Public Law 92-367). The National Dam Safety Program requires a periodic engineering analysis of every major dam in the country. The goal of this FEMA-monitored effort is to identify and mitigate the risk of dam failure so as to protect the lives and property of the public.

The U.S. Army Corps of Engineers (USACE) is responsible for safety inspections of some federal and non-federal dams in the United States that meet the size and storage limitations specified in the National Dam Safety Act. The Corps has inventoried dams; surveyed each state and federal agency's capabilities, practices and regulations regarding design, construction, operation and maintenance of the dams; and developed guidelines for inspection and evaluation of dam safety.

The Federal Energy Regulatory Commission (FERC) cooperates with a large number of federal and state agencies to ensure and promote dam safety. More than 3,000 dams are part of regulated hydroelectric projects in the FERC program. Two-thirds of these are more than 50 years old. As dams age, concern about their safety and integrity grows, so oversight and regular inspection are important. FERC inspects hydroelectric projects on an unscheduled basis to investigate the following:

- Potential dam safety problems
- Complaints about constructing and operating a project
- Safety concerns related to natural disasters
- Issues concerning compliance with the terms and conditions of a license.

In Hawai'i, over 80% of dams and reservoirs were built before 1940 to support sugarcane plantations.[79] Today, in addition to agriculture, dams and reservoirs within the state provide storage for drinking water, flood control, hydropower, and recreation. The Hawai'i Dam Safety Program was created in 1987 by the state legislature and was followed up in 1989 with the Hawai'i Administrative Rules, which were set up by the Hawai'i Department of Land and Natural Resources (DLNR). Only dams of a certain size criteria (height and volume) are regulated by the State's Dam and Reservoir Safety Program. Regulated dams are identified as having artificial barriers which are 25 feet or more in height or have an impounding capacity of 50 acre-feet (approximately 17 million gallons) or more.[80]

[79] Hawai'i DLNR. Dam Safety. Retrieved from https://dlnreng.Hawai'i.gov/dam/.
[80] 2018 State of Hawai'i Hazard Mitigation Plan, Section 4.4.1.

The State of Hawai'i's 2010 Dam Safety Act (HAR, Title 13, Subtitle 7, Chapter 190.1) is administered by the DLNR, which reviews and approves plans and specifications for the construction of new or modified dams. Any individual or entity seeking to construct, alter, repair or remove an existing dam must fill out the DLNR's *Application for Approval of Plans and Specifications for Construction, Enlargement, Repair, Alteration, or Removal of Dam.*

Location

Maui County contains many streams that have been dammed for either flood control or water storage. In total, Maui County has 57 dams and reservoirs. The number of dams in each community planning area include:

- Hāna – 0
- Kīhei-Mākena – 4
- Lānaʻi – 0
- Makawao-Pukalani-Kula – 8
- Molokaʻi – 1
- Pāʻia-Haʻikū - 17
- Wailuku-Kahului – 12
- West Maui - 15

The USACE National Inventory of Dams ranks dams by the hazard they present to the surrounding community. Hazard rankings are not reflective of the potential for a dam to fail, but instead represent the potential impact if a dam was to fail. Dams assigned the high hazard potential classification are those where failure or mis-operation will probably cause loss of human life. Significant hazard potential are those dams where failure or mis-operation results in no probable loss of human life but can cause economic loss. Dams assigned the low hazard potential classification are those where failure or mis-operation results in no probable loss of human life and low economic and environmental losses.[81] Of the 57 dams in Maui County, 54 are ranked as high hazard, 2 are ranked as significant, and 1 is ranked as low hazard. Dams and their hazard rank within Maui County are presented in Table 20**.** Figure 47 shows the location of these dams on the Island of Maui, and Figure 48 shows the location of the dam on the Island of Molokaʻi.

[81] USACE (2016). *National Inventory of Dams*. Retrieved from https://www.publications.usace.army.mil/Portals/76/Publications/EngineerPamphlets/EP_360-1-23.pdf.

Table 20. Maui County Dams and Hazard Class.

Dam Name	Dam ID	Hazard Class
Kīhei-Mākena		
HC&S RESERVOIR 81	HI00086	High
HC&S RESERVOIR 82	HI00087	Significant
HC&S RESERVOIR 90	HI00089	High
HC&S RESERVOIR 92	HI00090	High
Makawao-Pukalani-Kula		
OLINDA RESERVOIR	HI00048	High
HC&S RESERVOIR 20	HI00070	High
HC&S RESERVOIR 30	HI00075	High
HC&S RESERVOIR 33	HI00076	High
HC&S RESERVOIR 40	HI00077	High
HC&S RESERVOIR 42	HI00078	High
PUU KOA RESERVOIR	HI00133	High
MAUI FIELD 290 RESERVOIR	HI00139	High
Molokaʻi		
KUALAPUU RESERVOIR	HI00041	High
Pāʻia-Haʻikū		
WAIKAMOI DAM NO. 2	HI00046	Low
PIIHOLO 50 MG RESERVOIR	HI00047	High
HC&S RESERVOIR 14	HI00068	High
HC&S RESERVOIR 15	HI00069	High
HC&S RESERVOIR 21	HI00071	High
HC&S RESERVOIR 22	HI00072	High
HC&S RESERVOIR 24	HI00073	High
HC&S RESERVOIR 25	HI00074	High
PEAHI RESERVOIR	HI00091	High
PAPAAEA RESERVOIR	HI00092	High
KAUPAKALUA RESERVOIR	HI00093	High
KAPALAALAEA RESERVOIR	HI00094	High
HAʻIKŪ RESERVOIR	HI00095	High
PAUWELA RESERVOIR	HI00096	High
KAHAKAPAO RESERVOIRS	HI00138	High
KAILI ILI RESERVOIR	HI00143	High
WAIKAMOI RESERVOIRS	HI00152	Significant
Wailuku-Kahului		
HC&S RESERVOIR 52	HI00079	High
HC&S RESERVOIR 60	HI00080	High
HC&S RESERVOIR 61	HI00081	High
HC&S RESERVOIR 70	HI00082	High
HC&S RESERVOIR 73	HI00083	High

Dam Name	Dam ID	Hazard Class
HC&S RESERVOIR 74	HI00084	High
HC&S RESERVOIR 80	HI00085	High
HC&S RESERVOIR 84	HI00088	High
HAPPY VALLEY FLOOD PREVENTION	HI00125	High
KEHALANI OFFSITE RETENTION BASIN	HI00141	High
WAILUKU WATER RESERVOIR 6	HI00150	High
WAILUKU WATER RESERVOIR 10	HI00151	High
West Maui		
HORNER RESERVOIR	HI00054	High
HĀNAKAOO RESERVOIR	HI00056	High
KAHOMA RESERVOIR	HI00057	High
HONOKOWAI RESERVOIR	HI00058	High
RESERVOIR 140	HI00059	High
KAHANA NUI DAM	HI00126	High
NAPILI 4-5 DESILTING BASIN	HI00127	High
NAPILI 2-3 DESILTING BASIN	HI00128	High
HONOKOWAI - STRUCTURE #8	HI00130	High
UPPER FIELD 14 RESERVOIR	HI00132	High
KAOPALA BASIN	HI00134	High
UKUMEHAME RESERVOIRS	HI00140	High
MIDDLE FIELD 14 RESERVOIR	HI00142	High
MAHINAHINA RESERVOIR	HI00144	High
PLANTATION RESERVOIR	HI00153	High

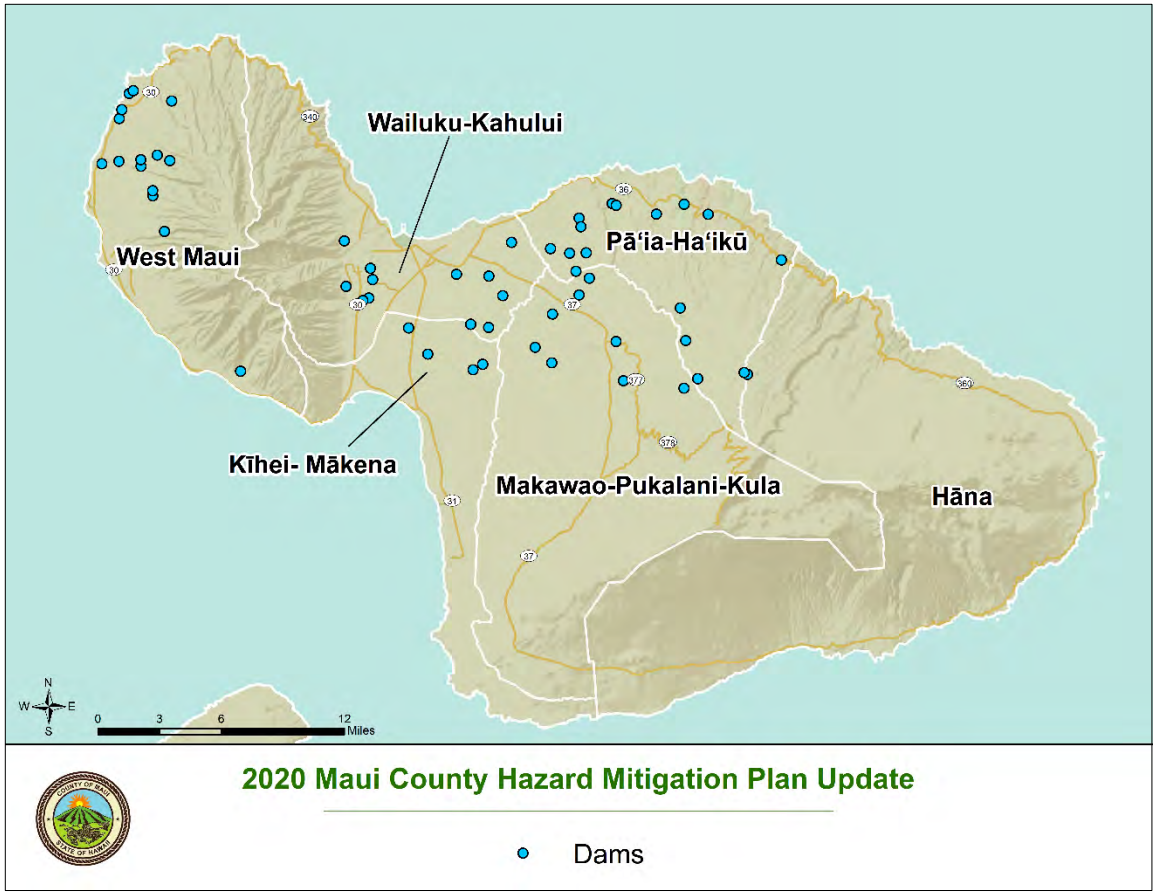


Figure 47. Dam and Reservoir locations on Maui Island.

Figure 48. Dam and Reservoir locations on Moloka'i Island.

Previous Occurrences

There has been one recorded historic dam failure incident in Maui County. Horner Reservoir, located in the West Maui community planning area, failed on November 13, 1994. No information was available regarding the impacts of this event.

Extent

The extent of dam failure is difficult to determine given minimal historic incidents and limited details associated with the historic events. The ranking provided by the National Inventory of Dams can be used as an indicator for the potential severity of dam failure. In Maui County, all but three dams are ranked as high hazard, meaning a failure would likely result in loss of human life.

Further, potential impacts may be gleaned from failures of similar dams. In 2006, the privately owned Ka Loko Dam on the Island of Kauai failed. This dam had similarities in dam construction, ground topography, and rainfall intensity to dams in Maui County. During the failure event, a 120-foot long portion of the dam breached after an unusually long period of torrential rainfall. Approximately 300 million gallons of water and debris destroyed several homes, devastated a 300-foot long portion of state highway, overturned several utility poles and lines, and killed seven people. An independent civil

investigation identified conditions and practices that could have contributed to the failure: inadequate inspections, non-permitted grading operations, inadequate maintenance, and non-enforcement of regulations. The failure of a dam or reservoir in Maui County could have similar impacts, and more severe impacts than the event described on Kauai are possible.

Probability of Future Events

Given that only one historic event has been reported, the probability assigned to the dam and reservoir failure hazard is unlikely for the entire county (less than 1% annual chance). Further, dams in Maui County are regularly inspected and monitored, further decreasing the probability of a failure event.

Vulnerability

All current and future buildings, infrastructure, and populations in dam inundation areas are considered at risk to dam failure. Specific impacts to buildings, infrastructure, socially vulnerable populations, life safety, public heath, and the economy from coastal erosion are described below. Climate-related impacts to coastal erosion are also described.

Building Impacts (including Critical Facilities)

All buildings, including critical facilities, located in dam inundation areas are at risk to dam failure. In 2009, the DLNR launched a study to generate dam failure inundation maps for all regulated dams in the state. GIS analysis was used to determine buildings and infrastructure within dam inundation areas, using DLNR inundation data (provided by Maui County Emergency Management), building footprints, critical facilities data, and parcel data from county tax assessor records.

For buildings, the determination of assessed value at-risk (exposure) was calculated by summing the total assessed building values for building footprints that were confirmed to be located within or partially within identified dam inundation areas. The number of parcels, building footprints, and their associated value are presented by community planning district in Table 21. This is an approximate analysis for planning purposes.

Table 21. Potentially At-Risk Parcels, Buildings, and Improvement Value in Dam Inundation Areas.

Community Planning Area	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Hāna	7	0%	0	0%	$0	$0	$0	0%
Kīhei-Mākena	39	0%	8	0%	$2,911,828	$1,455,914	$4,367,742	0%
Lānaʻi	0	0%	0	0%	$0	$0	$0	0%
Makawao-Pukalani-Kula	254	3%	139	1%	$23,867,852	$11,933,926	$35,801,778	1%
Molokaʻi	241	4%	95	4%	$24,881,000	$12,440,500	$37,321,500	3%
Pāʻia-Haʻikū	782	15%	500	7%	$122,263,089	$61,131,545	$183,394,634	9%
Wailuku-Kahului	2,404	13%	3,417	20%	$1,812,370,451	$906,185,226	$2,718,555,677	31%
West Maui	5,299	29%	572	9%	$7,012,870,910	$3,506,435,455	$10,519,306,365	54%

Community Planning Area	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Maui County Total	**8,953**	**11%**	**4,731**	**8%**	**$8,999,165,130**	**$4,499,582,565**	**$13,498,747,695**	**25%**

* Parcel total differs slightly from sum of community planning areas as some parcels are within multiple planning areas.
*Where inundation data was not available for GIS analysis, evacuation data was used.

The data in the table above indicates that several community planning areas have greater vulnerability to dam failure in terms of building exposure. Wailuku-Kahului has the greatest amount of exposure, with approximately 20% of all buildings within the planning area, which compromise 31% of total estimated building value, located in dam inundation areas. Further at-risk buildings within Wailuku-Kahului account for 72% of all Maui County buildings within dam inundation areas. Pāʻia-Haʻikū and West Maui also have over 5% of their buildings in dam inundation areas. In West Maui, the 9% of buildings in dam inundation areas account for over half of total building value, indicating that some of the community planning area's most valuable structures are located within dam inundation areas. Overall, there are 4,731 structures within dam inundation areas in Maui County, with an estimated value of almost $13.5 billion.

The figures below show building exposure within dam inundation areas by community planning area, as applicable.

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GIS analysis was used to determine number of critical facilities within dam inundation areas. Overall, there are 42 potentially at-risk critical facilities within Maui County dam inundation.

Table 22. Potentially At-Risk Critical Facilities in Dam Inundation Areas.

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Commercial Facilities	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	**2 (100%)**
Communications Facilities	0	2	0	0	0	N/A	0	N/A	**2 (25%)**
Emergency Services	0	0	0	0	0	0	2	1	**3 (8%)**
Energy	N/A	N/A	N/A	N/A	1	N/A	2	N/A	**3 (60%)**
Food and Agriculture	0	0	N/A	N/A	N/A	N/A	0	N/A	**0 (0%)**
Government Facilities	N/A	N/A	N/A	N/A	0	N/A	1	N/A	**1 (7%)**
Healthcare and Public Health	0	0	0	0	0	0	2	1	**3 (6%)**
Mass care	0	1	0	0	1	0	4	0	**6 (8%)**
Transportation	N/A	N/A	0	N/A	0	N/A	10	1	**11 (41%)**
Water and Wastewater Systems	N/A	0	N/A	0	0	0	6	5	**11 (14%)**
TOTAL	**0 (0%)**	**3 (9%)**	**0 (0%)**	**0 (0%)**	**2 (6%)**	**0 (0%)**	**29 (27%)**	**8 (15%)**	**42 (14%)**

The figures below show critical facilities in Maui County dam inundation areas by community planning area.

REDACTED

In addition to buildings and identified critical facilities, utility lines, roads, and bridges are vulnerable to dam inundation. Flooding from dam inundation can undermine roads, scour bridges, and expose underground utilities. When utility lines are damaged by flooding, functionality of water, sewer, gas, and electricity systems may be compromised. Because of their geographic extent, roads and utility lines can have a greater chance of being impacted by dam failure and are difficult to move out of hazard areas. Further, if any section of a road or utility line is damaged, the entire system may be impacted. For instance, inundation that results in one area of a road or a bridge being impassible may block accessibility to other roads or locations. In addition, dam failure can cause damage to the dams

themselves, which are important infrastructure for water retention and flood control. Dam failure may cause failure of dams located downstream along the same watercourse.

There are two bridges from the NBI that are in dam inundation areas, one the West Maui Community Planning Area and one on Molokaʻi Island. These bridges are shown in the figures below.

REDACTED

Life Safety, Health, Warning, and Evacuation Impacts

All populations within dam inundation areas are considered at-risk to dam failure. This includes populations who reside in inundation areas, as well as populations in the inundation area for work or recreation. Tourists and visitors may be at a higher risk if they are not familiar with the County's evacuation routes and procedures. Dam failure can result in injuries and loss of life. Warning time may range from several hours to just minutes. Threat of dam failure may prompt an evacuation. The State of Hawai'i County Civil Defense Agency generates evacuation maps using information from the inundation analyses performed by Hawai'i DLNR. These maps are used by Maui Emergency Management for evacuation planning.

Public Health Impacts

Dam failure can have many negative impacts on public health, which are similar to the public health issues associated with flooding (see this section's equivalent under the *Flood* hazard profile). In particular, having water and wastewater treatment facilities within dam inundation areas results in vulnerability to sewage spills and water contamination.

Impacts to Vulnerable Populations

While all populations within dam inundation hazard zones are considered at risk, those living downstream from dams and reservoirs classified as "high" or "significant" by the USACE National Inventory of Dams are those where failure or mis-operation will "probably cause loss of human life" or "cause economic loss." The Wailuku-Kahului, West Maui, Makawao-Pukalani-Kula, and Pāʻia-Haʻikū Community Planning Areas are particularly susceptible to dam inundation impacts due to having the greatest number of dams with these classifications. These areas rank second, third, seventh, and eighth, respectively, in terms of overall vulnerability in Maui County. Furthermore, 20% of buildings within the Wailuku-Kahului Planning Area are located within dam inundation areas. Only the Community Planning Areas of Lānaʻi and Hāna have no dams or reservoirs, however a limited number of parcels within the Hāna planning area are potentially exposed to a dam break due to a dam located in the neighboring Pāʻia-Haʻikū planning area.

Populations exhibiting constraints related to household composition, access to information, and access to lifelines may be most susceptible to negative consequences due to dam break inundation as

summarized below. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are also described.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty mobilizing and evacuating in a timely fashion in the event of a dam or reservoir failure, making it essential that these populations familiarize themselves with the emergency response plans for nearby dams and reservoirs. Further, the deaf or hard of hearing may not hear audible hazard alerts. Once evacuated, these populations will require additional services and care considerations in the response aftermath and during recovery. Special accommodations for these populations and all those displaced by dam or reservoir failure must be considered in disaster planning processes.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a natural disaster. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate preparedness actions such as stocking extra food and supplies, support recovery actions such as repairing of homes after a disaster, or fund mitigation actions that would protect their homes and property from future hazard impacts.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon urgent hazard warning information in the event of a dam or reservoir failure. Additionally, those who do not speak English well, may not comprehend hazard warning information to the extent that enables them to make timely decisions and take life-saving actions.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living in housing built before 1950, and prior to the enactment of modern building codes, are more susceptible to damages and losses due to structural damage as a result of hazard impacts. In addition, higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences as a result of hazard exposure.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

A dam or reservoir failure may necessitate rapid evacuation of downstream populations. Those with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges during an

evacuation. These populations may also have difficulty accessing needed supplies and services before, during and after a hazard event. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Moloka‘i households also do not have access to a vehicle.

Economic Impacts

Economic impacts resulting from flooding from dam failure are similar to those from flooding, though generally contained to inundation areas. (see this section's equivalent under the *Flood* hazard profile).

Climate Change Impacts

Climate change can have many indirect impacts on dam failure. The cause of most dam failures is flooding from prolonged periods of rainfall. In Maui County, expected increases in extreme rainfall events can increase the likelihood of dam failure due to increased flooding or inadequate spillway capacity. Further, many dams, including the ones analyzed for this plan, were constructed 80 or more years ago, and were originally designed based on climate conditions effective at the time of construction. Dam upgrades and renewals should consider changing climate conditions; such actions are typically addressed in a dam management plan and are out of the scope of this plan.

Drought

Description

Drought is a normal occurrence in virtually all climatic regions, including areas with high and low average rainfall. Drought is the consequence of a natural reduction in precipitation expected over an extended period, usually lasting a season or more. High temperatures, high winds, and low humidity can exacerbate drought conditions. In addition, human actions and demands for water resources can hasten drought-related impacts.

The National Centers for Environmental Information (NCEI) identifies drought as a "creeping phenomenon that slowly sneaks up and impacts many sectors of the economy, and operates on many different time scales."[82] Thus, the National Drought Mitigation Center has classified droughts into five

[82] National Centers for Environmental Information (2017). "Definition of Drought." *National Oceanic and Atmospheric Administration.* Retrieved from https://www.ncdc.noaa.gov/monitoring-references/dyk/drought-definition.

types: 1) meteorological, 2) hydrologic, 3) agricultural, 4) socioeconomic, or 5) ecological.[83] The definition for each of these drought classifications is shown in the table below:

Table 23. Drought Classification Definitions.

Drought Classification	Description
Meteorological Drought	The degree of dryness or departure of actual precipitation from an expected average or normal amount based on monthly, seasonal, or annual time scales. (Dry weather patterns dominate an area; can begin/end rapidly).
Hydrological Drought	The effects of precipitation shortfalls on stream flows and reservoir, lake, and groundwater levels. (Low water supply is evident; conditions take longer to develop and then recover.
Agricultural Drought	Soil moisture deficiencies relative to water demands of plant life, usually crops. (Crops significantly affected).
Socioeconomic Drought	The effect of demands for water exceeding the supply because of a weather-related supply shortfall.
Ecological Drought	A prolonged and widespread deficit in naturally available water supplies — including changes in natural and managed hydrology — that create multiple stresses across ecosystems

The U.S. Drought Monitor records drought in the U.S. and categorizes drought into five categories as shown in the table below.[84]

Table 24. Drought Monitor Categories.

D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions

[83] The National Drought Mitigation Center, Types of Drought. (2017). Retrieved May 3, 2019, from https://drought.unl.edu/Education/DroughtIn-depth/TypesofDrought.aspx.
[84] The National Drought Mitigation Center, U.S. Drought Monitor Classification Scheme. (n.d.). Retrieved May 3, 2019, from https://droughtmonitor.unl.edu/AboutUSDM/AbouttheData/DroughtClassification.aspx

D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies

Drought should not be viewed as merely a physical phenomenon or natural event. Its impacts on society result from the interplay between a natural event and the demand people place on water supply. Human activities often exacerbate the impact of drought. For example, excessive water use can deplete ground water supply.

Location

A drought is a regional event that is not confined to geographic or political boundaries; it can affect several areas at once. It can also vary in severity across those areas. While leeward facing areas, like Maui's Upcountry are more prone to drought, all areas of Maui County are at risk to drought occurrence.

Previous Occurrences

In order to understand the conditions of past drought, it can be helpful to understand the typical precipitation received each year. According to the Rainfall Atlas of Hawai'i, rainfall rates throughout Maui County are highly variable. Rainfall is highest on windward facing mountain slopes, and most of the county's rainfall is attributed to northeasterly trade winds. For instance, the windward side of Haleakalā in East Maui receives the highest amount of rainfall in Hawai'i, with an average annual rainfall of 404 inches. In contrast, the Kīhei area and parts of eastern Moloka'i receive as little as 10 inches of rainfall per year.[85] **Figure X** shows a map of annual rainfall for Maui County.

[85] University of Hawai'i at Manoa (2011). Rainfall Atlas of Hawai'i Rainfall. Retrieved from http://rainfall.geography.Hawai'i.edu/rainfall.html.

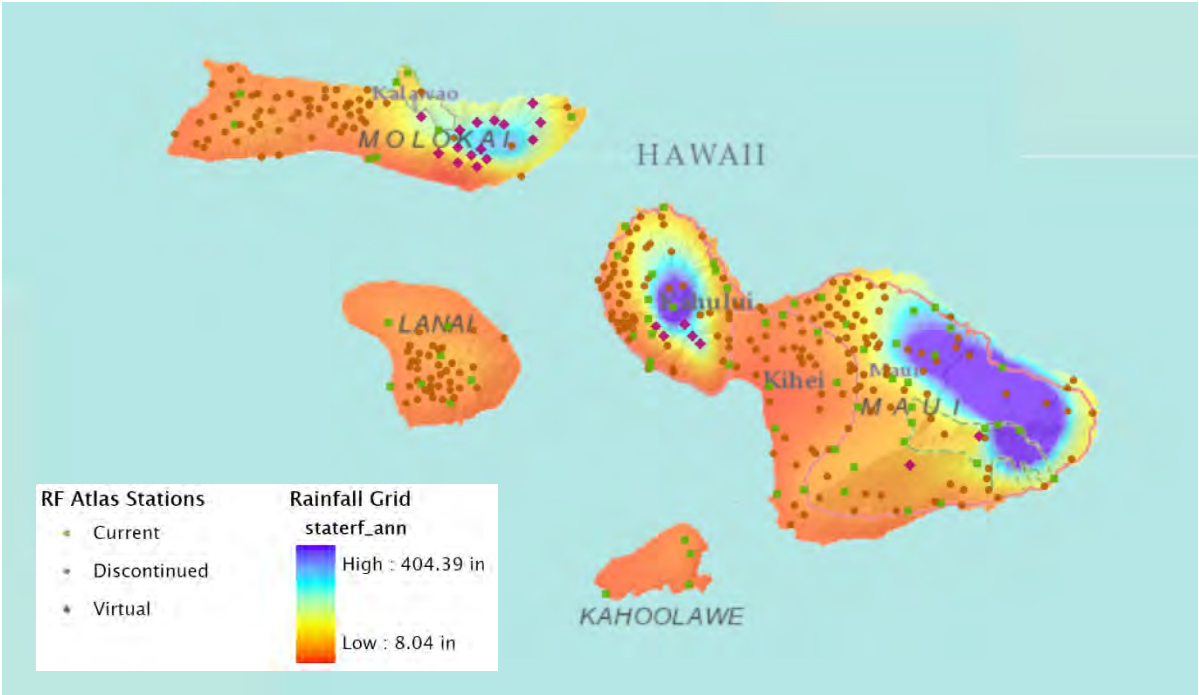

Figure 49. Annual Rainfall for Maui County.

It is also helpful to understand approximately how much rainfall the planning area receives each month. Figure 50 shows rainfall monthly rainfall amounts recorded at Kahului Airport. Note that due to the wide variation of rainfall across the county, other areas may receive significantly more or less rainfall than described in the graph below. As shown, majority of the area's rainfall is received in the winter months, with summer months being the driest.

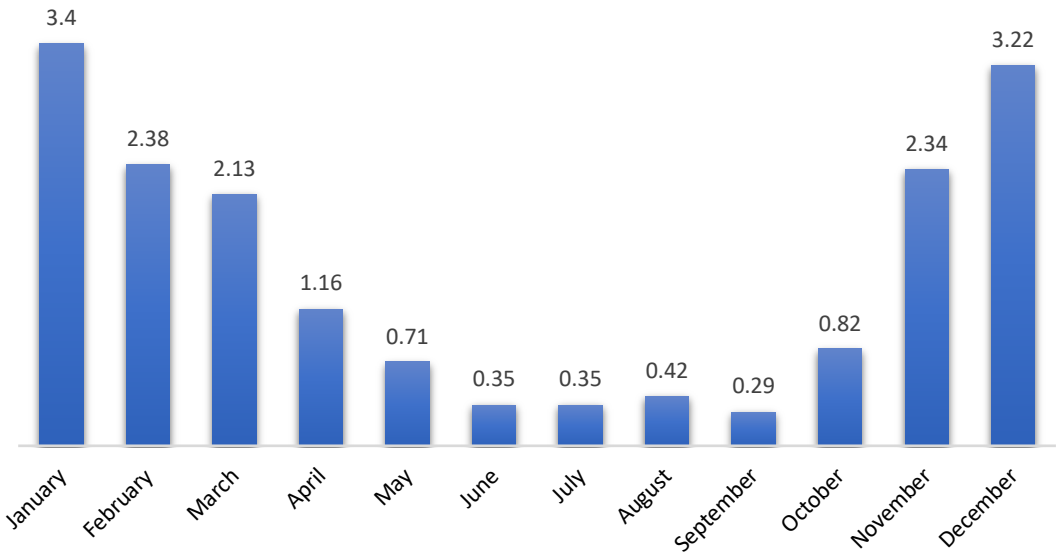

Figure 50. Average Monthly Rainfall at Kahului Airport, Maui.

The U.S. Drought Monitor was used to ascertain historical drought levels for Maui County. The U.S. Drought Monitor reports data on drought conditions from 2000 through 2019. Drought conditions are reported by category as percentages. Therefore, it is possible that more than one drought category was reported in each week. In such cases, the highest drought category reported was used. This information is compiled and presented in the table below.

Table 25. Historic Drought Occurrences in Maui County.

Year	Maui County
2000	**Extreme** (up to 7 weeks)
2001	**Extreme** (up to 17 weeks)
2002	**Severe** (up to 4 weeks)
2003	**Severe** (up to 20 weeks)
2004	**Moderate** (up to 1 week)
2005	**Moderate** (up to 2 weeks)
2006	**Moderate** (8 weeks)
2007	**Severe** (up to 26 weeks)
2008	**Extreme** (up to 20 weeks)
2009	**Extreme** (4 weeks)
2010	**Exceptional** (up to 9 weeks)
2011	**Extreme** (up to 9 weeks)
2012	**Exceptional** (up to 2 weeks)
2013	**Extreme** (52 weeks)
2014	**Extreme** (up to 13 weeks)
2015	**Severe** (up to 11 weeks)

Year	Maui County
2016	**Extreme** (up to 3 weeks)
2017	**Severe** (up to 12 weeks)
2018	**Severe** (up to 5 weeks)
2019	**Exceptional** (up to 5 weeks)

In the study period, years 2010, 2012, and 2019 reported the most intense droughts (weeks within the Exceptional Drought category). However, another notable trend is that some level of drought was present in each of the 20 years studied, indicating a long-term and ongoing drought concern.

The Hawai'i State Drought Plan describes several historic droughts that have occurred since the beginning of the 20th century, including 15 that impacted Maui County, as described below.[86]

1. **1908**: Serious drought
2. **1953**: Rainfall in the islands was 40% less than normal. Maui practiced water rationing, and pineapple production on Moloka‘i was reduced by 30%.
3. **1962**: The state declared a drought disaster for the islands of Hawai'i and Maui. Impacts included crop damage, cattle deaths, and severe fire hazards. Losses totaled $200,000.
4. **1971**: Irrigation and domestic water usage sharply curtailed due to drought on islands of Hawai'i and Maui.
5. **1977-78**: The state declared a drought disaster for the islands of Hawai'i and Maui.
6. **1980-81**: The state declared a drought disaster. Impacts included heavy agricultural and cattle losses. Damages totaled at least $1.4 million.
7. **1996**: The state declared drought emergency. Impacted included heavy damages to agriculture and cattle industries. Losses totaled at least $49.4 million. The islands of Maui and Moloka‘i were impacted by this event.
8. **1998**: The state declared drought emergency for the island for Maui.
9. **2000-2002:** The state declared drought emergency for all counties. East Maui streams reached record low levels. The statewide cattle losses alone projected at $9 million.
10. **2003:** Statewide drought emergency declared.
11. **2006:** Maui County designated a Primary Natural Disaster Area due to drought.
12. **2010:** El Niño drought conditions cause four counties, including Maui County, to be designated as Primary Natural Disaster Areas due to losses caused by drought. All four counties designated as farm disaster areas due to economic losses. The State of Hawai'i had the worst drought conditions in the country for 2010.
13. **2011:** The USDA implemented the Livestock Forage Disaster Program on the islands of Maui, Moloka‘i, and Lāna‘i.
14. **2012:** Primary Natural Disaster Area due to drought was declared for Maui, Kauai, and Hawai'i Counties.

[86] Hawai'i State Drought Plan, Chapter 9 (2017). Section 3.1. Retrieved from http://files.Hawai'i.gov/dlnr/cwrm/planning/HDP2017.pdf.

15. **2013-2014:** Maui and Hawai'i counties designated Drought Disaster Areas.
16. **2016:** Voluntary water reductions were implemented in certain locations on Maui.

During the 2019 drought, Maui County officials declared a Stage 1 water shortage on May 24th. In the month after the declaration, upcountry water levels dropped and additional 16% and water usage by 36%, prompting county officials to ask residents to curb non-essential water usage, and impacting expected crop yields.[87]

Extent

Extent can be defined by the highest drought monitor category: Exceptional Drought. Since the U.S. Drought Monitor began in 2000, there have been 16 weeks where all or part of Maui County experienced Exceptional Drought (in 2010, 2012, and 2019).

Drought severity can also be measured in terms of damages. In Hawai'i, the 2007-2014 drought period caused $44.5 million in losses for the ranching industry alone, and recovery is expected to take 10 to 14 years, at $4 - $6 million per year. It should be noted that more intense, prolonged droughts than those that have occurred in the past are possible.

Probability of Future Events

An exact probability is difficult to quantify given the limited reporting period available from the Drought Monitor (20 years; 2000-2019). There have been reported drought conditions in every year on record for Maui County. Further, drought frequency and severity are projected to increase in Maui County in the future due to projected warmer temperatures and decreased rainfall associated changing climatic conditions, as described in the section below. In addition, there is evidence that drought may be more common during El Niño years, when conditions are typically warmer and drier in the Hawai'i, as shown in Figure 51.[88] El Niño currently occurs approximately every two to seven years, and typically lasts 14 to 22 months.[89] However, findings included in the Fourth National Climate Assessment indicate that El Niño and La Niña extremes will double in frequency in the 21st century as compared to the 20th century.[90]

[87] Maui Now (2019). *Drought conditions tax upcountry water resources*. Retrieved from https://mauinow.com/2019/06/21/drought-conditions-tax-upcountry-water-resources/.
[88] U.S. Global Change Research Program. Fourth National Climate Assessment: C*hapter 27: Hawai'i and U.S.-Affiliated Pacific Islands, Figure 27.3*. Retrieved from https://nca2018.globalchange.gov/chapter/27/.
[89] National Drought Mitigation Center. ENSO and Drought Forecasting. Retrieved from https://drought.unl.edu/Education/DroughtIn-depth/ENSO.aspx
[90] U.S. Global Change Research Program. Fourth National Climate Assessment: C*hapter 27: Hawai'i and U.S.-Affiliated Pacific Islands*. Retrieved from https://nca2018.globalchange.gov/chapter/27/.

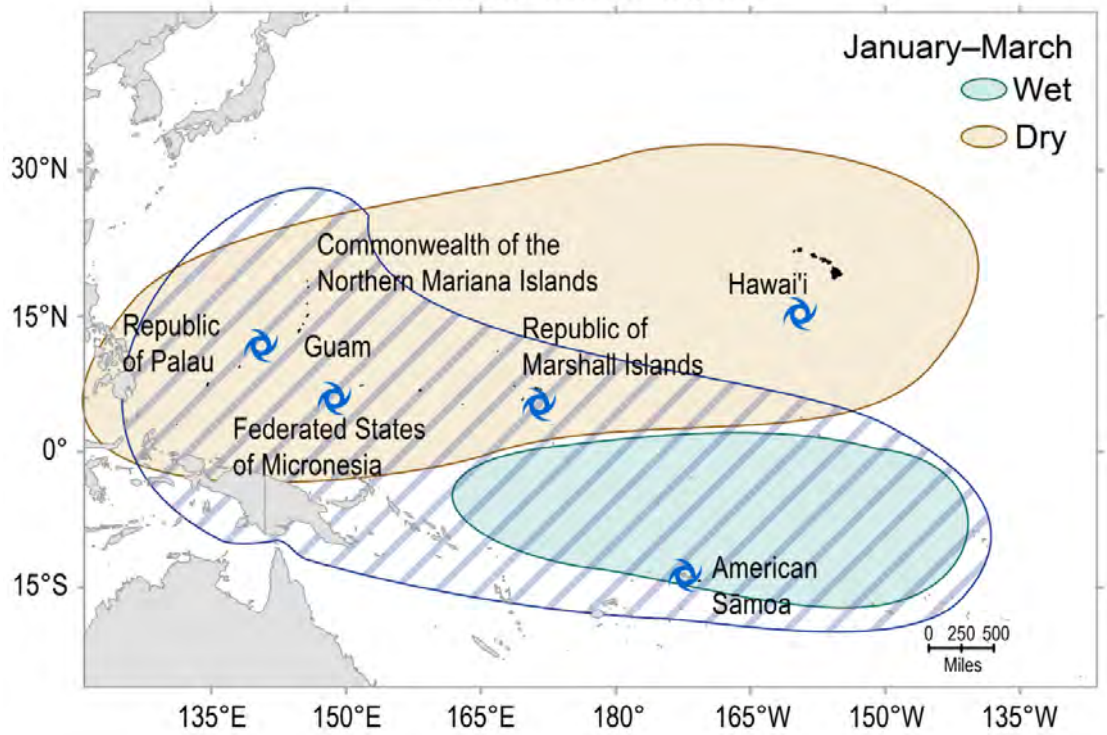

Figure 51. El Niño Climate Impacts in the Pacific.

Due to the regional nature of drought and the water cycle, all of Maui County, including all community planning areas, are considered to have the same drought probability. Based on historic data and information regarding future conditions, a probability of "highly likely" (greater than 90 percent annual probability) was assigned to the drought hazard in Maui County. It should be noted that drought events are likely to span several months, or even years, adding to the probability of occurrence.

Vulnerability

It is assumed that all current and future buildings, infrastructure, populations, and critical facilities in Maui County are at risk to drought. The atmospheric nature of drought and lack of specific boundaries make it more conducive to a qualitative assessment as opposed to a quantitative analysis, such as GIS analysis. The majority of drought impacts, however, are not structural but societal in nature. A drought's impacts on society result from the interplay between a natural event and the demand people place on water supply.

Building Impacts and Infrastructure (including Critical Facilities)

As noted above, drought has minimal impacts on buildings and infrastructure, although drought could have impacts on the functionality of a building if water supply is disrupted. In addition, structural issues could occur in the event that drought impacts building foundations or footings. There are no known losses associated with drought on buildings or infrastructure in Maui County.

Life Safety, Health, Warning, and Evacuation Impacts
As drought is a slow developing hazard, it is unlikely to have significant impacts on life safety, and it is not expected to result in warnings or evacuation. Drought occurrences may result in water use restrictions or require freshwater to be imported.

Water is also needed to manage wildfires. A lack of, or limited, water supply presents wildfire management vulnerability. Substantial water is needed to fight wildfires, which are also more frequent in dry conditions. In addition, soil that is dry and loosened due to dead or barren vegetation is more prone to landslides and sedimentation when a drought is followed by a heavy rain event.

Public Health Impacts
Drought has the potential to impact public health by reducing the quality and quantity of available drinking water. The State of Hawai'i, including Maui County, is an isolated land mass with limited freshwater resources. Drought may substantially reduce surface water stream flows or result in saltwater intrusion into groundwater and other freshwater sources. While drought has never been severe enough to fully deprive the county of water, it is possible.

Impacts to Vulnerable Populations
Based on the hazard information above, all populations within Maui County may experience impacts due to drought, especially those reliant on catchment for their water supply.

While all vulnerability subcomponents are discussed below, populations exhibiting constraints related to housing characteristics and socioeconomic status may be most susceptible to negative consequences due to drought. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are described below.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty in caring for household members with a limited or restricted water supply available for household use.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a natural disaster. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate preparedness actions such as stocking extra food and supplies, support recovery actions such as repairing of homes after a disaster, or fund mitigation actions that would protect their homes and property from future hazard impacts. Further, those with limited means, and especially those reliant on water catchment systems, may be unable to afford the purchase and delivery of potable water, sustain agricultural crops upon which they rely or restore landscaping around their homes after a drought.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon hazard information. Additionally, those who do not speak English well, may not comprehend information related to drought conditions, such as a mandate to reduce water usage.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living in housing built before 1950, and prior to the enactment of modern building codes, may have aged, leaky plumbing resulting in higher than normal water use in times of drought. Higher density living situations such as multi-unit housing,

populations residing in group living quarters or crowded housing have greater demands for water outside of drought conditions. Should water restrictions be necessary, these populations may be challenged to meet basic household water needs.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges and have difficulty accessing needed supplies and services before, during and after a hazard event. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Molokaʻi households also do not have access to a vehicle.

Economic Impacts

Drought has the potential to impact Maui County economically in several ways. Drought resulting in water shortage can also impact businesses (ranging from restaurants to manufacturing) which cannot operate without water. Maui's robust tourism industry could be severely impacted by water shortages, and eco-tourism may be curbed during events where drought has measurable impacts on ecosystems. In addition, in the case of a water shortage, the cost of water may increase (or the county may be forced to import water or set up expensive desalination facilities), which would have ripple effects on the local economy.

Additionally, drought has a history of negatively impacting agricultural holdings. Within the state, USDA paid of $50 million in livestock insurance claims to Hawaiian ranchers for grazing losses from 2008-2017, and farmers in Hawai'i have received $10 million in federal crop insurance payments since 1996 due to drought losses.[91] Further, the cultivation of traditional, culturally significant crops such as taro can be impacted.

Climate Change Impacts

In Maui County, climate change is projected to result in increased drought frequency and severity. Warming temperatures result in increased evaporation and evapotranspiration, reducing water levels and drying out plants and soils. Further, Maui County is experiencing decreased precipitation. A documented decrease in trade winds, which bring moisture to windward mountain slopes, over the last 40 years has subsequently resulted in decreased rainfall.[92] The figure below shows changes in annual rainfall in Maui County from 1920 to 2012.[93] Areas with cross-hatching represent locations where the change in rainfall was statistically significant. As shown, some of the most significant decreases are in Maui County's wettest areas.

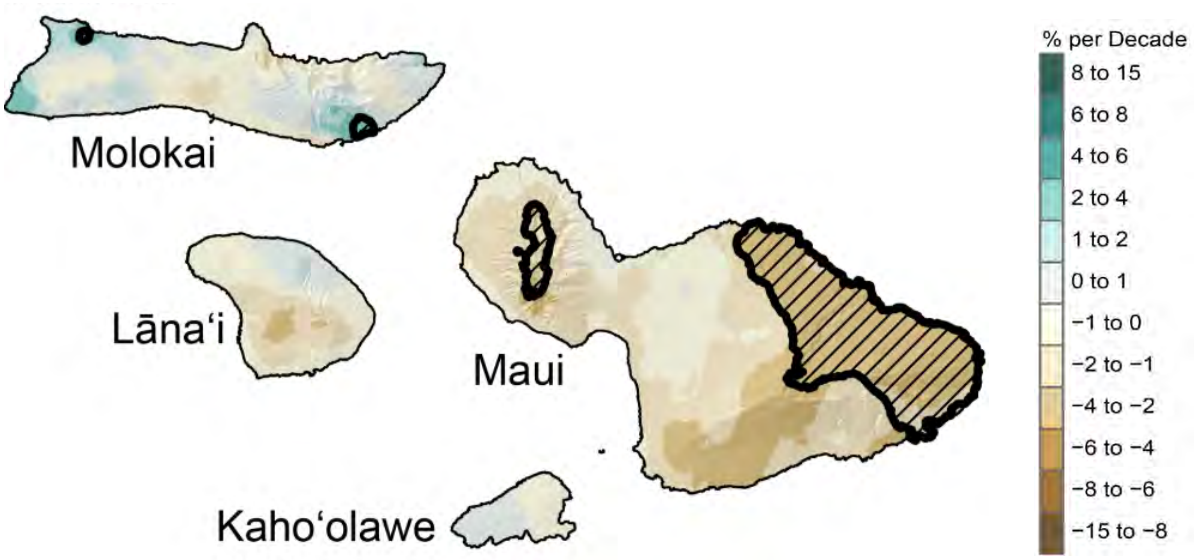

Figure 52. Rainfall Trends in Maui County.

Lastly, end-of-century rainfall projections for the entire state under a higher emissions scenario (RCP8.5) range from small increases to increases of to up to 30% in wet areas, and from small decreases to decreases of up to 60% in dry areas.

[91] Finnerty, R. (2019). *Cost of Hawai'i's record-breaking drought reaches millions*. Hawai'i Public Radio. Retrieved from https://www.Hawai'ipublicradio.org/post/cost-Hawai'is-record-breaking-drought-reaches-millions#stream/0.
[92] 2018 State of Hawai'i Hazard Mitigation Plan. *Section 4.5: Drought*.
[93] U.S. Global Change Research Program. Fourth National Climate Assessment: C*hapter 27: Hawai'i and U.S.-Affiliated Pacific Islands, Figure 27.6*. Retrieved from https://nca2018.globalchange.gov/chapter/27/.

This information indicates that droughts in Maui County could become more frequent and pronounced, which could lead to increased drought-related impacts on water quality and quantity, local flora, and the local economy.

Earthquake

Description

Earthquakes are scientifically defined as the sudden release of strain (or displacement of rock) in the earth's crust, resulting in waves of shaking that radiate outward from the earthquake source. They may result from crustal strain, volcanism, landslides or the collapse of caverns. Earthquakes can occur underwater or on land. Earthquakes can affect hundreds of thousands of square miles. Their intensity ranges from very minor (shaking not detected by humans without instruments) to very violent (catastrophic in nature). Damages follow this intensity ranging from minor to catastrophic. Earthquakes also occur without warning, resulting in deaths and injuries.

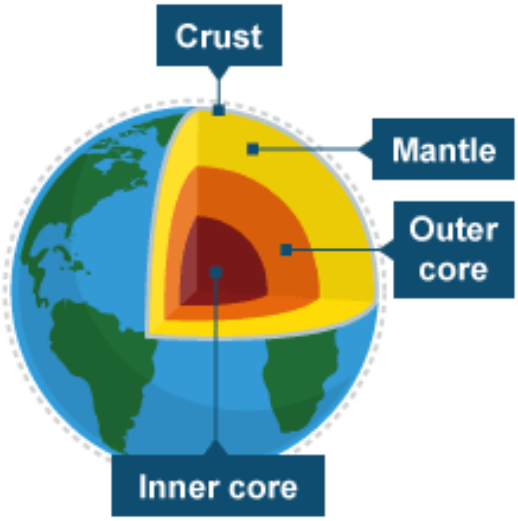

Figure 53. Earth's Sub Layers.

To understand the nature of earthquakes, the composition of the earth must be explored. The earth is made up of four major layers and several sub layers (Figure 53[94]): a solid inner core, a liquid outer core, a semi-molten mantle, and the rocky crust (the thin outermost layer of the earth). The upper portion of the mantle combined with the crust forms the lithosphere. This area is susceptible to fractures and is referred to as a shell. The lithosphere breaks up into large slabs, known as tectonic plates. This area is where earthquakes occur.

There are approximately twelve major plates and several dozen more minor plates on the earth's crust, as shown in Figure 54. Plates are regions of the crust that continually move over the mantle. Areas where these plates meet, grind past each other, dive under each other, or spread apart, are called plate boundaries. Most earthquakes are caused by the release of stresses accumulated due to the sudden displacement of rock along opposing plates in the Earth's crust. The areas bordering the Pacific Plate, also known as the "Pacific Ring of Fire", are at a particularly high risk since most of the largest earthquake events of the last century have occurred in the region.[95]

[94] BBC. *Plate Tectonics*. Retrieved from http://www.bbc.co.uk/bitesize/ks3/geography/physical_processes/plate_tectonics/revision/2/.
[95] Canales, M. and Chwastyk, M. The Pacific's Fiery Ring. National Geographic. Retrieved from https://www.nationalgeographic.com/magazine/2019/06/pacific-ring-of-fire-volcanoes-earthquakes-threaten-millions/.

While earthquakes typically occur along plate boundaries, they can affect hundreds of thousands of square miles, causing damage to property (measured in the tens of billions of dollars), resulting in loss of life and injury to hundreds of thousands of persons, and disrupting the social and economic functioning of the affected area. The point where an earthquake starts is termed the focus or hypocenter and may be many miles to several hundred miles deep within the earth. The point at the surface directly above the focus is called the earthquake's epicenter. Earthquakes are measured in terms of their magnitude and intensity.

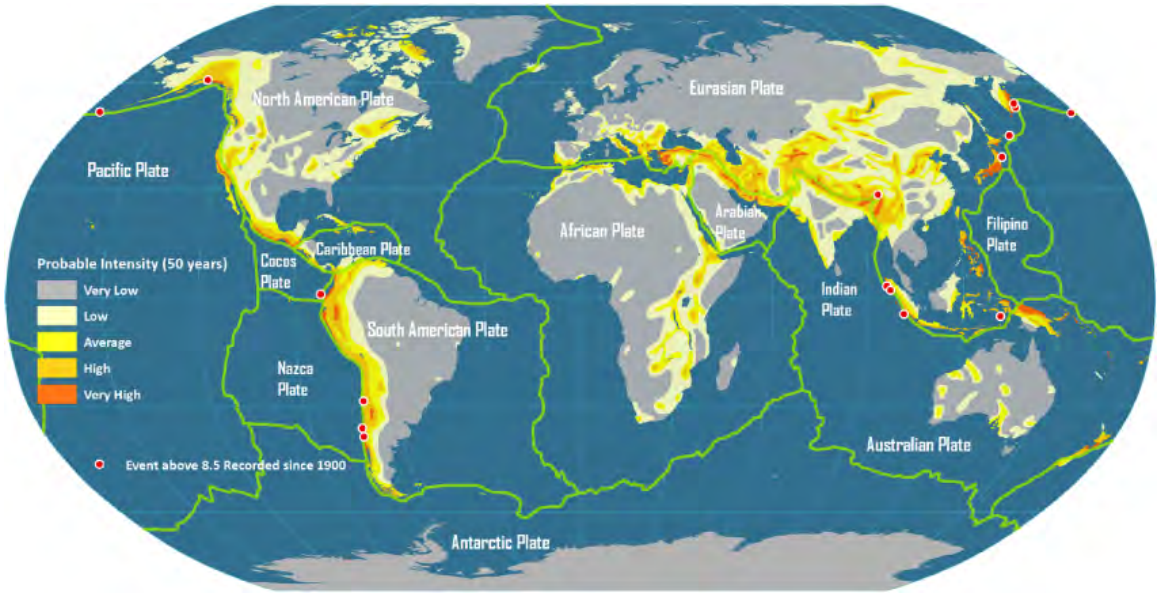

Figure 54. Global Plate Tectonics and Seismic Activity.[96]

Most property damage and earthquake-related deaths are caused by the failure and collapse of structures due to ground shaking. The level of damage depends upon the amplitude and duration of the shaking, which are directly related to the earthquake size, distance from the fault, site, and regional geology. Other damaging earthquake effects include landslides, the down-slope movement of soil and rock (mountain regions and along hillsides), and liquefaction, in which ground soil loses the ability to resist shear and flows much like quicksand. In the case of liquefaction, anything relying on the substrata for support can shift, tilt, rupture, or collapse.

The greatest earthquake threat in the United States is along tectonic plate boundaries and seismic fault lines located in the central and western states; however, Hawai'i does faces earthquake risks ranging from moderately low to very high. Figure 55 shows relative seismic risk for the United States.

[96] Rodrigue, J.P. Global Plate Tectonics and Seismic Activity. (2017). Hofstra University. Retrieved from https://people.hofstra.edu/geotrans/eng/ch9en/conc9en/plate_tectonics.html.

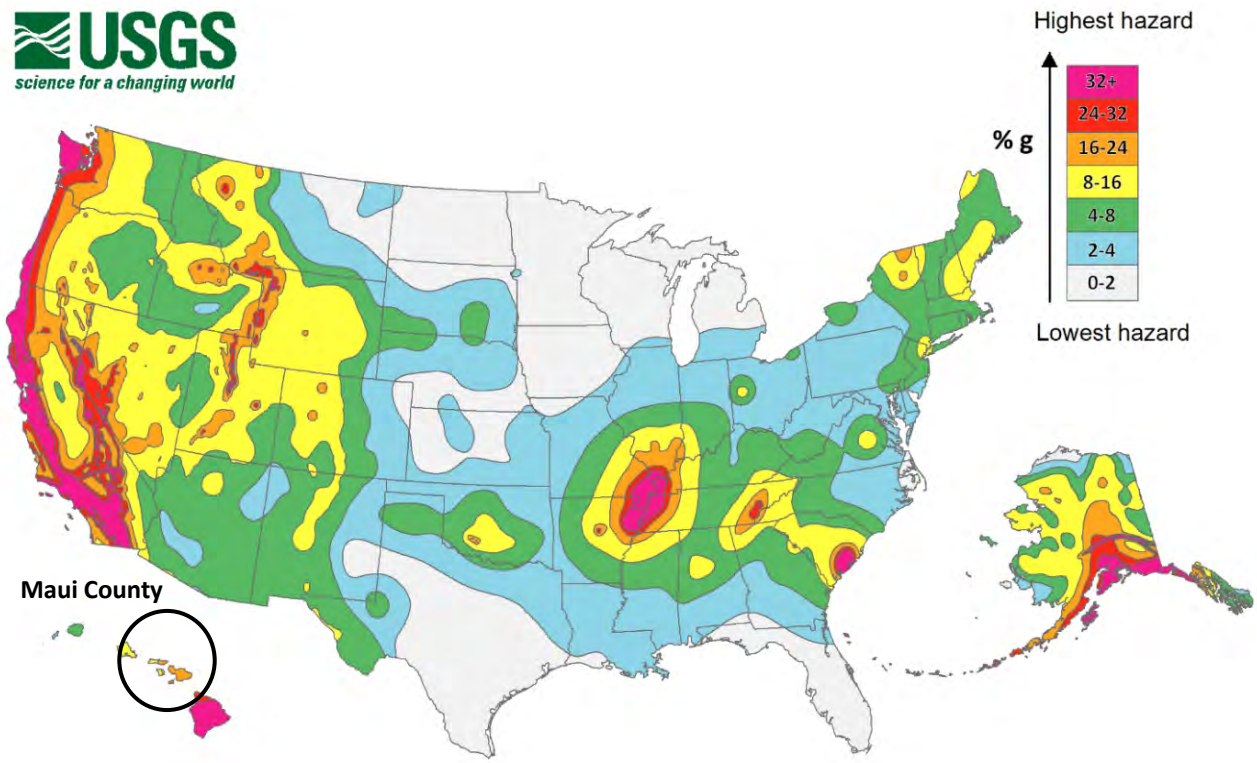

Figure 55. United States Earthquake Hazard Map.

Source: United States Geological Survey

Earthquake magnitude is measured using the Richter Scale, an open-ended logarithmic scale that describes the energy release of an earthquake through a measure of shock wave amplitude (Table 26).[97] Each unit increase in magnitude on the Richter Scale corresponds to a 10-fold increase in wave amplitude, or a 32-fold increase in energy. Beginning in 2002, the USGS began using Moment Magnitude as the preferred measure of magnitude for all USGS earthquakes greater than magnitude 3.5. This was primarily due to the fact the Richter Scale has an upper bound, so large earthquakes were difficult to measure. Moment Magnitude also has a scale, but no instrument is used to measure it. Instead, factors such as the distance the earthquake travels, the area of the fault, and land that was displaced (also known as "slip") are used to measure moment magnitude. Table 27 shows the Moment Magnitude Scale.

Table 26. Richter Scale.

RICHTER MAGNITUDES	EARTHQUAKE EFFECTS
<3.5	Generally, not felt but recorded.
3.5 - 5.4	Often felt, but rarely causes damage.

[97] USGS. *Richter scale*. Retrieved from https://earthquake.usgs.gov/learn/glossary/?term=Richter%20scale.

RICHTER MAGNITUDES	EARTHQUAKE EFFECTS
5.4 - 6.0	At most slight damage to well-designed buildings. Can cause major damage to poorly constructed buildings over small regions.
6.1 - 6.9	Can be destructive in areas up to about 100 kilometers across where people live.
7.0 - 7.9	Major earthquake. Can cause serious damage over larger areas.
8 or >	Great earthquake. Can cause serious damage in areas several hundred kilometers across.

Source: Federal Emergency Management Agency

Table 27. Moment Magnitude Scale.

SCALE VALUES	EARTHQUAKE EFFECTS
<3.5	Very weak; unlikely to be felt
3.5 - 5.4	Generally felt; rarely causes damage
5.4 - 6.0	Will not cause damage to well-designed buildings; will damage poorly designed ones
6.1 - 6.9	Considered a "major earthquake" that causes a lot of damage
7.0 - 7.9	Large and destructive earthquake that can destroy large cities
8 or >	Large and destructive earthquake that can destroy large cities

Source: Federal Emergency Management Agency

Intensity is most commonly measured using the Modified Mercalli Intensity (MMI) Scale based on direct and indirect measurements of seismic effects. The scale levels are typically described using roman numerals, ranging from "I" corresponding to imperceptible (instrumental) events to "XII" for catastrophic (total destruction). A detailed description of the Modified Mercalli Intensity Scale of earthquake intensity and its correspondence to the Richter Scale is given in Table 28**.** Table 29 compares the Richter scale magnitudes and MMI magnitudes for several well-known historic earthquakes in the U.S.

Table 28. Modified Mercalli Intensity Scale for Earthquakes.[98]

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER
I	INSTRUMENTAL	Detected only on seismographs.	
II	FEEBLE	Some people feel it.	< 4.2
III	SLIGHT	Felt by people resting; like a truck rumbling by.	
IV	MODERATE	Felt by people walking.	
V	SLIGHTLY STRONG	Sleepers awake; church bells ring.	< 4.8

[98] Magnitude/Intensity Comparison. USGS. Retrieved from http://earthquake.usgs.gov/learn/topics/mag_vs_int.php Retrieved March 3, 2015.

SCALE	INTENSITY	DESCRIPTION OF EFFECTS	CORRESPONDING RICHTER
VI	STRONG	Trees sway; suspended objects swing, objects fall off shelves.	< 5.4
VII	VERY STRONG	Mild alarm; walls crack; plaster falls.	< 6.1
VIII	DESTRUCTIVE	Moving cars uncontrollable; masonry fractures, poorly constructed buildings damaged.	
IX	RUINOUS	Some houses collapse; ground cracks; pipes break open.	< 6.9
X	DISASTROUS	Ground cracks profusely; many buildings destroyed; liquefaction and landslides widespread.	< 7.3
XI	VERY DISASTROUS	Most buildings and bridges collapse; roads, railways, pipes, and cables destroyed; general triggering of other hazards.	< 8.1
XII	CATASTROPHIC	Total destruction; trees fall; ground rises and falls in waves.	> 8.1

Table 29. Richter v. Moment Magnitude Values.

Earthquake	Richter Scale	Moment Magnitude
New Madrid, MO 1812	8.7	8.1
San Francisco, CA 1906	8.3	7.7
Prince William, AK 1964	8.4	9.2
Northridge, CA 1994	6.4	6.7

Liquefaction

Liquefaction is the phenomenon that occurs when the strength and stiffness of a soil is reduced by earthquake shaking or other rapid loading.[99] Essentially, the soil acts like a fluid, similar to wet sand near the beach, resulting in ground failure. Liquefaction causes several types of ground failure: lateral spread/flow failures and loss of bearing strength. Lateral spread develops on gentle slopes and entails the sidelong movement of large masses of soil as an underlying layer liquefies. Similarly, flow failures also displace large masses of soil laterally, generally on slopes greater than three degrees. Loss of bearing strength results when the soil supporting structures liquefies and causes structures to collapse.

[99]What is soil liquefaction? (n.d.). University of Washington. Retrieved October 9, 2017 from http://www.ce.washington.edu/~liquefaction/html/what/what1.html

Liquefaction can also cause increased lateral pressure on retaining walls when the soil behind a wall liquefies, causing failure or displacement.[100]

Location

Hawai'i experiences thousands of earthquakes every year, typically caused by eruptive processes within active volcanoes. Shaking from earthquakes associated with volcanic activity are typically too small to cause damage. In Maui County, these small earthquakes, often referred to as swarms, are located around the Haleakalā volcano in eastern Maui. However, a major earthquake event could impact the entire county. Fault locations and earthquake risk areas also help define location. Notable faults within Maui County include the West Maui Fault, East Molokaʻi Fault, and an extensive fault system on Lānaʻi. These faults are shown in Figure 56**.** Earthquakes occurring on other Hawaiian Islands, such as the Big Island of Hawai'i, or in the Pacific Ocean, have the potential to impact Maui County.

[100] Earthquake Basics: Liquefaction: Earthquake Engineering Research Institute. (n.d.). Retrieved October 9, 2017 from https://eeri.org/wp-content/uploads/store/Free%20PDF%20Downloads/LIQ1.pdf

Figure 56. Active Fault Lines and Zones in Maui County.

Liquefaction

Liquefaction tends to occur in areas with loose, sandy soils and a shallow groundwater table, which are typically located in alluvial river valleys and floodplains. Areas with man-made fill are also considered to have increased susceptibility to liquefaction.[101] Maui County does not currently have available liquefaction mapping. However, areas underlain by National Earthquake Hazards Reduction Program (NEHRP) class D, E, and F soils are more susceptible to liquefaction. Maui County contains class D soils; areas underlain with this soil classification are shown in Figure 57.[102]

In addition, NOAA Coastal Service Center sponsored a project in 2005 to identify areas with the potential for soil liquefaction in Maui County and Hawai‘i County. The results of the study showed small areas of

[101] Liquefaction Susceptibility. USGS. Retrieved from https://earthquake.usgs.gov/learn/topics/geologicmaps/liquefaction.php.
[102] State of Hawai’i Hazard Mitigation Plan Update (2018). *Chapter 4: Risk Assessment, 4.6: Earthquake.*

high liquefaction susceptibility in Maui, including the community planning areas of West Maui (from Lahaina to Nāpili), Kīhei-Mākena, and Wailuku-Kahului.[103]

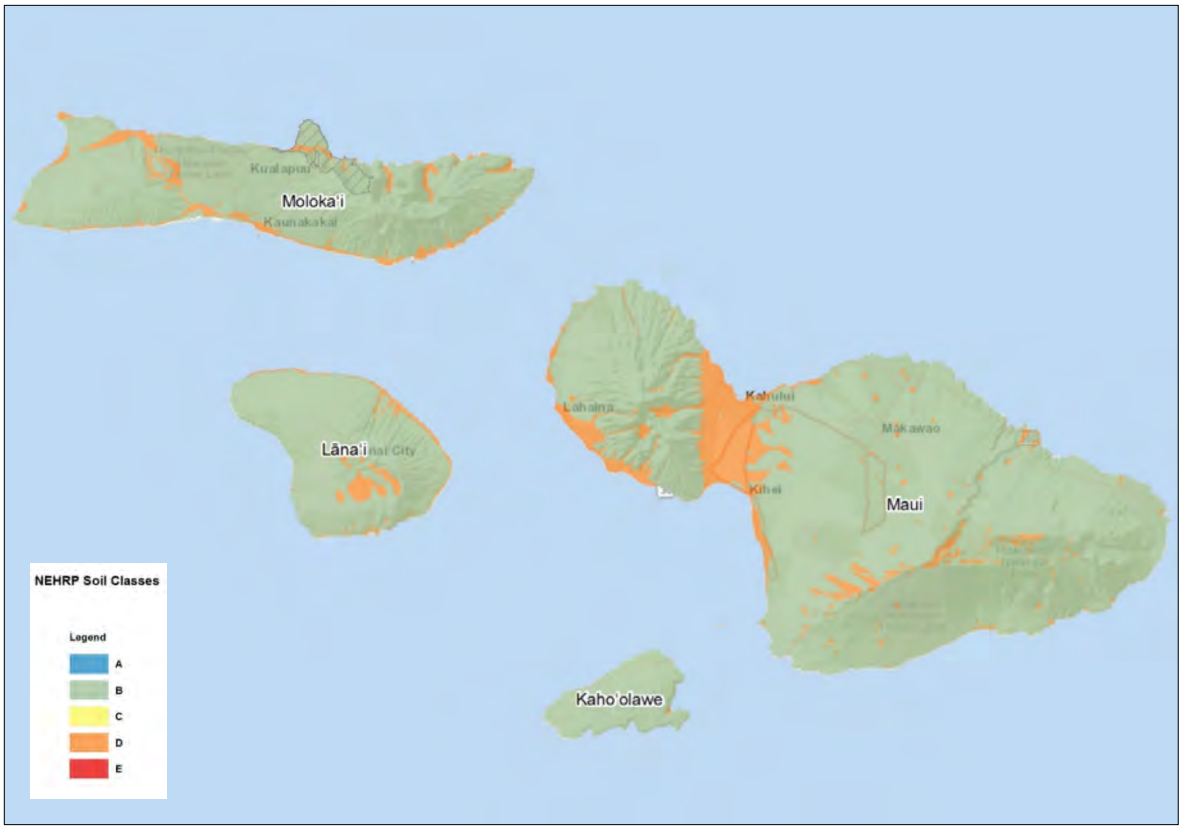

Figure 57. NEHRP Soil Classes in Maui County (D, E and F are most susceptible to liquefaction).

Previous Occurrences

Several local, state, and federal data sources were used to investigate previous earthquake occurrences. These sources include:

- NOAA's Significant Earthquake Database.[104] Earthquakes in this database meet at least one of the following criteria:
  - Moderate damage (approximately $1 million or more),
  - 10 or more deaths,
  - Magnitude 7.5 or greater,
  - Modified Mercalli Intensity X or greater, or the
  - Earthquake generated a tsunami.
- The 2018 State of Hawai'i Hazard Mitigation Plan

[103] State of Hawai'i Hazard Mitigation Plan Update (2018). *Chapter 4: Risk Assessment, 4.6: Earthquake.*

[104] National Geophysical Data Center / World Data Service (NGDC/WDS): Significant Earthquake Database. National Geophysical Data Center, NOAA. doi:10.7289/V5TD9V7K [July 5, 2017]

- The 2015 Maui County Hazard Mitigation Plan Update

From the sources referenced above, records of 25 earthquakes over magnitude 6.0 and their aftershocks are referenced between 1850 and 2020 in Maui County or surrounding Hawaiian Islands. It should be noted that, unless indicated, the inclusion of the following earthquake events does not necessarily mean they resulted in damages within Maui County.

NOAA Significant Earthquakes Database

According to the NOAA Significant Earthquake Database, 13 significant earthquakes[105] have been recorded in the Hawaiian Islands since 1850,[106] most of which occurred on the Big Island of Hawai'i, just south of Maui County. The impacts of these events are detailed in the table below, as available. Impacts are provided for the entire event and are not limited to Maui County.

Table 30. NOAA Significant Historic Earthquakes Potentially Impacting Maui County.

Year	Location	Magnitude	MMI	Deaths/ Injuries	Damages ($)	Houses Destroyed / Damaged
1868	Hawai'i	7.9	10	77 / 0	N/A	46 / 0
1871	Hawaiian Islands	7.0	N/A	N/A	N/A	N/A
1877	Hawai'i	N/A	N/A	N/A	N/A	N/A
1908	Hawai'i	6.8	N/A	N/A	N/A	N/A
1926	Hawai'i	N/A	N/A	N/A	N/A	N/A
1951	Hawai'i	6.9	N/A	0 / 2	N/A	N/A
1952	Hawai'i	N/A	N/A	N/A	N/A	N/A
1973	Hawai'i - Hilo	6.5	8	0 / 11	$5,750,000	N/A
1975	Hawai'i	7.7	9	2 / 0	$4,000,000	8 / 230
1983	Hawai'i - Kapapala	6.7	8	0 / 6	$6,500,000	N/A
1989	Hawaiian Islands – Puna District	6.1	6	0 / 5	N/A	105 / 0
2006	Hawaiian Islands	6.7	8	N/A	$73,000,000	N/A
2018	Hawaiian Islands – Puna District	6.9	N/A	0 / 1	$370,000,000	716 / 0

In addition to events reported by the NOAA Significant Earthquakes Database, the earthquakes described below were noted in the 2015 Maui County Hazard Mitigation Plan Update as having a significant impact on Maui County.

[105] Significant Earthquake Search. NOAA Significant Earthquake Database. Retrieved from https://www.ngdc.noaa.gov/nndc/struts/form?t=101650&s=1&d=1.
[106] The NOAA Significant Earthquake Database contains information on destructive earthquakes from 2150 BC to the present.

1871 Lānaʻi Earthquake—The Lānaʻi earthquake of 1871 was one of the most significant earthquakes to have affected Maui County. From the geographic distribution of its effects, its magnitude is estimated to have been 7.0 and its epicenter to be near the south coast of the Island of Lānaʻi.

1938 Maui Earthquake—The January 22, 1938 Magnitude-6.9 earthquake had an epicenter about 12 miles northeast of Keʻanae Point in East Maui. The Island of Maui suffered more damage than any other Hawaiian Island, though there were few injuries and no mortalities. Damage on Molokaʻi and Lānaʻi was small and resulted from a few ground cracks. No tsunami accompanied the shock.

2006 Kiholo Bay and Mahukona Earthquakes—The most recent earthquakes to strike Hawai'i were the Kiholo Bay and Mahukona earthquakes of October 15, 2006, centered in the Pacific Ocean west of the Island of Hawai'i. The Magnitude-6.7 Kiholo Bay earthquake occurred at 7:07 a.m., followed by the Magnitude-6.0 Mahukona earthquake at 7:14 a.m. Although the Mahukona earthquake was the smaller of the two in magnitude, its intensity of was reportedly equal to or greater than that of the Kiholo Bay earthquake in some areas due to its shallower depth. On the Island of Maui, the earthquakes induced several landslides and rockfalls along Piilani Highway (Highway 31) on the southeastern coast. About 500 residents were cut off in the Manawainui area due to an incipient rockfall hazard and due to closure of a bridge damaged by erosion at Pahihi. This event resulted in a disaster declaration for Maui County, with estimated damages for the county at $28.1 million.

The table below includes additional earthquake events that may have impacted Maui County due to their proximity, as identified in the 2015 Maui County Hazard Mitigation Plan Update.

Table 31. Historic Earthquakes Potentially Impacting Maui County

Year	Richter Magnitude	Location / Epicenter
1918	6.2	Kaoiki, between Maunaloa and Kilauea
1919	6.1	Kau District, Maunaloa south flank
1927	6.1	Northeast of Hawai'i Island
1929	6.1	Hualalai
1940	6.0	North of Hawai'i Island
1941	6.0	Kaoiki
1950	6.4	Kona
1951	6.3	Lithospheric
1954	6.5	Kilauea south flank
1955	6.0	Lithospheric
1962	6.1	Kaoiki

Extent

One way to measure the extent of an earthquake is peak ground acceleration.

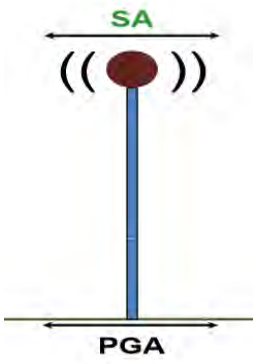

Figure 58. SA and PGA Comparison.

USGS peak ground acceleration (PGA) measures the intensity of an earthquake. It is the probability that ground motion will reach a certain level during an earthquake (the fastest measured change in speed, for a particle at ground level that is moving horizontally due to an earthquake). PGA is expressed as g (the acceleration of gravity, equivalent to g-force), where a higher level means higher shaking. It is frequently stated as "x percent probability of exceedance in C years," For data stating PGA (%g) as "10 percent probability of exceedance in 50 years," a map would indicate that there is a 10 percent probability of reaching that level of shaking (%g) in 50 years. (It is meant to show the upper bounds of possible shaking).

In addition, spectral acceleration (SA) is presented and measured as %g. According to the USGS, SA can be described as "approximately what is experienced by a building, as modeled by a particle mass on a massless vertical rod having the same natural period of vibration as the building."[107] It is the maximum acceleration in an earthquake on an object and approximates building motion during an earthquake. Further, PGA estimates ground motion versus object motion. SA is best used for taller buildings, while PGA is best used for shorter buildings (less than 7 stories). Figure 59[108] shows a comparative diagram.

PGA was estimated for Maui County. PGA was considered rather than SA because most buildings in the county are less than 7 stories. Given an input of 2% probability of exceedance in 50 years, most of Maui County, including the Island of Maui and part of eastern Molokaʻi, have a PGA value of 33%g (strong shaking - damage negligible in buildings of good design and construction; slight to moderate in well-built ordinary structures; considerable damage in poorly built structures). The remainder of the county, including most of Molokaʻi and all of Lānaʻi, have an estimated PGA value of 17%g

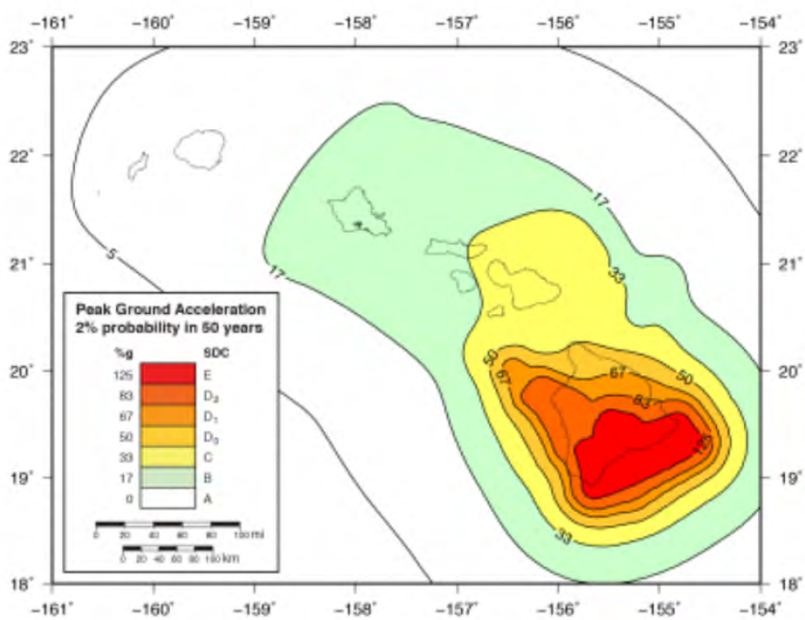

Figure 59. Peak Ground Acceleration (PGA) for the Hawaiian Islands (2-percent probability of exceedance in 50 years).

[107] http://earthquake.usgs.gov/hazards/about/technical.php#sa
[108] http://kula.geol.wwu.edu/rjmitch/pga_maps.pdf

(moderate shaking - felt by all, many frightened; some heavy furniture moved; a few instances of fallen plaster; damage is slight). These areas are shown in the figure above.[109]

Probability of Future Events

Several active faults are within Maui County. Further, the Island of Hawai'i, south of Maui County, is known for having seismic activity. The probability of future major earthquake events impacting Maui County was determined using historic occurrence information. Twenty-five significant (above a 6.0 magnitude) events have been reported over a 170-year reporting period, resulting in a significant earthquake every 6-7 years, on average. Considering the number of major historic earthquakes occurring in or near Maui County, the probability assigned to the entire county for a significant earthquake event is "possible" (1 to 10 percent annual probability). Due to the ability of earthquakes to have a regional impact, all community planning areas in Maui County were assigned the same probability.

Vulnerability

It can be assumed that all existing and future buildings, infrastructure, and populations are at risk to the earthquake hazard. There are several factors that impact vulnerability to earthquake in Maui County.

An earthquake could result in deaths, injuries, property damage, environmental damage and disruption of normal services and business activities. The effects could be aggravated by collateral emergencies such as fires, flooding, tsunamis, landslides, hazardous material spills, utility disruptions, and transportation emergencies. Aftershocks to major earthquakes could also be large enough to cause damage.

Building and Infrastructure Impacts (including Critical Facilities)
All buildings, including critical facilities, are at risk to earthquakes, but certain structures may be at a higher risk. Any structures not built to the Hawai'i State Building Code are at higher risk for damage or collapse. In addition, certain building types, such as unreinforced masonry and concrete, are at a higher risk of damage. Softer soils may collapse or slide during an earthquake, and soils subject to liquefaction may cause buildings to sink or foundations to fail.

Hazus-MH Loss Estimates
Hazus-MH 4.2 was used to estimate the potential of complete structural damage due to an earthquake. A baseline of dollar exposure for buildings and their contents in Maui County was reviewed, as detailed in Table 32**.** These dollar values reflect a combination of building value from parcel data and building footprints provided by Maui County (GIS, tax assessor data). This information provides a baseline of how much property, in terms a dollar value, is at risk. Exposure for the identified buildings where a majority of residents reside is approximately $54 billion.

[109] Hawaiian Volcano Observatory (HVO). USGS. Retrieved from https://volcanoes.usgs.gov/observatories/hvo/hazards_earthquakes.html.

A Level 2 Hazus-MH Shakemap analysis was performed using USGS Earthquake Planning Scenario Shakemaps. Two scenarios were modeled. An event in the Kalohi Channel, 5 miles north of the Island of Lānaʻi, with a 7.0 Moment Magnitude, and an event 32 miles northeast of Kahului, with a 7.0 Moment Magnitude. The results presented reflect the building and content loss to structures (Table 32), and the percent chance of physical damage to a structure within each community planning area (Table 33). Damage distribution for these scenarios are presented in Figure 60 and Figure 61**.** PGA values for these scenarios are presented in Figure 62 and Figure 63**.**

Table 32. Hazus-MH 4.2 Building and Content Loss.

Lānaʻi 7.0 Scenario			
	Building Loss	**Content Loss**	**Total Loss**
Hāna	$43,031	$6,090	$49,121
Kīhei-Mākena	$10,933,195	$2,134,115	$13,067,310
Lānaʻi	$27,960,290	$7,677,158	$35,637,448
Makawao-Pukalani-Kula	$1,321,223	$224,826	$1,546,049
Molokaʻi	$24,776,118	$6,926,983	$31,703,101
Pāʻia-Haʻikū	$681,940	$118,620	$800,560
Wailuku-Kahului	$9,679,701	$2,042,889	$11,722,590
West Maui	$42,488,069	$9,792,338	$52,280,407
Total	**$117,883,567**	**$28,923,019**	**$146,806,586**
Northeast Maui 7.0 Scenario			
	Building Loss	**Content Loss**	**Total Loss**
Hāna	$494,138	$107,092	$601,230
Kīhei-Mākena	$16,688,416	$3,467,090	$20,155,506
Lānaʻi	$234,834	$37,176	$272,010
Makawao-Pukalani-Kula	$8,665,633	$2,010,374	$10,676,007
Molokaʻi	$312,298	$51,783	$364,081
Pāʻia-Haʻikū	$9,520,226	$2,477,234	$11,997,460
Wailuku-Kahului	$17,490,780	$4,121,878	$21,612,658
West Maui	$16,236,971	$3,288,195	$19,525,166
Total	**$69,643,296**	**$15,560,822**	**$85,204,118**

Table 33. Hazus-MH Earthquake Event Damages Per Percent Chance.

Lānaʻi 7.0		
	Physical Damage – None (# of Buildings)	**Physical Damage – Complete (# of Buildings)**
Hāna	1,945	0
Kīhei-Mākena	8,366	0

Lānaʻi	939	7
Makawao-Pukalani-Kula	12,947	0
Molokaʻi	1,475	6
Pāʻia-Haʻikū	7,149	0
Wailuku-Kahului	16,267	0
West Maui	6,038	0
Total	**55,126**	**13**
Northeast Maui 7.0		
	Physical Damage – None (# of Buildings)	**Physical Damage – Complete (# of Buildings)**
Hāna	1,853	0
Kīhei-Mākena	8,250	0
Lānaʻi	1,795	0
Makawao-Pukalani-Kula	12,213	0
Molokaʻi	2,479	0
Pāʻia-Haʻikū	6,219	2
Wailuku-Kahului	15,837	0
West Maui	6,313	0
Total	**54,959**	**2**

The results indicate the probability of complete destruction for buildings in both scenarios is low and a majority of buildings would not be damaged. However, some slight to moderate physical damage is possible. All buildings in these scenarios have a chance to sustain some damage.

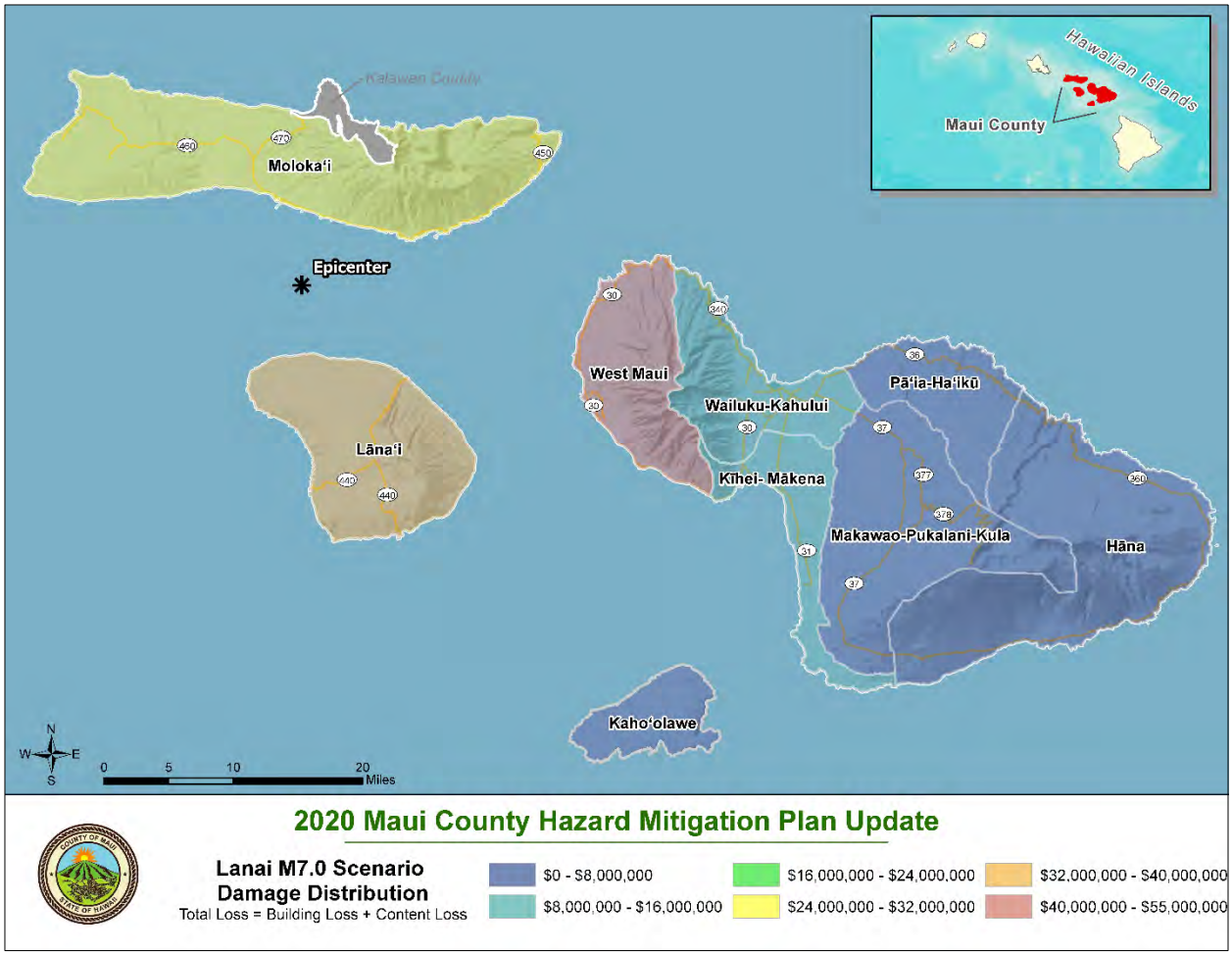

Figure 60. Lāna'i M7.0 Scenario Damage Distribution.

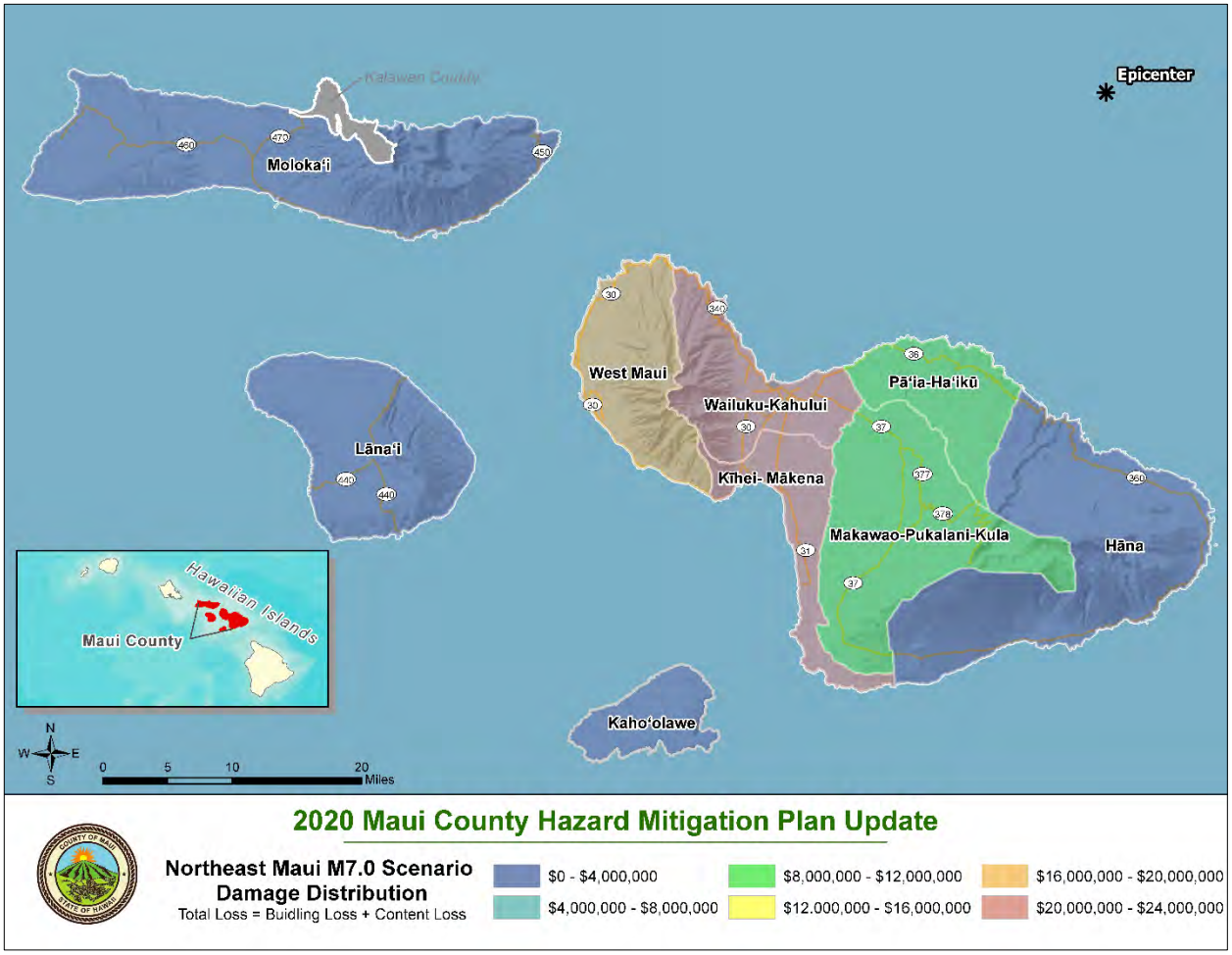

Figure 61. Northeast Maui M7.0 Scenario Damage Distribution.

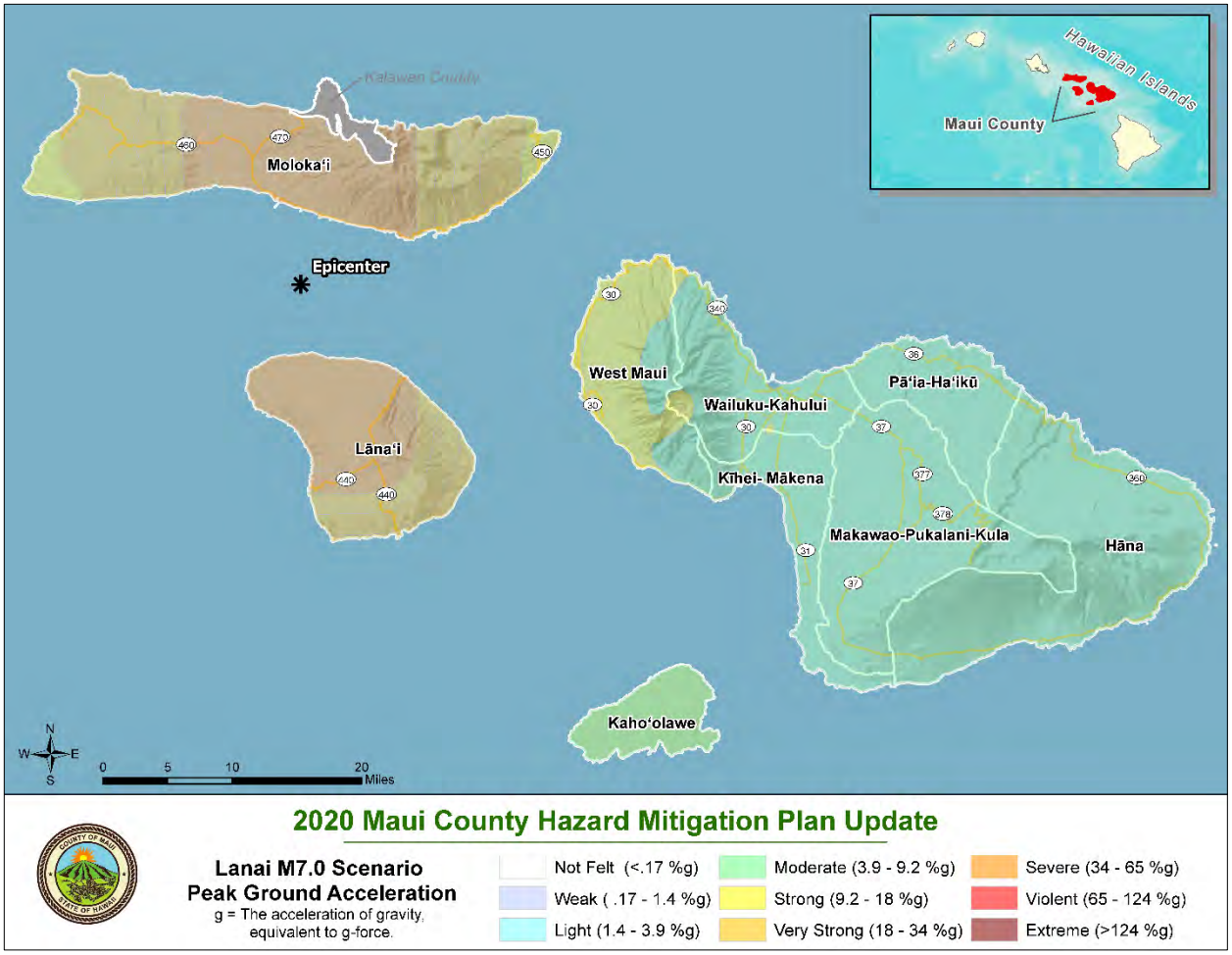

Figure 62. Lāna'i M7.0 Scenario Peak Ground Acceleration.

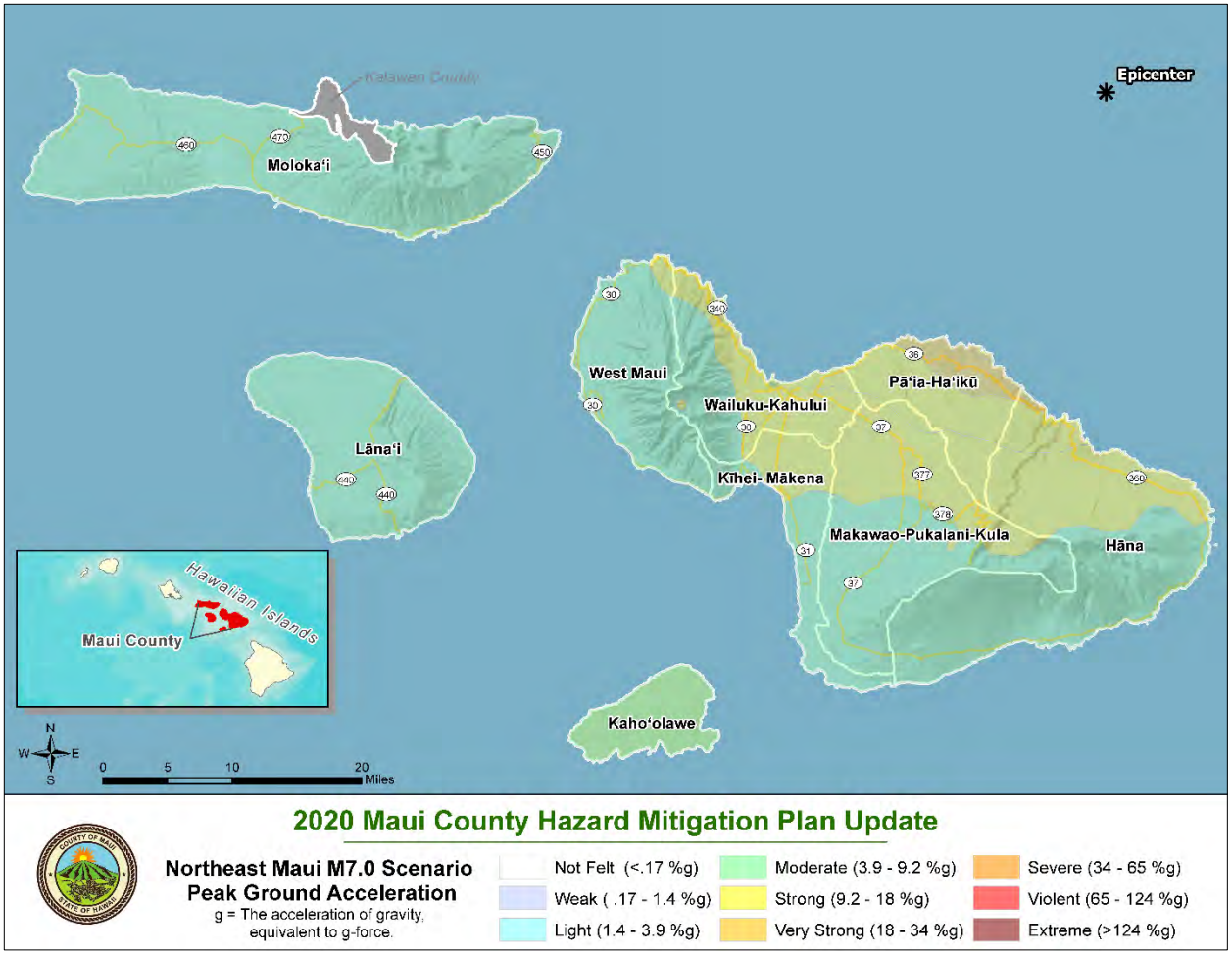

Figure 63. Northeast Maui M7.0 Peak Ground Acceleration.

All infrastructure within Maui County is also considered at risk to earthquakes, including all pipes, roads, bridges, dams, water and wastewater treatment facilities, and utility poles. During earthquakes, underground infrastructure, such as water and sewer systems and natural gas pipelines, are especially vulnerable. Damaged or impassable roads may cut off certain populations from vital resources. In addition, in the event that a dam is damaged during an earthquake, there is potential for dam failure. Further, infrastructure in areas with liquefaction-prone soils may sink (e.g., drinking water pipes) or buried infrastructure may float to the surface (e.g., manholes or other infrastructure containing air). Secondary impacts from an earthquake, such as rock falls or fires, may also damage infrastructure. Much of Maui County's infrastructure was built in the 1970s and may not be seismically constructed or retrofitted to withstand strong earthquakes.

Life Safety, Health, Warning, and Evacuation Impacts

It can be assumed that all existing and future populations are at risk to the earthquake hazard. Injuries are possible if earthquake shaking causes items to fall off shelves or walls, or if shaking is severe enough to cause structural damage. Damages to structures or infrastructure could have impacts on the

population. For instance, down power lines could result in power outages, or a failed dam may result is localized flooding.

Earthquakes typically occur without warning. Therefore, evacuations are unlikely for an earthquake event, but individuals should take cover under a heavy, sturdy object (such as a desk or table) in the event of an earthquake.

Public Health Impacts
Earthquakes that are strong enough to damage infrastructure may have public health impacts, such as contaminated water supply, fires from natural gas leaks, or prolonged power outages (which can especially impact public health when combined with extreme temperatures.

Impacts to Vulnerable Populations
Based on available hazard information, a major earthquake event could impact the entire county, and therefore the entire population. Due to the potential for serious injury or death, and extensive damages to homes and property, vulnerable populations exhibiting constraints related to household composition, socioeconomic status, household characteristics and access to lifelines may be most susceptible to negative consequences resulting from an earthquake. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are described below.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty taking protective action during an earthquake, or safely evacuating a damaged structure after an earthquake. These populations will also require additional services and care considerations in the response aftermath and during recovery. Special accommodations for these populations must be considered in disaster planning processes.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a damaging earthquake. The

unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate preparedness actions, support recovery actions such as repairing of homes after a disaster, or fund mitigation actions that would protect their homes and property from future hazard impacts.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon alerts and information in the aftermath of a damaging earthquake. Additionally, those who do not speak English well, may not comprehend hazard-related information to the extent that enables them to make timely and effective decisions.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living in housing built before 1950, and prior to the enactment of modern building codes, are more susceptible to damages and losses as a result of an earthquake. In addition, higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences resulting from an earthquake. Populations in crowded or high-density living situations may struggle to safely navigate damaged structures or evacuate quickly after an earthquake should a structural fire break out as a result of the hazard.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total

count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges, and have difficulty accessing needed supplies and services after an earthquake. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Molokaʻi households also do not have access to a vehicle.

Economic Impacts
Economic impacts of an earthquake in Maui County include losses from damaged buildings and infrastructure, building contents (e.g., goods falling off shelves in grocery stores), and disruption of services, such as loss of power and water service). Loss of service could cause prolonged business interruptions and reduced tourism for significant events.

Climate Change Impacts
Climate Change is not considered to have a significant impact on earthquakes in Maui County.

Extreme Cold

Description

The term “extreme cold” can have varying definitions in hazard identification. Further, what is considered an extreme cold event will vary greater by region. Generally, extreme cold events refer to a

prolonged period (days) with extremely cold temperatures, which may or may not be associated with a winter storm. Temperatures near or below freezing in Maui's generally year-round warm and mild weather regions can have health risks to vulnerable populations, as well as economic impacts.

Hypothermia is an extreme cold-related impact that result when individuals are exposed to extreme temperatures. Hypothermia occurs when the body begins to lose heat faster than it can produce it. As a result, the body's temperature begins to fall. If an individual's body temperature falls below 95°F, then hypothermia has set in and immediate medical attention should be sought. Hypothermia is characterized by uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness and exhaustion. Left untreated, hypothermia will lead to death. Hypothermia occurs most commonly at very cold temperatures but can occur at cool temperatures (above 40°F) if an individual isn't properly clothed or becomes chilled.

Location

Nearly the entire United States is susceptible to extreme cold events. The degree of exposure typically depends on the normal expected severity of local winter weather. Given the atmospheric nature of the hazard, the entire county may experience extreme cold events, but higher elevations, such as Haleakalā summit, are more likely to experience extreme cold.

Previous Occurrences

In order to understand extreme cold events in Maui County, average cold temperatures were researched. Due to wind patterns and changing topography, average temperatures across Maui County and its many microclimates can vary widely. As taken from a monitoring station at Kahului Airport in central Maui, average low temperatures range from the low 60s in the winter months to the low 70s in the summer months. Record lows were colder, ranging from the upper-40s in the winter months to around 60 degrees in the summer months. The figure below shows average monthly maximum and record temperatures for the Kahului Airport monitoring station. It should be noted that average and extreme low temperatures at higher elevations within the County can be much cooler. For instance, temperatures at Haleakalā summit can regularly dip below freezing.

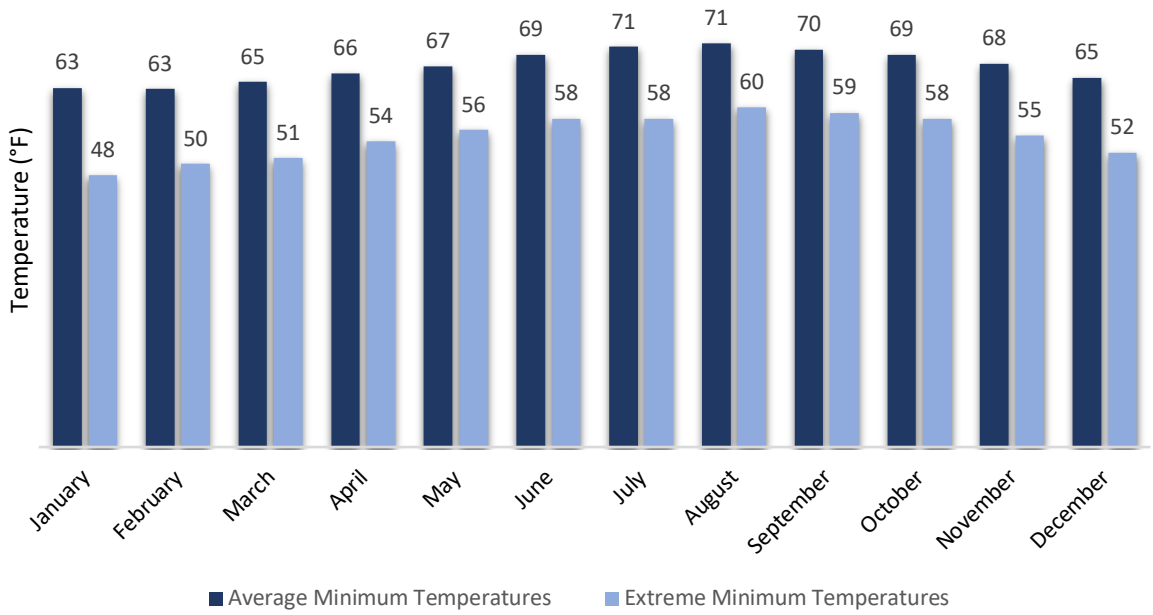

Figure 64. Average and Extreme Minimum Temperatures at Kahului Airport, Maui County.[110]

Past extreme cold events were gleaned from the NCEI Storm Events Database, which reported one historic extreme cold event in Maui County occurring in 2005 (reported as a high wind event). During this event, icy conditions on Haleakalā caused power outages and interruptions to broadcasting. Further, according to Maui County officials, Haleakalā received snow in 2019 and in 2020, and winter weather advisories were issued for Haleakalā in December 2016, December 2017, and February 2018 for snow, freezing rain, and icy roads at elevations above 9,000 feet. In addition, during the 2019 snow event, snow fell at Polipoli State Park on the slope of Haleakalā (6,200 feet elevation), which is possibly the lowest elevation record of snowfall in Hawai'i.[111] The figures below show icy conditions on Haleakalā from the 2019 event. During Kona storms, blizzard conditions are possible on Haleakalā. It is also expected that the county has experienced extreme cold events that have gone unreported, especially those events which did not result in injuries or damages.

[110] Western Regional Climate Center, Kahului Airport (512572) (2020). Retrieved from https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?hi2572.

[111] Erdman, J. (2019). *Hawai'i Storm Might Have Set the State's All-Time Record Low; Snow Fell on Maui, Too*. NWS. Retrieved from https://weather.com/news/news/2019-02-11-Hawai'i-storm-record-cold-maui-snow.

Figure 65. Blizzard Conditions at the Haleakalā Visitor Center (February 2019).

Figure 66. Ice covers telecommunications equipment on Haleakalā summit (February 2019).

Extent

The extent of extreme cold or freeze events can be measured in terms of record low temperatures. The lowest temperature reported from the Western Regional Climate Center at the Kahului Airport was 48°F, occurring in January of 1969. However, the lowest temperature recorded at Haleakalā summit was 15°F.[112] Lower temperatures are possible.

Extent of extreme cold can also be measured in terms of loss of human and animal life, or by economic costs imposed by property and infrastructure loss. No extreme cold impacts have been reported by the Maui County officials. Therefore, it is unlikely that an extreme cold event would cause significant property damage in the county.

Probability of Future Events

Extreme cold and winter weather events have been reported on Haleakalā every year since 2016. Further, it is likely that many extreme cold events impacting the county have occurred but were not reported.

The frequency of extreme cold events is projected to decline in the future due to overall warming trends associated with climate change (see section below). Based on the above factors, an annual probability was assigned for extreme cold events in each community planning area in Maui County. Community planning areas with higher elevations are more likely to experience extreme cold events than those at lower elevations, such as central valley areas. The table below presents extreme cold probabilities for each community planning area.

Table 34. Extreme Cold Event Probabilities for Maui County Community Planning Areas.

Community Planning Area	Extreme Cold Probability
Hāna	Likely (10% to 90% annual chance)
Kīhei-Mākena	Unlikely (Less than 1% annual chance)
Lānaʻi	Possible (1% to 10% annual chance)
Makawao-Pukalani-Kula	Likely (10% to 90% annual chance)
Molokaʻi	Possible (1% to 10% annual chance)
Pāʻia-Haʻikū	Possible (1% to 10% annual chance)
Wailuku-Kahului	Possible (1% to 10% annual chance)
West Maui	Possible (1% to 10% annual chance)

[112] Western Regional Climate Center, Haleakala Summit, 338 (1957-1975). *Minimum of Minimum Temperatures*. Retrieved from https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?hi1008.

Vulnerability

While extreme cold events are rare, particularly in lower elevations, all of Maui County, including all current and future buildings, populations, and critical facilities, are vulnerable to extreme cold events.

Building and Infrastructure Impacts (including Critical Facilities)

All structures, including critical facilities, are at risk to extreme cold events. Temperatures dipping below freezing may cause damage to structures, such as burst pipes, although temperatures in most areas of the county are rarely low enough to freeze pipes. Structure fires are also more common during extreme cold events, as alternative or unsafe heating sources are more likely to be employed (i.e., woodfires, space heaters).

Life Safety, Health, Warning, and Evacuation Impacts

All populations in Maui County are considered at risk to extreme cold events. While unlikely in most areas of Maui County, extreme cold can result in frostbite or hypothermia. Certain populations, such as the elderly, young children, and those without access to an adequate heat source are considered at a higher risk to the impacts of extreme cold. Evacuations are not likely for extreme cold events. In summit areas, winter storm or wind chill warnings may be issued in association with extreme cold events. At elevations below 6,000 feet, a freeze warning is issued if temperatures drop below freezing.[113]

Public Health Impacts

Wide-scale impacts to public health from extreme cold/wind chill events are limited. Carbon monoxide-related deaths are highest during extreme cold events, due to the increased use of gas-powered furnaces and alternative heating sources (e.g., generators, grills, and camp stoves) inside homes and buildings. Risk for fire and electric shock is also increases when using alternative heating and power sources, such as space heaters.[114]

Impacts to Vulnerable Populations

While rare, and more likely to affect those in high-elevation areas of Maui County such as portions of the Makawao-Pukalani-Kula and Hāna Community Planning Areas, based on the available hazard information extreme cold events may affect the entire county. While all vulnerability subcomponents are summarized below, vulnerable populations exhibiting constraints related to household composition, socioeconomic status and access to lifelines may be most susceptible to negative consequences resulting from extreme cold. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are also described below.

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[113] National Weather Service Honolulu, HI Forecast Office. *Questions about products*. Retrieved from https://www.weather.gov/hfo/prod_questions.

[114] Extreme weather and Public Health. (2017). Arizona Department of Health Services. Retrieved from http://www.azdhs.gov/preparedness/epidemiology-disease-control/extreme-weather/index.php#cold-co-poisoning.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty managing the impacts of extreme cold due to their inability to communicate needs or take actions to warm themselves.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints may lack the necessary economic resources to adequately prepare for an extreme cold event. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate preparedness or mitigation actions such as repair or insulation of homes, or purchase and installation of safe heating options.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon hazard information related to extreme cold. Additionally, those who do not speak English well may not comprehend hazard information to the extent that enables them to make timely decisions and take appropriate actions.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living at higher elevations and in housing built before 1950, prior to the enactment of modern building codes, may be more susceptible to extreme cold events in that these homes may lack insulation or adequate heating systems. In addition, higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences as a result of hazard exposure.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges and have difficulty accessing needed supplies and services before, during and after a hazard event. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care. Delays in accessing treatment for conditions resulting from extreme cold (i.e., hypothermia) can result in loss of life.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health

insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Moloka‘i households also do not have access to a vehicle.

Economic Impacts
Economic impacts of extreme cold events in Maui County and limited. Losses due to decreased tourist activity during extreme cold events (such as beach-going, water sports, and boating) may occur. Further, extreme cold temperatures may result in losses to agriculture or landscaping.

Climate Change Impacts
Extreme cold and freeze events are projected to become less frequent and less intense in Maui County as temperatures increase. According to the Fourth National Climate Assessment, annual average temperatures in Hawai'i will increase by 2-3°F by the mid-21st century and 5-6°F by the late-21st century under a high emissions scenario (representative concentration pathway (RCP) 8.5).[115] RCP 8.5 is a scenario in which emissions continue to rise sharply through 2050 and plateau around 2100.

However, an increase in intense storms may result in increased snowfall events at Maui County's higher elevations, as observed in recent years. When it snows on Haleakalā, traffic jams are caused up the mountain as people travel to see it. Further, it is unknown if climate change will cause increases in Kona storm frequency and intensity, which can bring blizzard-like conditions to high elevations.

Extreme Heat

Description

Extreme heat is generally defined as temperatures that hover 10 degrees or more above the average high temperature for the region and last for an extended period. A heat wave may occur when temperatures hover 10 degrees or more above the average high temperature for the region and last for an extended period. The actual temperature threshold depends on norms for the region.[116]

Extreme heat events are usually a result of both high temperatures and high relative humidity. (Relative humidity refers to the amount of moisture in the air.) The higher the relative humidity or the more moisture in the air, the less likely that evaporation will take place. This becomes significant when high relative humidity is coupled with soaring temperatures. On hot days, the human body relies on the evaporation of perspiration or sweat to cool and regulate the body's internal temperature. Sweating does nothing to cool the body unless the water is removed by evaporation. When the relative humidity is high, then the evaporation process is hindered, robbing the body of its ability to cool itself.

[115] US Global Change Research Program (2018). Fourth National Climate Assessment, Chapter 2: Climate. Retrieved from https://nca2018.globalchange.gov/chapter/2/.
[116] University of Washington Emergency Management (2017). *Extreme heat*. Retrieved from https://www.washington.edu/uwem/preparedness/know-your-hazards/extreme-heat/

NOAA's NWS devised the Heat Index as a mechanism to better inform the public of heat dangers. The Heat Index Chart, shown in Figure 67, uses air temperature and humidity to determine the heat index or apparent temperature.[117] In addition, information regarding the health dangers by temperature range is presented.

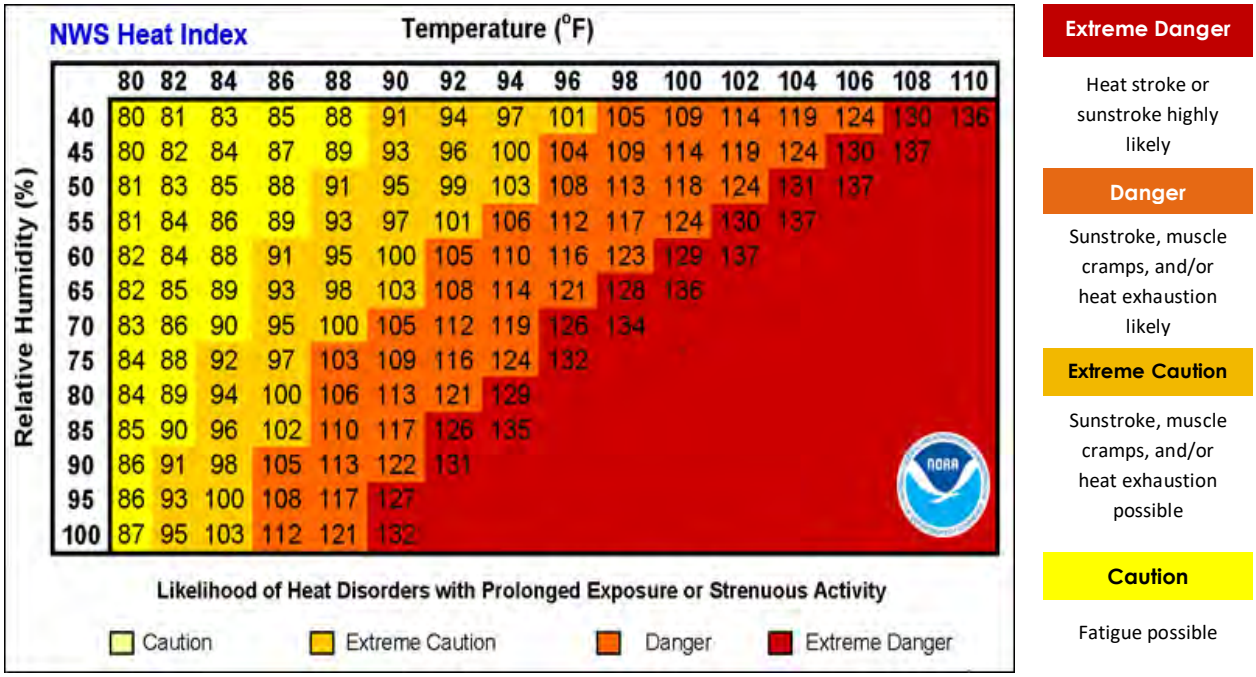

Figure 67. NWS Heat Index Chart.

Some populations, such as the elderly and young, are more susceptible to heat danger than other segments of the population.

Heat Disorders: Heat disorders are illnesses caused by prolonged exposure to hot temperatures and are characterized by the body's inability to shed excess heat. These disorders develop when the heat gain exceeds the level the body can remove or if the body cannot compensate for fluids and salt lost through perspiration. In either case, the body loses its ability to regulate its internal temperature. All heat disorders share one common feature: the individual has been overexposed to heat, or over exercised for their age and physical condition on a hot day. The following describes the symptoms associated with the different heat disorders.

Sunburn: Sunburn is characterized by redness and pain of skin exposed too long to the sun without proper protection. In severe cases it can cause swelling, blisters, fever and headaches. It can significantly retard the skin's ability to shed excess heat.

Heat Cramps: Heat cramps are characterized by heavy sweating and painful spasms, usually in the muscles of the legs and possibly the abdomen. The loss of fluid through perspiration leaves the body

[117] NWS Heat Index (n.d.). NOAA. Retrieved May 3, 2019 from https://www.weather.gov/safety/heat-index.

dehydrated resulting in muscle cramps. This is usually the first sign that the body is experiencing trouble dealing with heat.

Heat Exhaustion: Heat exhaustion is characterized by heavy sweating, weakness, nausea, exhaustion, dizziness and faintness. Breathing may become rapid and shallow and the pulse weak. The skin may appear cool, moist and pale. Blood flow to the skin increases, causing blood flow to decrease to the vital organs. This results in a mild form of shock. If not treated, the victim's condition will worsen.

Heat Stroke (Sunstroke): Heat stroke is a life-threatening condition characterized by a high body temperature (106°F or higher). The skin appears to be dry and flushed with very little perspiration present. The individual may become mentally confused and aggressive. The pulse is rapid and strong. There is a possibility that the individual will faint or slip into unconsciousness. If the body is not cooled quickly, then brain damage and death may result.

Studies indicate that, all things being equal, the severity of heat disorders tend to increase with age. Heat cramps in a 17-year-old may be heat exhaustion in someone 40 and heat stroke in a person over 60. Elderly persons, small children, chronic invalids, those on certain medications and persons with weight or alcohol problems are particularly susceptible to heat reactions.

Location

The entire county is impacted by extreme heat events. Warmer, drier locations within the county (such as leeward areas) may be higher risk for extreme heat events than windward locations within the county, or areas at high elevations.

Previous Occurrences

In order to understand extremes, average temperatures were researched. Average maximum temperatures in Maui County range from the mid-80s throughout the year. Record highs were hotter, ranging from the low-90s in the winter months to the upper-90s in the summer months. Such temperatures can be extremely dangerous. Figure 68 below shows average monthly maximum and record maximum temperatures for a monitoring station at Kahului Airport in Maui.

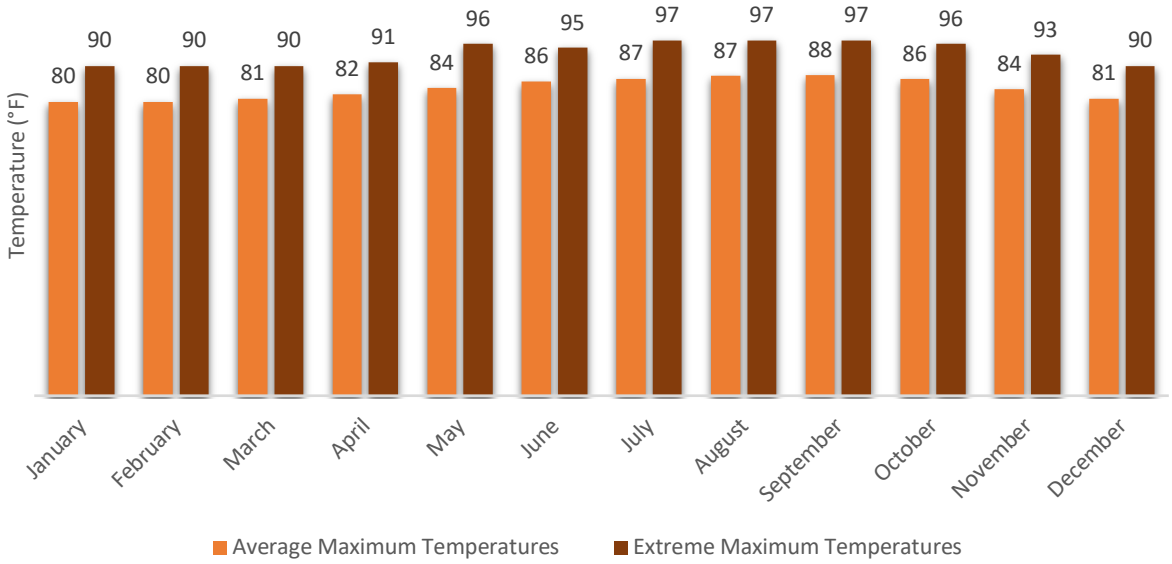

Figure 68. Average and Extreme Maximum Temperatures in Maui County (Kahului Airport), 1954-2019.[118]

Past extreme heat events were gleaned from the NCEI Storm Events Database, which reported no historic extreme heat events for Maui County. However, Maui County experiences temperatures in the 80s and 90s regularly, and historic extreme heat events have occurred. Most notable was the recent heat wave in 2019. The heat wave set records from spring through early fall. From mid-August to mid-September, Hawai'i experienced record-breaking heat for 29 out of 30 days.[119] From April to October, 84 heat records were tied or broken in Maui County, and July saw the highest energy demand in Maui County in a decade.[120,121] Further, it is likely that Extreme Heat events have impacted Maui County that have not been reported.

Extent

Extent of extreme heat can be defined with record highs and the NWS Heat Index. The record temperature at the Kahului Airport monitoring station is 97°F, occurring in 1994, 2015, and 2019. This temperature reaches the extreme danger level (Figure 67) of the NWS Heat Index Chart when combined

[118] Western Regional Climate Center (2020). *Monthly Temperature Listings for Kahului AP, HI (512572)*. Retrieved from https://wrcc.dri.edu/cgi-bin/cliMAIN.pl?hi2572.
[119] Osher, W. (2019). *Record heat for 29 out of 30 days in Hawai'i*. Maui Now. Retrieved from https://mauinow.com/2019/09/16/record-heat-for-28-out-of-29-days-in-Hawai'i/.
[120] Imada. L. (2019). *84 heat records tied, broken since April.* The Maui News. Retrieved from https://www.mauinews.com/news/local-news/2019/10/84-heat-records-tied-broken-since-april/.
[121] Cerizo, K. (2019). *Maui Electric Co. reports highest energy demand in decade amid island heat wave*. The Maui News. Retrieved from https://www.mauinews.com/news/local-news/2019/07/meco-reports-highest-energy-demand-in-decade-amid-heat-wave/.

with relative humidity levels over 65%, which are common in Maui County. Higher temperatures are possible, especially as warming trends are projected to occur with climate change.

The extent of extreme heat events can also be measured in terms of loss of human life, or by economic costs imposed by property, crop, and infrastructure loss. No deaths or damages have been reported due to extreme heat events in Maui County.

Probability of Future Events

While temperatures in much of Maui County are fairly consistent year-round (e.g., not prone to temperature extremes), Maui County regularly experiences temperatures in the "danger" category on the NWS Heat Index Chart (upper 80s and 90s considering Maui's relative humidity). Further, it is likely that record temperatures and frequency of heat events will increase as a result of climate change as temperatures warm (see *Vulnerability Assessment*, below). Based on the above factors, an annual probability was assigned for extreme heat events in each community planning area in Maui County. Community planning areas with higher elevations and dense vegetation are less likely to experience extreme heat events, whereas urban areas at lower elevations, such as the central valley, are more likely to experience extreme heat. The table below presents extreme heat probabilities for each community planning area.

Table 35. Extreme Heat Event Probabilities for Maui County Community Planning Areas.

Community Planning Area	Extreme Heat Probability
Hāna	Likely (10% to 90% annual chance)
Kīhei-Mākena	Highly Likely (Greater than 90% annual chance)
Lānaʻi	Likely (10% to 90% annual chance)
Makawao-Pukalani-Kula	Likely (10% to 90% annual chance)
Molokaʻi	Likely (10% to 90% annual chance)
Pāʻia-Haʻikū	Likely (10% to 90% annual chance)
Wailuku-Kahului	Highly Likely (Greater than 90% annual chance)
West Maui	Highly Likely (Greater than 90% annual chance)

Vulnerability

As the extreme heat hazard is atmospheric and does not have a geographic boundary, all current and future populations and structures, including critical facilities, are considered at risk.

Building and Infrastructure Impacts (including Critical Facilities)

Extreme heat events generally have limited impact on buildings. However, in some rare cases extreme heat can cause structures to collapse or buckle. Similarly, extreme heat events generally have minimal impact on infrastructure. Power consumption for air-conditioned environments could increase and thus stress utility infrastructure, resulting in blackouts or brownouts.

Life Safety, Health, Warning, and Evacuation Impacts

Maui County is vulnerable to extreme heat, particularly in the summer months. Urban areas are exposed more acutely to the dangers of extreme heat due to the urban heat island effect. While all populations are considered vulnerable to extreme heat, certain populations may be more vulnerable to the effects of extreme heat. Groups particularly vulnerable to extreme heat include:[122]

- Older adults who do not adjust as quickly to changes in temperature. Older adults are also more likely to be on medications or have chronic illnesses that affect the body's ability to regulate its temperature.
- Infants and children, who rely on others to keep them cool and hydrated.
- Athletes, who may be more likely to exercise and become dehydrated during extreme heat events.
- Outdoor workers, who have more exposure to extreme heat and are more likely to become dehydrated.
- Households without air conditioning available at home.

People are at risk for heat stroke or sun stroke, heat exhaustion, fatigue, and dehydration. Preparedness reduces the risks associated with this hazard. In cases of extreme heat:

- Stay indoors as much as possible to limit exposure (consider public buildings such as libraries, schools, movie theaters, or cooling centers if you do not have air conditioning);
- Limit alcoholic intake;
- Drink plenty of water, even if you do not feel thirsty;
- Do not leave children or pets in vehicles;
- Check on vulnerable populations;
- Arrange your day to avoid strenuous work during the warmest part of the day, if possible;
- Use an electric fan to vent hot air out or bring cool air in; and
- Wear loose-fitting clothing.

In Maui County, an Excessive Heat Advisory is issued by the NWS for elevations at or below 3,000 feet when daytime heat indices of 105°F or greater and nighttime heat index values of 80°F or greater are expected for at least two consecutive days.[123] Visitors who are not adjusted to warmer climates may be at a higher risk to adverse heat impacts, or may not recognize symptoms associated with heat exhaustion or heat stroke.

Public Health Impacts

Aside from the heat-induced health impacts described above, extreme heat negatively impacts air quality by increasing the amount of ground-level ozone (or smog). Worsened air quality can aggravate

[122] Centers for Disease Control and Prevention (2017). *Natural Disasters and Severe weather – About extreme heat*. (2017). Retrieved from https://www.cdc.gov/disasters/extremeheat/heat_guide.html.

[123] National Weather Service Honolulu, HI Forecast Office. *Questions about products*. Retrieved from https://www.weather.gov/hfo/prod_questions.

existing respiratory illnesses, and long-term exposure can result in decreased lung function.[124] Extreme heat can degrade water quality by heating water bodies directly or heating runoff that drains into them.

Impacts to Vulnerable Populations

Based on available hazard information, extreme heat events may affect the entire county of Maui but have a greater probability of occurring in the Wailuku-Kahului, West Maui, and Kīhei-Mākena Community Planning Areas, ranked second, third, and sixth, respectively, for overall vulnerability. While all vulnerability subcomponents are summarized below, vulnerable populations exhibiting constraints related to household composition, socioeconomic status and access to lifelines may be most susceptible to negative consequences resulting from extreme heat. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are also described.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty managing the impacts of extreme heat due to their inability to communicate needs or take actions to cool themselves. According to the Centers for Disease Control and Prevention (CDC),[125] elders are particularly vulnerable to heat stress as they do not adjust readily to sudden changes in temperature, are more likely to have a chronic medical condition that alters normal body responses to heat, and are more likely to take prescription medications that affect the body's ability to regulate temperature.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints may lack the necessary economic resources to adequately prepare for an extreme heat event. The unemployed, low-income households, and those receiving public assistance have little to no financial

[124] Ozone Basics. (2017). US EPA. Retrieved August 29, 2017 from https://www.epa.gov/ozone-pollution/ozone-basics#effects.

[125] Heat and Older Adults. (2017). CDC. Retrieved June 24, 2020 from https://www.cdc.gov/disasters/extremeheat/older-adults-heat.html#:~:text=Older%20adults%20do%20not%20adjust,control%20its%20temperature%20or%20sweat.

buffers that would facilitate preparedness or mitigation actions such as purchase and installation of cooling systems such as air conditioning, or insulation of homes.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience difficulty in receiving and acting upon information pertaining to extreme heat. Additionally, those who do not speak English well, may not comprehend hazard information to the extent that enables them to make timely decisions and take appropriate actions.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living in housing built before 1950 and prior to the enactment of modern building codes may be more susceptible to the effects of extreme heat events in that these homes may lack adequate ventilation, insulation, or modern air conditioning systems. In addition, higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences as a result of hazard exposure.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of

the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges and have difficulty accessing needed supplies and services before, during and after a hazard event. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care. Delays in accessing treatment for conditions resulting from extreme heat (i.e., heat stroke, heat exhaustion) can result in serious health risks and loss of life.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Molokaʻi households also do not have access to a vehicle.

Economic Impacts

Generally, economic impacts due to extreme heat are minimal. It is possible that indirect losses due to business interruption in the case of a power outage during an extreme heat event. Extreme heat waves may negatively impact tourism. Economic impacts expected from warming caused by climate change are further described below.

Climate Change Impacts

According to the Fourth National Climate Assessment, annual average temperatures in Hawai'i will increase by 2-3°F by the mid-21st century and 5-6°F by the late-21st century under a high emissions scenario (representative concentration pathway (RCP) 8.5).[126] This warming trend means that extreme heat events in Maui County are expected to become more frequent and more intense.

[126]US Global Change Research Program (2018). Fourth National Climate Assessment, Chapter 2: Climate. Retrieved from https://nca2018.globalchange.gov/chapter/2/.

Significant increases in extreme heat events could have severe health impacts, especially for vulnerable populations such as the elderly, young, outdoor workers, and impoverished households. An increase in extreme heat days could also contribute to more frequent and severe droughts and wildfires, as baseflow in streams decreases and evaporation increases. In addition, warming has the potential to cause economic and environmental impacts within Maui County. According to the Fourth National Climate Assessment, coral reefs contribute an estimated $477 million to the local economy every year in Hawai'i. Under projected warming, all nearshore coral reefs in Hawaiʻi will experience annual bleaching before 2050.

Flood

Description

Flooding is a frequent, dangerous, and costly hazard. Globally, it accounts for 40% of all natural disasters and results in an average of over 6,500 deaths annually.[127] In the U.S. flooding results in an average of 86 deaths annually.[128] Nearly 90% of all presidential disaster declarations result from natural events where flooding was a major component.

Flooding is the most common environmental hazard in the United States, due to the widespread geographical distribution of valleys and coastal areas, and the population density in these areas. The severity of a flooding event is typically determined by a combination of several major factors, including stream and river basin topography and physiography; precipitation and weather patterns; recent soil moisture conditions; and the degree of vegetative clearing and impervious surface. Flooding events can be brought on by severe (heavy) rain. On Maui, heavy rains typically occur from October through April. On Molokaʻi, heaviest rainfall is typically from December through March. Heavy rainfall, and therefore flooding, is generally produced by the following types of storms in Maui County:

- **Kona Storms** - These storms occur during the wettest period of the year, from November to April. Trade winds from the northeast slack during this time, allowing storms from the south to more easily approach the islands. Kona winds are generally warmer and carry moisture that is dropped evenly as rain over the entire county. The low-elevation and southern location of these storms means that drier sides of the islands get most of their rainfall (approximately 25 to 30 inches each season) during Kona storms. Because of the potential combination of high winds and heavy rains, these events can cause coastal and inland flooding over large geographic areas. Due to special hazards associated with these storms, they are addressed further under the *Hurricane (Including Tropical Storm and Kona Storm)* hazard profile.

- **Frontal Storms** — Frontal storms usually occur from December through March. They originate over the Pacific Ocean as a result of the intersection of polar and tropical air masses and move

[127] Data from 1980-2008. http://www.preventionweb.net/english/hazards/statistics/?hid=62
[128] http://www.nws.noaa.gov/om/hazstats/resources/weather_fatalities.pdf

eastward over the islands. Heavy continuous rainfall over a period of several hours can create hazard conditions in high sloping areas of the islands. Low-lying areas with poor drainage are prone to landslides and flash floods during these storms.

- **Upper Level Lows** — Upper level lows and troughs can occur any time of the year. In many instances, upper level lows have little or no effect on the lower levels of the atmosphere. However, these lows are sometimes able to tap into the marine layer and induce heavy showers that can result in flash flooding.

- **Tropical Cyclones**—Tropical depressions, tropical storms, and hurricanes hitting or passing near the Hawaiian Islands cause heavy rains, storm surge, high winds and surf. Impacts from these events include severe coastal and inland flooding. Tropical cyclones also cause severe damage due to high surf. Due to special hazards associated with these storms, they are addressed further under the *Hurricane (Including Tropical Storm and Kona Storm)* hazard profile.

In coastal areas, sea level rise and high surf can result in coastal flooding events. Storm surges due to hurricanes and tsunamis can also cause coastal flooding. Due to special hazards associated with these two types of coastal flooding, they are addressed as separate hazards within the *Hurricane* and *Tsunami* profiles of this risk assessment.

Types of flooding caused by inland and coastal flooding are presented below:

Types of Inland Flooding

- *Flash Flooding:*
  Flash floods occur within a few minutes or hours of heavy amounts of rainfall and can destroy buildings, uproot trees, and scour out new drainage channels. Heavy rains that produce flash floods can also trigger mudslides and landslides. Most flash flooding is caused by slow-moving thunderstorms, cyclones, Kona storms, or repeated thunderstorms in a local area. Although flash flooding often occurs in mountainous areas, it is also common in urban centers where much of the ground is covered by impervious surfaces. In Maui County, heavy precipitation at higher elevations can quickly flow downslope and cause flooding in more densely populated valley areas.

- *Sheet Flooding:*
  Sheet flooding is a condition where storm water runoff forms a sheet of water to a depth of six inches or more. Sheet flooding and ponding are often found in areas where there are no clearly defined channels and the path of flooding is unpredictable. It is also more common in flat areas. Most floodplains are adjacent to streams or oceans; although, almost any area can flood under the right conditions where water may accumulate.

- *Urban Flooding:*
  Urban flooding is usually caused by heavy rain over a short period of time. As land is converted from fields or woodlands to roads and parking lots, it loses its ability to absorb rainfall. Since sidewalks and roads are non-absorbent, rivers of water flow down streets and into sewers. Roads and buildings generate more runoff than tropical forestland. Fixed drainage channels in urban areas may be unable to contain the runoff that is generated by relatively small but intense rainfall events. Urbanization increases runoff two to six times over what would occur on natural terrain. This high volume of water can turn parking lots into lakes, flooding basements and businesses, and cause lakes to form in roads where drainage is poor or overwhelmed.

  Urban flooding often occurs where there has been development within or near stream floodplains. This is partly a result of the use of waterways for transportation purposes in earlier times. Sites adjacent to rivers and coastal inlets provided convenient places to ship and receive commodities. The accessibility to the water led to development near waterways which has generally increased in density overtime, leading to increased flooding in the ensuing urban areas. Urbanization intensifies the magnitude and frequency of floods by increasing impermeable surfaces, amplifying the speed of drainage collection, reducing the carrying capacity of the land and, occasionally, overwhelming sewer systems.

- *Riverine Flooding:*
  Periodic flooding of lands adjacent to non-tidal rivers and streams is a natural and inevitable occurrence. When stream flow exceeds the capacity of the normal watercourse, some of the above-normal stream flows onto adjacent lands within the floodplain. Riverine flooding is a function of precipitation levels and water runoff volumes within the watershed of a stream or river. The recurrence interval of a flood is defined as the average time interval, in years, expected to take place between the occurrence of a flood of a particular magnitude and an equal or larger flood. Flood magnitude increases with increasing recurrence interval.

Types of Coastal Flooding

- ***High Wave Flooding***
  High wave flooding, or high surf, is a frequently occurring coastal hazard within the Hawaiian Islands. Waves reaching the shoreline are determined by the wave energy within the approaching swell, which is a function of wave height and wave length (the distance between wave crests), as well as the shoreline aspect, slop, morphology, and geology. Offshore characteristics, such as seafloor depth and barriers, such as sandbars, islands, rocks, and reefs, also impact wave energy. When deep ocean swells encounter shallow island margins as they approach the shoreline, friction caused by the shallower seafloor cause the tops of swells to stack up on their bottoms, building wave height. Because the change from deep ocean seafloor to the island margins around the Hawaiian Islands is abrupt, surface waves grow very tall, very quickly. This process is shown in Figure 69. Large waves tend to travel in sets, and after breaking

they rush up onto the beach temporarily elevating the sea surface near the shoreline. Storm events that produce large swells may cause high wave coastal flooding.

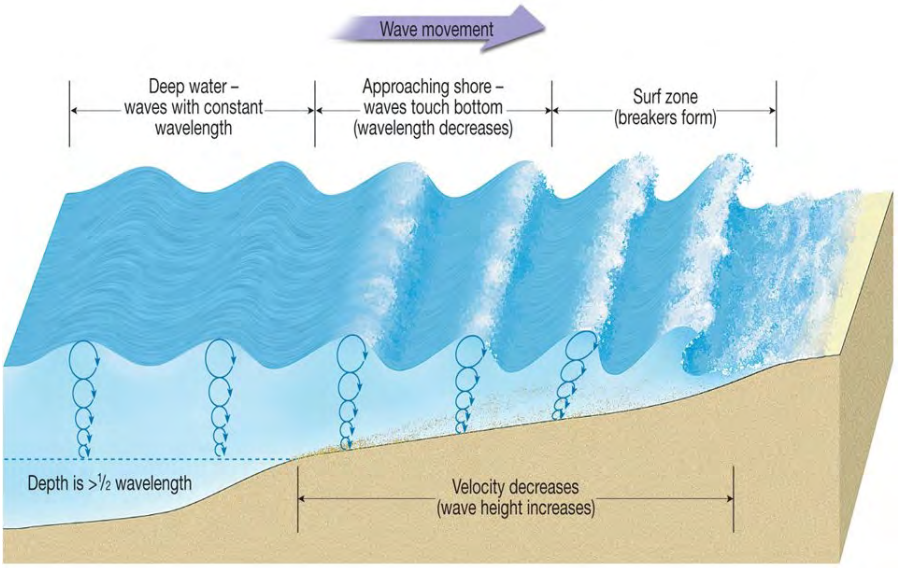

Figure 69. Wave Movement Cross-Section.[129]

- ***King Tides***
  King Tides, for which the scientific term is perigean spring tides, are the highest high tides of the year. Unlike high wave flooding, which is typically a product of storm events and large swells, King Tides are a product of the moon's orbit around Earth and the Earth's orbit around the sun. In Hawai'i, King Tides tend to occur during the summer (e.g., July and August) and winter (e.g., December and January) months in conjunction with full moons and new moons. King Tides occur when the moon is at its closest point to Earth during its monthly orbit, as the gravitational pull is stronger, and when the Earth, moon, and sun are in alignment, as the sun and the moon's individual gravitational pulls produce largest tides.[130] The figure below shows the formation of King Tide conditions. King Tides can cause coastal flooding and inundation of low-lying coastal areas.

[129] Pearson Prentice Hall (2009). *Changes that occur when a wave moves onto shore.*
[130] University of Hawai'i Sea Grant (2018). *What is a King Tide?* Retrieved from https://seagrant.soest.Hawai'i.edu/coastal-and-climate-science-and-resilience/ccs-projects/what-is-a-king-tide/.

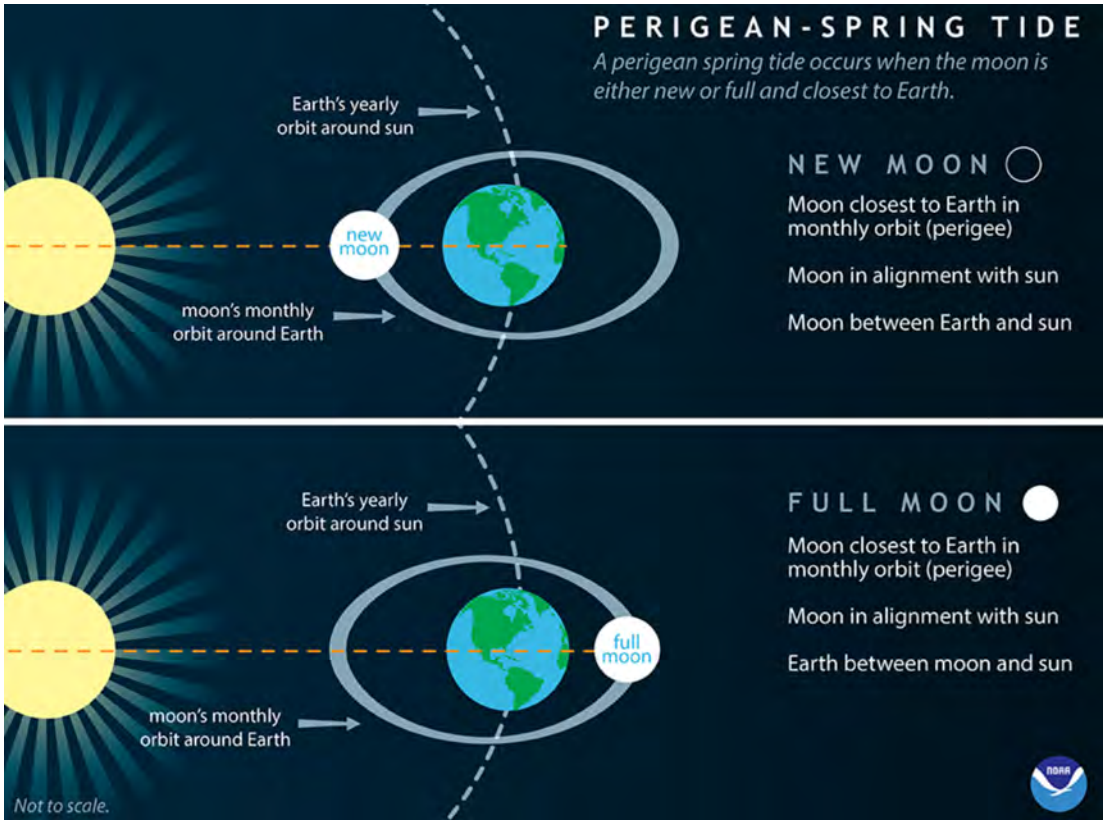

Figure 70. King Tide Formation.[131]

- ***Sea Level Rise***
  While sea level rise is more passive than other types of flooding, over time rising sea levels will inundate buildings and infrastructure that is not currently inundated. More imminent threats occur when rising sea levels contribute to the intensity of other coastal hazards, such as high surf, high tides, coastal erosion, and storm surges. For instance, along the U.S. coastline, high tide flood is 300% to 900% more common than it was 50 years ago. Sea level rise is an effect of climate change. Rising sea levels are mostly due the combination of meltwater from glaciers and ice sheets and thermal expansion of seawater as it warms. Globally, mean sea level has risen approximately eight to nine inches since 1880. Moreover, the rate of global sea level rise is accelerating, doubling from 0.06 inches per year throughout most of the twentieth century to 0.14 inches per year from 2006 to 2015.[132]

[131] NOAA. Retrieved from https://seagrant.soest.Hawai'i.edu/coastal-and-climate-science-and-resilience/ccs-projects/what-is-a-king-tide/.
[132] Lindsey, R. (2019). *Climate Change: Global Sea Level.* NOAA. Retrieved from https://www.climate.gov/news-features/understanding-climate/climate-change-global-sea-level.

FEMA Flood Zones

As part of the National Flood Insurance Program (NFIP), FEMA identifies and maps several types of floodplains. These are identified areas of flood occurrence. However, not all flooding occurs in such areas. Localized urban flooding and flash flooding often occur outside of designated floodplain areas. Further, areas of future flood risk associated with climate change, such as areas subject to sea level rise or coastal erosion, may not be included in FEMA mapped floodplains.

Floodplains are delineated on Flood Insurance Rate Maps (FIRMs), which are official maps of a community on which FEMA has delineated both the Special Flood Hazard Areas (SFHA) and the risk premium zones applicable to the community. These maps identify:

- SFHAs;
- The location of a specific property in relation to SFHAs;
- The base flood elevation (1-percent-annual-chance) at a specific site;
- The magnitude of a flood hazard in a specific area;
- The undeveloped coastal barriers where flood insurance is not available; and,
- Locations of regulatory floodways and floodplain boundaries (1-percent and 0.2-percent-annual-chance floodplain boundaries).

Floodplains: A floodplain is generally the land area susceptible to being inundated or flooded by water from any source (i.e., river, stream, lake, ocean, estuary, etc.). Floodplains are natural features of any river or stream. Streams that drain more than one square mile have their estimated floodplain areas mapped in most areas. The mapped floodplain areas are called the regulatory floodplain. The regulatory floodplain mapping is a result of the hydrologic (rainfall) and hydraulic (runoff) analysis of the watershed and stream.

The regulatory floodplain is also known as the 100-year floodplain, base flood elevation, 1.0-percent-annual-chance floodplain or the SFHA. The 100-year floodplain is the land area that is subject to a 1.0 percent or greater chance of flooding in any given year. The term “100-year flood” is often misinterpreted. The 100-year flood does not mean that it will occur once every 100 years. A 100-year flood has a 1 in 100 (1%) chance of occurring in any given year and may occur multiple times in a single year. It is also possible not to have a 100-year flood event over the course of 100 years or more.

The floodway is a portion of the floodplain required to convey the flood event. The flood fringe provides flood water storage. The floodway is the high velocity area and structures or obstructions in the floodway can increase flood heights.

Floodplains in Maui County, including the floodway, are regulated by the Hawaiian DLNR and local regulations. DLNR works with FEMA and local governments by providing grants and technical assistance, evaluating community floodplain management programs, reviewing local floodplain ordinances, and participating in statewide flood hazard mitigation planning.

While the 100-year (or base flood) is the standard most commonly used for floodplain management and regulatory purposes in the United States, the 500-year flood, also known as the 0.2-percent-annual-chance flood area, is the national standard for protecting critical facilities, such as hospitals and power plants (when federally funded). A 500-year flood has a 1 in 500 (0.2%) chance of occurring in any given year. It is generally deeper than a 100-year flood and covers a greater amount of area; however, it is statistically less likely to occur.

Special Flood Hazard Area and Flood Insurance Rate Maps: A SFHA shown on a FIRM is the regulatory floodplain. SFHAs are delineated on the FIRMs and may be designated as Zones A, AE, AO, AH, AR V, VE, A-99. Structures located in the SFHA are highly susceptible to flooding. Structures located in the SFHA Zones are required by lenders to purchase flood insurance. Anyone in a community that participates in the NFIP may voluntarily purchase flood insurance. The following SFHA zones are present within Maui County:

- **Zone A**: Zone A is the flood insurance rate zone that corresponds to the 1.0-percent-annual-chance floodplains determined in the Flood Insurance Study by approximate methods. Because detailed hydraulic analyses are not performed for such areas, no Base Flood Elevations (BFEs) or depths are shown within this zone. Mandatory flood insurance purchase requirements apply.

- **Zone AE**: Zone AE is the flood insurance rate zone that corresponds to the 100-year floodplains determined in the Flood Insurance Study (FIS) by detailed methods. In most instances, BFEs derived from the detailed hydraulic analyses are shown at selected intervals within this zone. Mandatory flood insurance purchase requirements apply.

- **Zone AH:** Zone AH is a flood insurance rate zone that corresponds to areas subject to inundation by 1% annual chance shallow flooding (usually areas of ponding) where average depths are between one and three feet. BFEs derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements and floodplain management standards apply.

- **Zone AO**: Zone AO is a flood insurance rate zone that corresponds to the 1.0-percent-annual-chance shallow flooding (usually sheet flow on sloping terrain) where average depths are between one and three feet. Average flood depths derived from detailed hydraulic analyses are shown in this zone. Mandatory flood insurance purchase requirements apply.

- **Zone V**: Zone V is a flood insurance rate zone that corresponds to areas along coasts subject to inundation by the 1% annual chance flood event with additional hazards associated with storm-induced waves (i.e. velocity). Because detailed hydraulic analyses have not been performed, no BFEs or flood depths are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

- **Zone VE**: Zone VE is a flood insurance rate zone that corresponds to areas subject to inundation by the 1% annual chance flood event with additional hazards due to storm-induced velocity

wave action. BFEs derived from detailed hydraulic analyses are shown. Mandatory flood insurance purchase requirements and floodplain management standards apply.

Coastal SFHAs occur within Maui County. The NFIP depicts the following coastal flood hazard zones on its DFIRMs:

- Zones VE, where flood elevation includes wave heights equal to or greater than three feet. These areas are referred to Coastal High Hazard Areas (CHHAs); and,
- Zone AE, where flood elevation includes wave heights less than three feet.

Post-storm field visits and laboratory tests throughout coastal areas of the United States have confirmed that wave heights as low as 1.5 feet can cause significant damage to structures that were not constructed to withstand forces such as wave hazards present within VE zones. Because of this hazard, FIRMs include a line showing the Limit of Moderate Wave Action (LiMWA), which is the inland limit of the area expected to receive 1.5-foot or greater breaking waves during the 1-percent-annual-chance flood event. In this way, LiMWA alerts property owners in Zone AE that their property may be affected by 1.5-foot or higher breaking waves. The area between Zone VE and the LiMWA is referred to as the Coastal Zone A, although this is not an official flood zone.[133] The figure below shows LiMWA and coastal flood zones.

The current effective FIRM for Maui County does not delineate LiMWA areas. Future map updates will likely include such information and should be used to inform additional coastal flooding mitigation measures.

[133] FEMA. *Coastal flood risk information and the Limit of Moderate Wave Action.*. Retrieved from https://www.fema.gov/media-library-data/1516028296688-05a9d47bf6ed912adac04cadbd6ab055/New_Coastal_Flood_Risk_Information_-_LIMWA.pdf

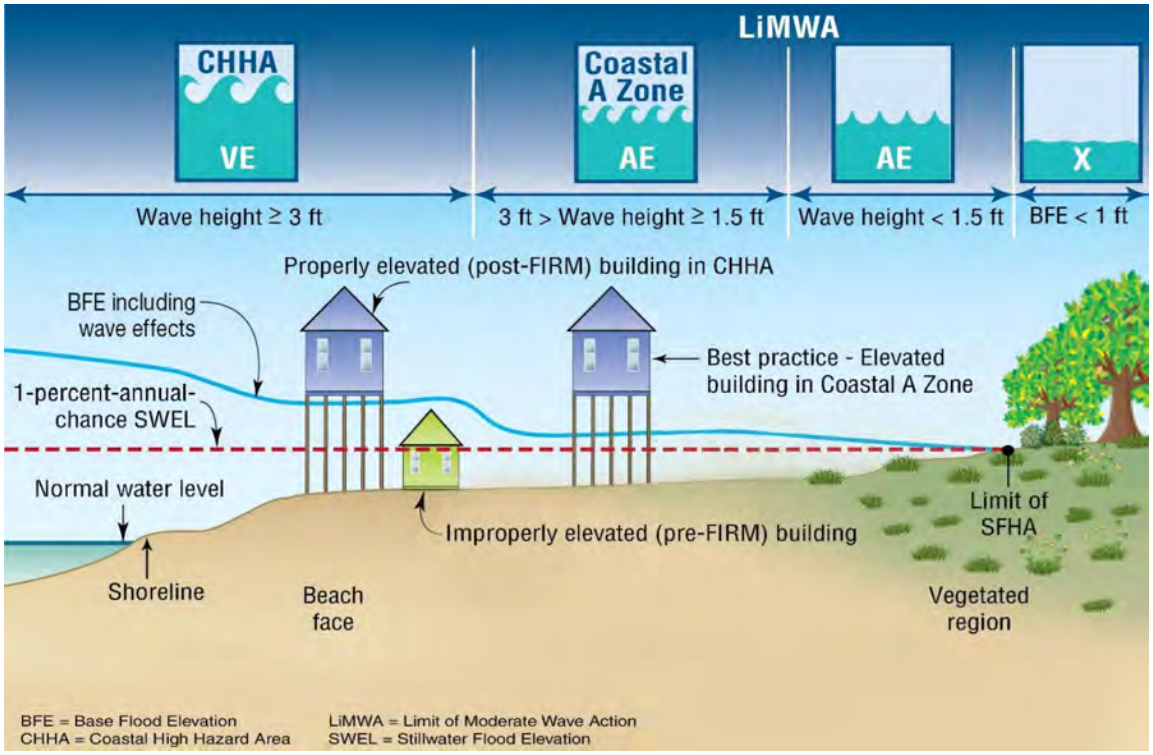

Figure 71. Limit of Moderate Wave Action.

In addition to SFHA zones, Zone X is also present in Maui County. Zone X corresponds to areas outside of the 1.0-percent-annual-chance flood area and includes areas in the 0.2-percent-annual-chance flood boundary and areas of minimal flood hazard. Zone D is also present within Maui County. The Zone D designation is used for areas where there are possible but undetermined flood hazards, as no analysis of flood hazards has been conducted. The designation of Zone D is also used when a community incorporates portions of another community's area where no map has been prepared. Flood insurance is available in Zone D and property owners are encouraged to purchase it, but flood insurance is not mandatory as it is in the 1-percent-annual-chance flood hazard area.

As a part of the NFIP, the Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed the minimum program requirements. For participating communities, NFIP flood insurance premium rates are discounted to reflect the reduced flood risk resulting from the community actions meeting the three goals of the CRS:

1. Reduce flood damage to insurable property;
2. Strengthen and support the insurance aspects of the NFIP, and
3. Encourage a comprehensive approach to floodplain management.

The CRS uses a class rating system that is similar to fire insurance rating to determine flood insurance premium reductions for residents. CRS classes are rated from 10 to 1. Most communities enter the

program at a CRS Class 9 or Class 8 rating, which entitles residents in SFHAs to a 5% discount on their flood insurance premiums for a Class 9 or a 10% discount for Class 8. As a community engages in additional mitigation activities in alignment with the CRS, its residents become eligible for increased NFIP policy premium discounts, as each CRS class improvement produces a 5% greater discount on flood insurance premiums for properties.[134] Over 1,500 communities in the U.S. currently participate in the CRS. Maui County has participated in the CRS since 1995. As of 2018, Maui County participates in the CRS as a Class 7, which allows for a 15% discount on flood insurance premiums.

The severity of flooding is determined by a combination of topography and physiography, ground cover, precipitation and weather patterns and recent soil moisture conditions. Principal flooding sources on the Island of Maui, as identified on FEMA flood maps, include the following:[135]

- Hahakea Gulch
- Honokahua Stream
- Honokeana Bay Gulch
- Honokōwai Stream
- Iao Stream
- Kahana Stream
- Kahoma Stream
- Kahului Harbor
- Kailua Gulch
- Kalepa Gulch
- Kalialinui Gulch
- Kaluaihakoko Stream
- Kamaole Gulch
- Kaopala Gulch
- Kauaula Stream
- Keahaiwai Gulch
- Kēōkea Gulch
- Kīhei Gulch 1
- Kīhei Gulch 2
- Kīhei Gulch 3
- Kīhei Gulch 4
- Kope Gulh
- Kulanihakoi Gulch
- Liilioholo Gulch
- Mahinahina Gulch
- Nāpili Gulch 2
- Nāpili Gulch 3
- Nāpili Gulch 4
- Nāpili Gulch 5
- Olowalu Gulch 2
- Olowalu Stream
- Spreckel's Ditch (Wailuku Town Area)
- Unnamed Stream at Kuau Point
- Waiakoa Gulch
- Waiakoa/Keahaiwai Split Flow
- Waiehu Stream
- Waiheʻe River
- Waikapū Honoapaiilani Highway Overflow
- Waikapū Stream
- Waipuilani Gulch

Similarly, principal flooding sources on the Island of Molokaʻi, as identified on FEMA flood maps, include the following:

- Kahananui Gulch
- Kamalo Gulch
- Kamiloloa Gulch
- Kaunakakai Stream
- Kawela Gulch
- Keawanui Gulch
- Manawai Gulch
- Mile 84 Stream
- Ohia Gulch
- Pukoo Gulch
- Unnamed Gulch
- Waialua Stream

[134]FEMA (2020). *Community Rating System*. Retrieved from https://www.fema.gov/media-library-data/1584566648735-b8216fe96907ffae2399034acd4c8e92/NFIP_CRS_Fact_Sheet_2020_508OK.pdf.
[135] FEMA (2015). *Maui County, Hawaiʻi Flood Insurance Study (150003V001D)*. Retrieved from https://map1.msc.fema.gov/data/15/S/PDF/150003V001D.pdf?LOC=bb787f550d43d7b0ddd5e04aa3e2284f.

In addition to the streams above, detailed studies were also conducted on the entire coastlines of Maui and Molokaʻi to determine tsunami inundation limits. Approximately 80% of the coastline of Lānaʻi has undergone such assessment. Additionally, the following sections of coast were studied in whole for the hurricane storm surge and wave height hazard using detailed methods:

- On the Island of Lānaʻi, the southwestern and southern coastline from Kaumalapau to Mānele
- On the Island of Maui, the western, southern, and eastern-facing coasts from Honokahua to Kulepeamoa Point
- On the Island of Molokaʻi, the coastline south and east of Ilio Point to Cape Hālawa.

More than 65 additional streams were also assessed on the Islands of Maui and Molokaʻi. These streams were studied with approximate methods because the areas surrounding the streams were identified as having low development potential or impact from flooding.

The flood hazard area information presented in this risk assessment reflects effective FIRMs for Maui County (effective 2015).

El Niño–Southern Oscillation (ENSO) Cycle and Flooding

El Niño-Southern Oscillation can be described as a reoccurring climate pattern lasting three to seven years where conditions over the Pacific Ocean basin change dramatically. El Niño causes warmer than normal sea temperatures in the equatorial Pacific. Southern Oscillation is defined as a "seesaw of atmospheric pressure between the eastern equatorial Pacific and Indo–Australian areas."[136] During ENSO events, El Niño is the sea temperature component while Southern Oscillation is the atmospheric pressure component. The systems can impact weather patterns throughout the globe when in effect.

In Hawaiʻi, ENSO events cause more rainfall at the beginning of the cycle, then rapidly less, meaning flooding associated with severe rainfall events can cause flooding, proceeded by years of drought as trade wind decline. This first year of heavy rainfall is referred to as the El Niño year. Sea level may be slightly higher in Hawaiʻi during ENSO events, and tropical cyclones increase due to warmer ocean temperatures. Increased tropical cyclones can increase the frequency and severity of coastal flooding and storm surges during ENSO cycles.[137]

Location

All areas of Maui County are subject to flooding impacts. Flooding in Maui County typically occurs along within low-lying coastal areas and within floodplains associated with each island's principal flooding sources. Most flooding sources, as listed in the previous section, include streams and gulches that flow from higher elevations in mountainous areas to the sea. Urban flooding also occurs in dense, developed areas. Several data sources utilized to show the location of current and future potential inland and coastal flooding in Maui County, as described below.

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[136] http://drought.unl.edu/DroughtBasics/ENSOandForecasting.aspx
[137] NWS. *El Niño and its impacts on Hawaiʻi.* Retrieved from https://www.weather.gov/media/peac/one_pagers/El%20Nino%20Impacts%20on%20Hawaiʻi.pdf.

FEMA Flood Zones

FEMA FIRMs for Maui County show flood hazard areas. Of the nearly 745,000 acres that comprise Maui County, approximately 24,800 acres are in the 1% annual chance floodplain (all zones). This equates to approximately 3.3% of the county. Table 36 summarizes the land area in the 1% annual chance floodplain by community planning area. Overall, Lānaʻi, Molokaʻi, and Kīhei-Mākena have the most land area in the SFHA, with Makawao-Pukalani-Kula and Pāʻia-Haʻikū having the least.

Table 36. FEMA Special Flood Hazard Areas (1% Annual Chance Flood Zones) in Maui County.

Community Planning Area	Area (acres)	% of Total Countywide SFHA
Hāna	3,848	15.5%
Kīhei-Mākena	4,561	18.4%
Lānaʻi	6,208	25.0%
Makawao-Pukalani-Kula	55	0.2%
Molokaʻi	5,564	22.4%
Pāʻia-Haʻikū	419	1.7%
Wailuku-Kahului	1,716	6.9%
West Maui	2,429	9.8%
TOTAL	**24,800**	**100.0%**

The figures below show the location of FEMA 1% (regulatory) annual chance flood hazard areas as well as less frequent flood hazard areas (1% annual chance flood) for the Islands of Maui, Molokaʻi, and Lānaʻi.

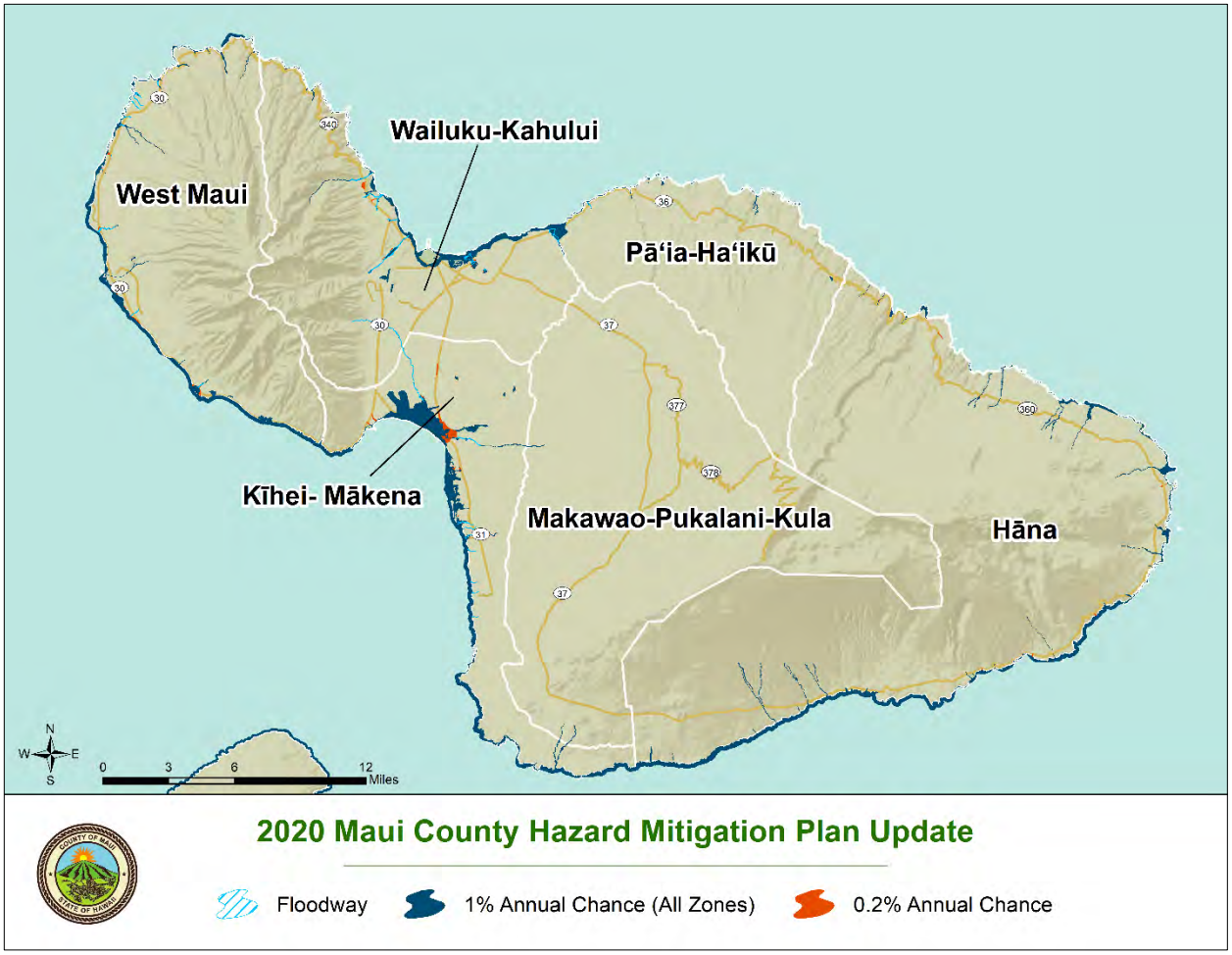

Figure 72. FEMA 1% and 1% Annual Chance Floodplains on the Island of Molokaʻi.

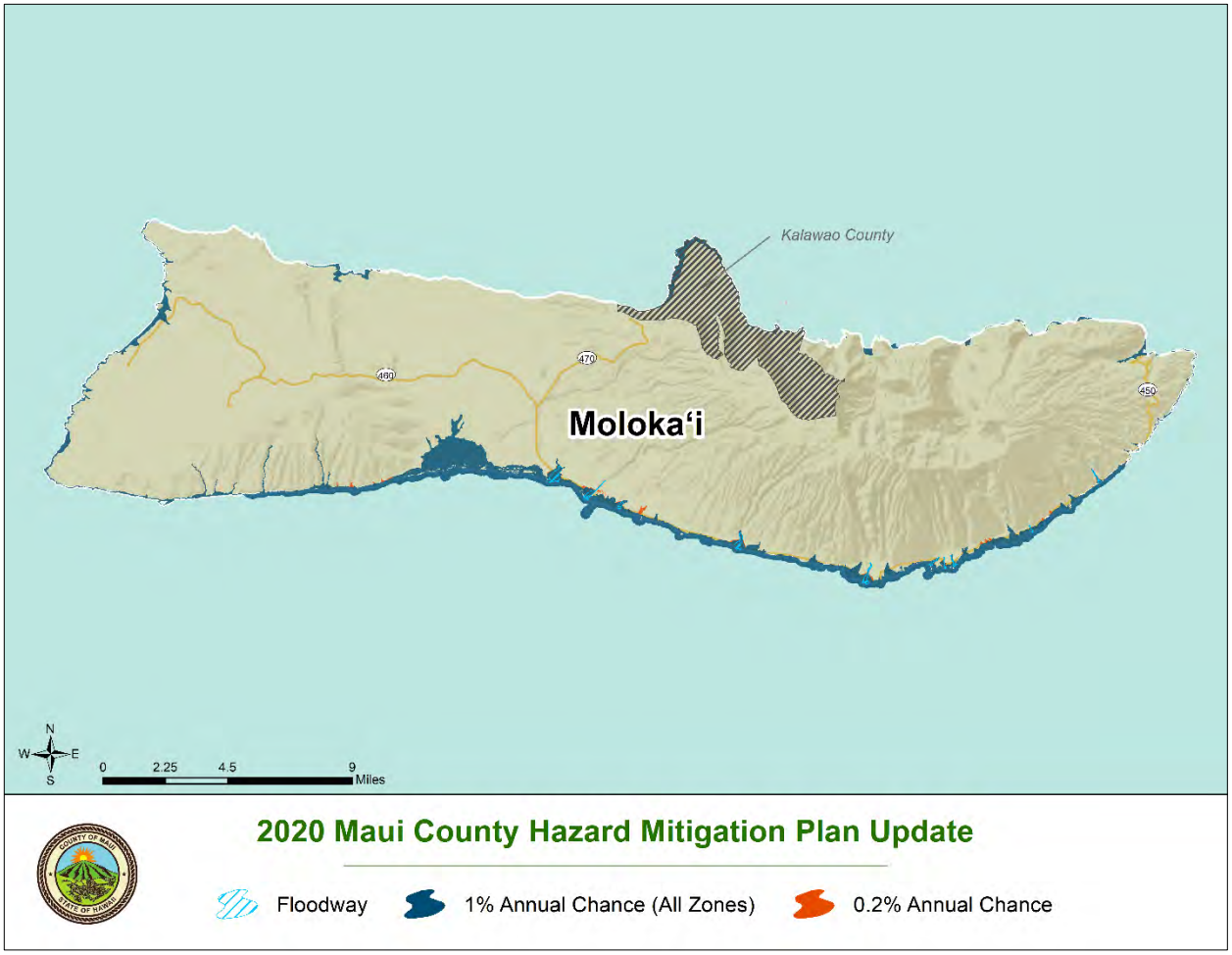

Figure 73. FEMA 1% and 1% Annual Chance Floodplains on the Island of Moloka'i.

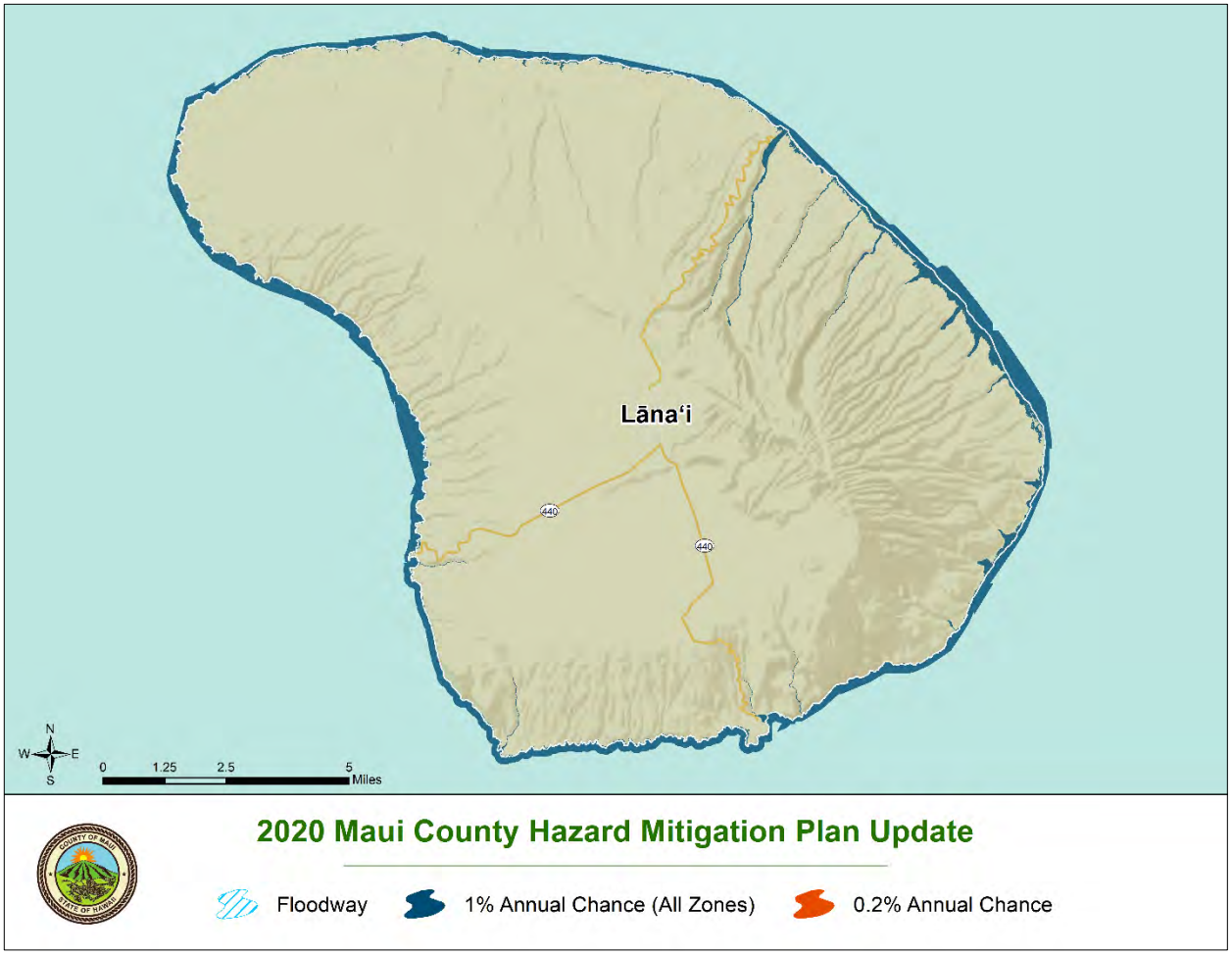

Figure 74. FEMA 1% and 1% Annual Chance Floodplains on the Island of Lānaʻi.

Sea Level Rise

In addition to FEMA FIRMs, PacIOOS has modeled future areas of expected coastal flooding due to the impacts of climate change. Chronic coastal flooding hazards, including coastal erosion, annual high wave flooding, and passive flooding due to sea level rise were aggregated to map sea level rise hazard areas for 2030, 2050, 2075, and 2100.[138] While this data is not regulatory for insurance purposes, it has been validated for use in land management decisions as best available information.[139] Further information regarding sea level rise impacts in Maui County can be found in the 2018 Hawai'i Sea Level Rise

[138] Based on a Representative Concentration Pathway (RCP) 8.5 Scenario. Models for Molokaʻi and Lānaʻi are based on passive sea level rise only.

[139] PacIOOS (2018). *Hawaiʻi Sea Level Rise Viewer*. Retrieved from https://www.pacioos.Hawaiʻi.edu/shoreline/slr-Hawaiʻi/.

Vulnerability and Adaptation Report.[140] The figure below shows how these multiple causes of chronic coastal flooding were combined into one dataset.

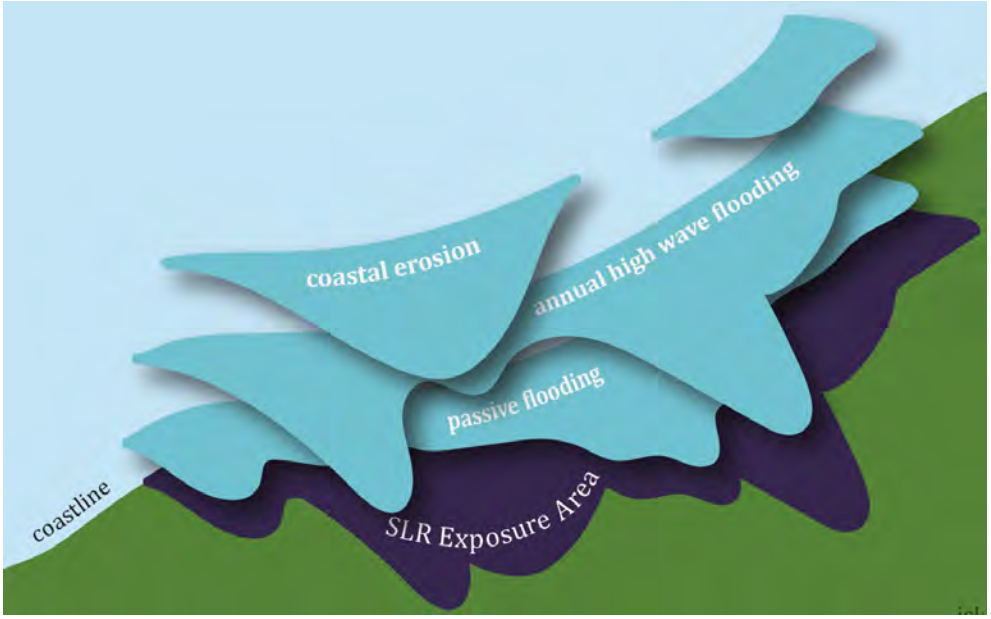

Figure 75. PacIOOS Combined Exposure to Sea Level Rise Diagram.

The figures below show the areas expected to be impacted by sea level rise for the Islands of Maui, Molokaʻi, and Lānaʻi. These figures show sea level rise inundation for the years 2030, 2050, 2075, and 2100.

[140] 2018 Hawai'i Sea Level Rise Vulnerability and Adaptation Report. Hawai'i Climate Change Mitigation and Adaptation Commission. Retrieved from https://climateadaptation.hawaii.gov/wp-content/uploads/2018/01/SLR-Report_-January-2018.pdf.

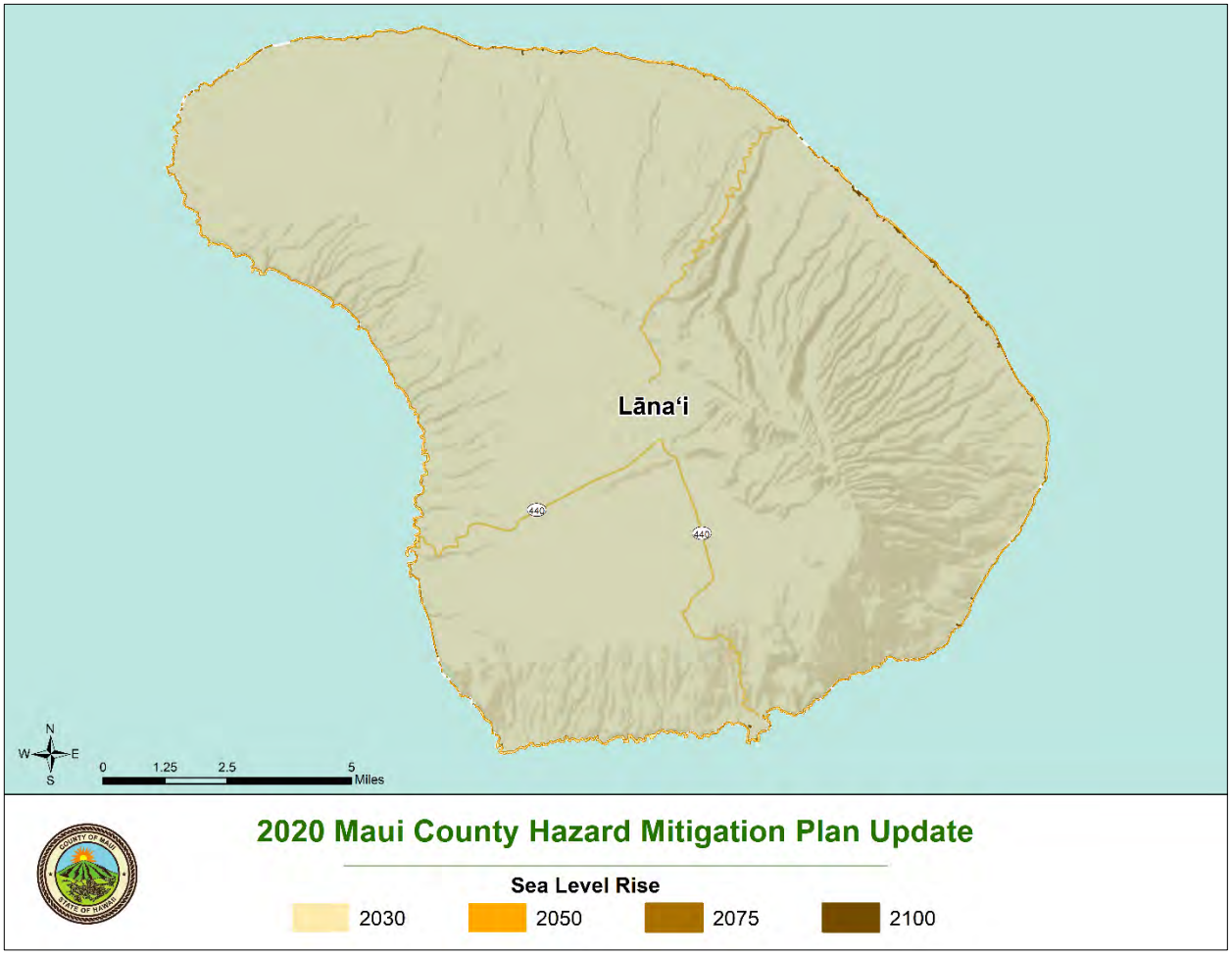

Figure 76. Sea Level Rise on the Island of Lānaʻi.

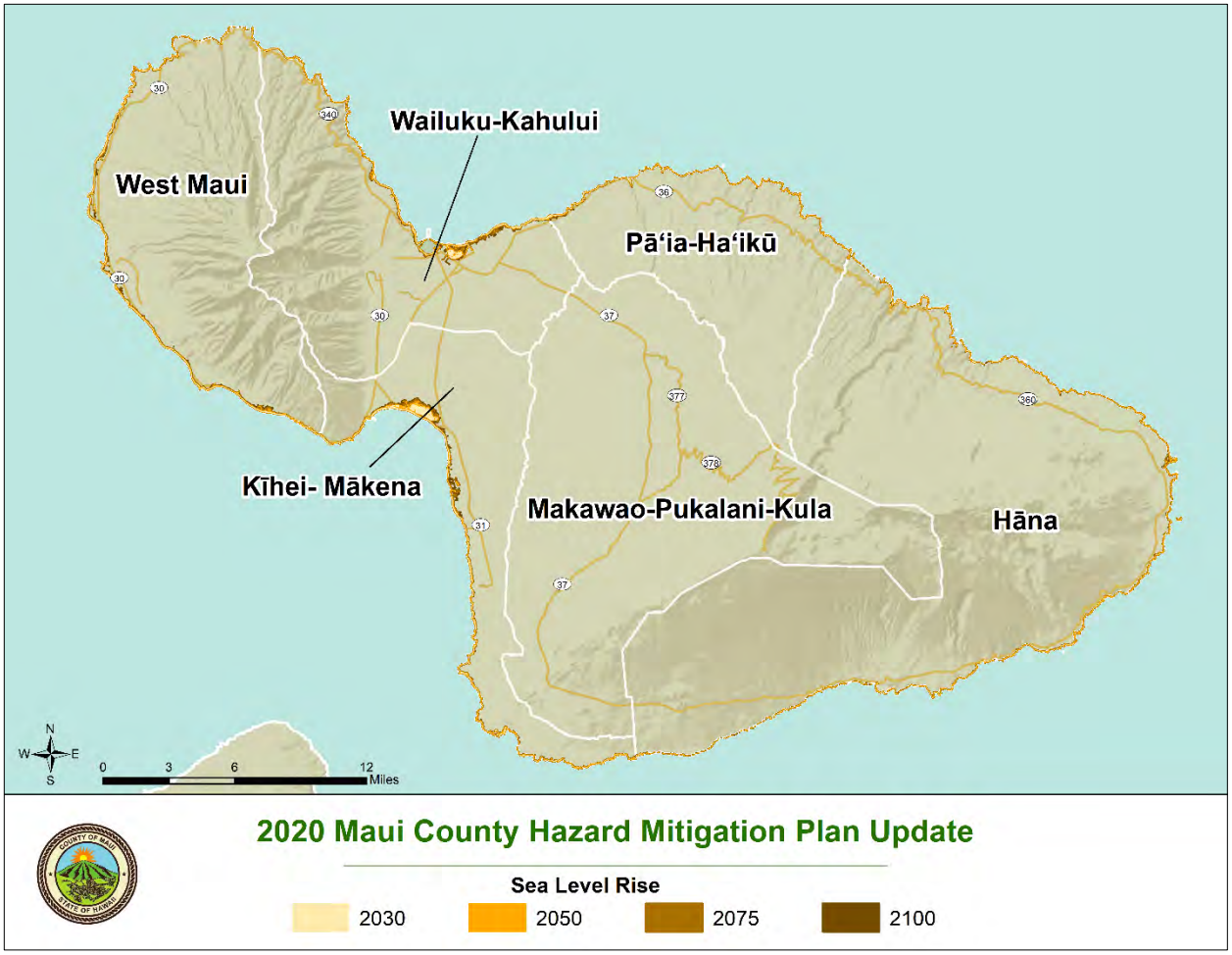

Figure 77. Combined Sea Level Rise on the Island of Maui.

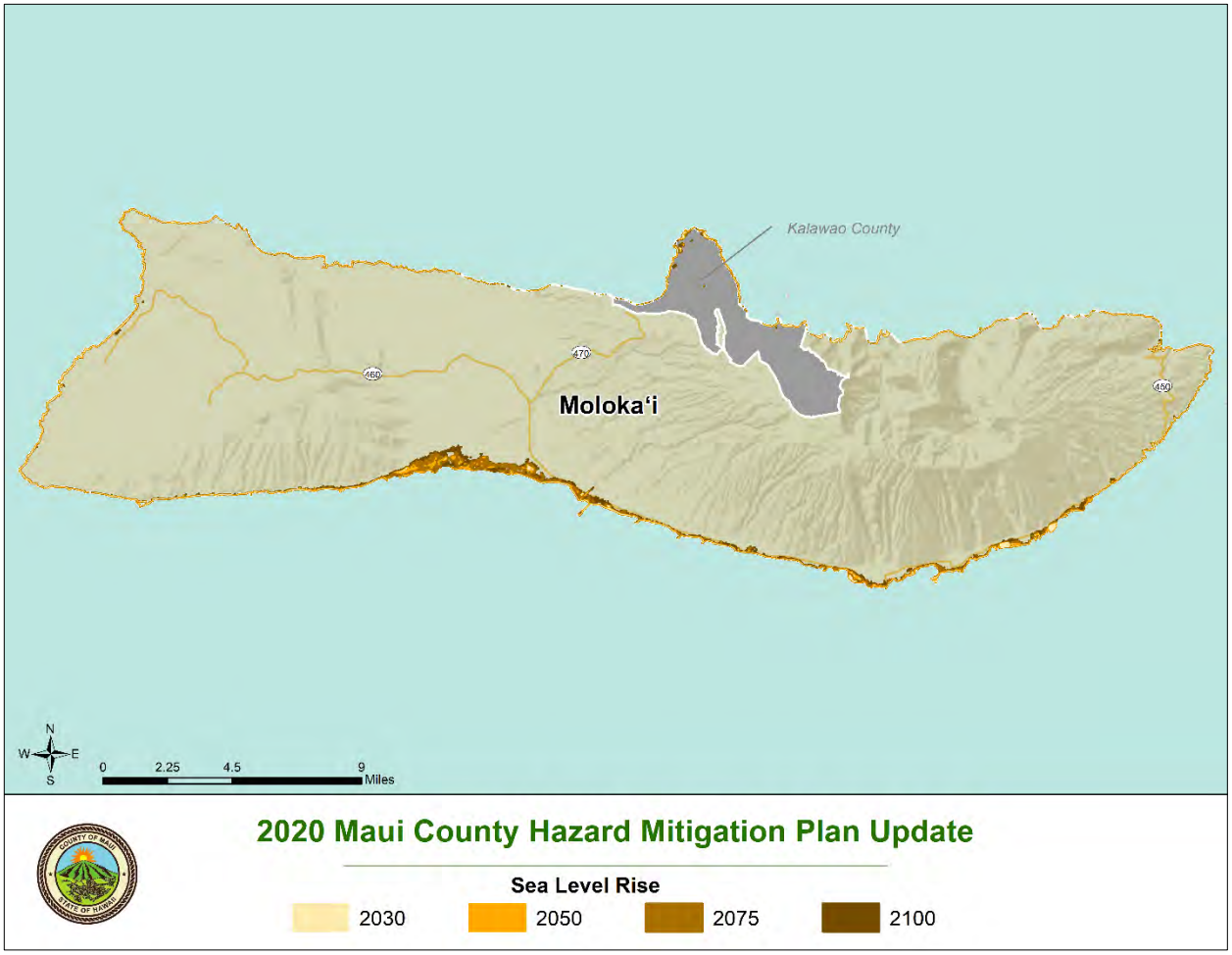

Figure 78. Sea Level Rise on the Island of Moloka'i.

High Wave Flooding

Further, PDC has mapped shoreline susceptibility to high wave flooding. Data classifies high wave intensity as low, moderately low, moderately high, or high. It is assumed that communities along shorelines ranked as high or very high are more susceptible to high wave flooding. Areas categorized as having high susceptibility include those along northern shores of West Maui, Wailuku-Kahului and Moloka'i. Eastern Maui Island, Western Lāna'i, and Western Moloka'i are considered to have moderately high intensity, and the more insulated shorelines of Southern Moloka'i, Eastern Lāna'i, and Western Maui are classified as having lower high wave intensity. The figure below shows coastal high wave intensity along Maui County shorelines.

Figure 79. High Wave Intensity in Maui County.

In addition to high wave intensity, a map showing the location of recorded King Tide impacts is included as Figure 80 under the *Previous Occurrences* section of this profile. Further, the following areas in each community planning area have been identified as flood-prone by the county:[141]

Inland Flooding:

- **Hāna**: High-velocity sheet flow floods have caused road damage.

- **Kīhei-Mākena**: Flooding occurs near Wailea and Poolenalena, where the ravines that drain the mountain slopes above flow into stream mouths that coincide with small beaches. Flood problems also occur where streams are near residential development around Kalama Park, Kamaole Beach, and Lipoa Avenue. The principal streams within the watershed that flow westward and seaward only during periods of excessive rainfall are Kulanihakoi, Waipuilani, and Kēōkea streams. These streams are narrow and poorly defined. Localized depressions, ponds,

[141] 2015 Maui County Hazard Mitigation Plan Update. Chapter 11: Flood.

swales, and ditches are typical of areas near the intersections of these streams with Kīhei Road. Flash flooding is a problem in Kīhei. Between Kīhei Road and Piilani Highway (State Highway 31), there are four gulches (Waiakoa, Kulanihakoi, Waipuilani, and Kēōkea) that flow east-west and drain approximately 65% of the watershed. Storm runoff flows at high velocities above the coastal plain because of the steep ground gradient at upper elevations. These slopes establish little or no defined surface drainage pattern. The drainage ways do not maintain stabilized channels and are generally narrow and poorly defined. As floodwaters approach the coastline, ponding occurs because of inadequate outlets to the sea (outlets are frequently plugged with ocean-deposited sand). On their approach to the Kīhei floodplain, the floodwaters of these streams cause overtopping of existing drainage structures crossing Kīhei Road. This flat low-lying coastal area receives all of this surface runoff, contributing to flood problems in the Kīhei area.

- **Lānaʻi**: Floods occur on the island's arid west coast. However, as Lānaʻi has limited coastal development, these floods do not pose a significant threat to population centers.

- **Molokaʻi:** Because of the lack of rainfall over most areas of the Island of Molokaʻi, the only perennial streams that reach the sea are those of the large valleys on the windward side of East Molokaʻi. The permanence of the streams on the northern slope is the result of numerous high level springs that issue from the dike complex where exposed by erosion. Other streams are fed from swamps. Due to geological conditions such as the steepness of the terrain and the intermittent character of heavy rainfall, the streams in most of the area have high flows and velocities during heavy rainfall. The streams on the southern slope of the East Molokaʻi and most areas of West Molokaʻi are perennial in the upper courses but normally lose their water to seepage and evaporation before reaching the coast. Flooding of these streams can occur after heavy rainfalls or Kona storms. The major flood issues on the Island of Molokaʻi are associated with the heavy flow of four water courses in East Molokaʻi: the Wailaua stream and the Wawaia, Kamalo, and Kawela gulches. The primary causes of flood damage are stream overflow, inadequate highway bridge openings, and periodical accumulation of deposits on the stream beds that reduce flow capacity. Sheet flow flooding in this area is caused by water flowing rapidly down the steep hillside onto flat areas causing the water to collect in ponds. Sheet flow also occurs at east Kawela and west Wawaia valleys when water rushes over cleared portions of the flood plain after intense rainfall.

- **Wailuku-Kahului**: Flooding associated with the Iao Stream causes major problems in Kahului, Maui County's most urbanized area. Flash flooding is also a serious problem in Kahului and Wailuku due to large amounts of water from the steep hillsides of the Iao valley collecting when encountering a coastal lowland area. Flash flooding poses serious threats in the low-lying coastal terraced area near Waiheʻe Point and Waiheʻe Beach Park. High velocity flows from the streams within the Iao valley area bring rocks and boulders to the beaches near Waiheʻe. In Wailuku, flooding caused by stormwater runoff can overtop irrigation ditches. Floods along Wells park

and Main Street in Wailuku occur during periods of heavy rainfall. Low-lying sections of Kahului also flood during heavy rains due to inadequate storm drainage facilities.

- **West Maui**: Lahaina is subject to flash floods caused by the steep slope of the foothills on the west side of the West Mountains and a lack of vegetation. Since 1879, 19 damaging floods have occurred in Lahaina.

Coastal Flooding:

- **Kīhei-Mākena:** Storm surge flooding is threat to heavily developed coastal areas near Mā'alaea, Kīhei, and Mākena. In Kīhei, transportation, and in some cases evacuation, problems are severe due to the North/South Kīhei Road that runs parallel and very close to the coastline. This road has been flooded on many occasions by low-magnitude coastal flood events such as those caused by south swells, Kona storms, and heavy rains.

- **All coastlines:** Coastal flooding including surge, high wave flooding, king tides, and sea level rise, occurs along all coastal shorelines throughout the county.

Previous Occurrences

Maui County is susceptible to a variety of flooding, whether coastal, riverine, or flash. Often, events resulting in flood can result in multiple flooding types (i.e., coastal and riverine) at the same time. Several sources were used to glean historic flood events, including previous plans, county officials, data from Sea Grant, and the NCEI Storm Events Database.

Inland Flooding

NOAA's National Centers for Environmental Information's Storm Events Database and the Spatial Hazard Events and Losses Database for the United States (SHELDUS) were used to inform historic flood events in Maui County from 1971 to July 2014. During this period, 116 flood events were reported, which resulted in two deaths and one injury. Five of these events were described as resulting in damages.[142]

NOAA's NCEI Storm Events Database was used to glean flood events occurring after July 2014. From 2014 to March 2020, 21 additional flood events were reported in Maui County. All of these were reported as flash flood events, but several events are described as having stream (riverine) flooding as well. None of these events resulted in reported damages, deaths, or injuries within the county. However, it is likely that damages, especially those to private businesses and residences, have gone unreported. Further, descriptions for many events indicate damages to buildings and infrastructure occurred, although no monetary figures are provided. The table below presents details for these events.

[142] Maui County Hazard Mitigation Plan Update (2015). *Chapter 11: Flood.*

Table 37. Previous Flood Events (NCEI, 2014 – present).

Date	Community Planning Area(s)	Description
12/22/2014	Makawao-Pukalani-Kula, Wailuku-Kahului, Molokaʻi	Kahului Police reported flooding around Maliko Gulch and Makawao Avenue. Maunaloa Highway was closed at the Kaunakakai Gulch due to high water on the Island of Molokaʻi.
8/17/2015	Hāna	Flooding forced the closure of Piilani Highway at mile marker 29 in the Nuu area, not far from Kaupo.
8/20/2015	Makawao-Pukalani-Kula	Kula Highway closed near Sun Yat Sen Park due to flash flooding and debris on the road.
8/23/2015 - 8/25/2015	Hāna, Molokaʻi, Wailuku-Kahului	Flash floods made Piilani Highway impassable near Kaupo between mile markers 37 and 38, and near mile marker 29. Ulaino Road near Hāna was closed due to deep water. Parts of Kipahulu became inaccessible because of flooding on Hāna Highway near the town. Flooding waters forced the closure of Wainapanapa State Park north of Hāna. Several schools in the Hāna area, and around Kaunakakai on Molokaʻi, were closed for the day because of the road flooding and power outages. Flooding near mile marker 16 at Pukoo along Kamehameha IV Highway on the island of Molokaʻi forced the closure of the roadway in that area. Lower Honoapiilani Highway was flooded by excessive rainfall near Kahana and Honokōwai, which also experienced flooding in different neighborhoods. Inundation forced the closure of Iao Valley State Park near Wailuku.
3/25/2016	Molokaʻi, Pāʻia-Haʻikū	Maui Civil Defense reported a swift water rescue of a family of eight in Hālawa Valley at the east end of Molokaʻi. Another party of 12 was evacuated. A hiker requested a rescue at the Bamboo Forest near Huelo because of flash flooding conditions.
5/8/2016	Hāna	Maui County officials reported flooding and road closures on Ulaino and Waikoloa roads in Hāna.
7/24/2016	Hāna	Heavy rain from Tropical Storm Darby closed Piilani Highway between mile markers 25 and 38 at Pahihi Gulch.
9/13/2016 - 9/16/2016	Hāna, Kīhei-Mākena, Wailuku-Kahului, West Maui	Overflowing streams along Piilani Highway between mile markers 20 and 30 caused debris flows. Part of the Hāna Highway near Keʻanae was closed due to a debris flow and high water. Flash flood waters along the Wailuku River inundated the Iao Valley. There was significant damage at the Iao Valley State Park and Kepaniwai Heritage Gardens County Park. An emergency manager reported two homes in Iao Valley inundated with water overflowing from the Wailuku River (Iao Stream). A debris flow and flooding occurred along Honoapiilani Highway between Māʻalaea and Lahaina. This event resulted in a disaster declaration for Maui County.
12/11/2016	Kīhei-Mākena	A portion of Highway 30, the Honoapiilani Highway, was closed between the North Kīhei Road junction and Papalaua State Wayside Park on Maui due to flooding.

Date	Community Planning Area(s)	Description
12/31/2016	Hāna	Hāna Highway in windward Maui was closed between mile markers 14 and 16 due to a downed tree and other debris from flooding.
2/11/2017	Kīhei-Mākena	South Kīhei Road on Maui was closed between Wailana Place and Kaonoulu Street because of two feet of water on the roadway.
2/27/2017	Hāna, Makawao-Pukalani-Kula	Maui police reported heavy flooding on Kokomo Road at Makawao Avenue just north of Makawao. A debris flow, in this case a rock slide, blocked both lanes of Hāna Highway near Wailua Falls.
3/7/2017	Kīhei-Mākena	A portion of South Kīhei Road was closed due to flash flooding. Several homes had to be evacuated. Several vehicles and condominiums were damaged, and seven individuals trapped by the flood had to be rescued by fire crews.
12/20/2017	Wailuku-Kahului, West Maui	An area near mile marker 7 along Kahekili Highway in West Maui flooded. Flooding also occurred along Hāna Highway near Kaupakalua Road, where a debris flow closed the roadway. The intersection of Puunene and Wakea avenues near Christ the King Church in Kahului had to be closed because of deep water.
2/18/2018	Wailuku-Kahului	In West Maui, floodwaters covered portions of Kahekili Highway at the Waiheʻe Valley Bridge. Also, portions of Iao Valley Road and Waiehu Beach Road were closed due to high water. The Fire Department reported that a young man had to be rescued from rising water at a home on River Road.
3/14/2018	Hāna	Uakea and Waikoloa roads closed in Hāna due to flooding rains on the roadways. Also, Hāna Highway was closed at Mill Place, as well as Haneoo and Ulaino roads, due to deep water.
4/2/2018	Molokaʻi, West Maui	Law enforcement reported water over Kamehameha V Highway on Molokaʻi near Mile Post 4, west-southwest of Kawela. Lower Honoapiilani Road was closed near the Pohailani Resort in West Maui due to flooding caused by clogged drainage. Police officers on scene reported a vehicle stuck on the road with 10 inches of water over the roadway.
8/23/2018	Hāna, Pāʻia-Haʻikū	Hurricane Lane brought heavy rains to the county. Flooding rains closed Waikoloa Road near Hāna. Waianapanapa and Ulaino roads were also closed. A 30-foot section of Puu Way in Haʻikū was washed out at a culvert.
9/12/2018	Hāna, Molokaʻi, West Maui	Flooding occurred throughout the county as Tropical Storm Olivia approached. Deep water on Ulaino Road near Hāna on Maui forced its closure. Waikoloa Road near Hāna was also closed because of flooding. Honokohau Stream overflowed onto the bridge in Honokohau in West Maui and closed Honoapiilani Highway. Deep water closed Highway 450 near Kawela on the Island of Molokaʻi.
9/27/2018	West Maui	Water from heavy rain flooded several businesses along Front Street in Lahaina in West Maui. A home was inundated on Lahainaluna Road in Lahaina.

Date	Community Planning Area(s)	Description
2/14/2019	Makawao-Pukalani-Kula, Pāʻia-Haʻikū	Gulches in the Haʻikū and Makawao overflowed due to heavy rainfall. Low water crossings became flooded, so county officials had to close roadways temporarily.

Other notable floods in Maui County include the following:

- **April 1968** – In Hāna, sheet flow flooding from heavy rainfall caused drainage ditch bedding and earthen banks to wash downstream into the ocean. Road shoulders, retaining walls, and pavement throughout the area were severely damaged.
- **April 2003** – Flash flooding occurred in Haleakalā National Park at the bottom of the 184-foot Makahiku Fall. This flood resulted in the death of a man and a girl who were swept away by a 6-foot wall of water while crossing the stream at the bottom of the waterfall. The deaths led to a federal lawsuit by the family of the victims. Ultimately the United States government paid $5 million in 2009. According to Haleakalā National Park officials, there have been nine deaths at the falls since 1983.
- **December 2007** – A strong Kona storm produced heavy rains that caused flooding and landslides throughout eastern Maui. This event resulted in a disaster declaration for the county. Details for this event can be found in the *Hurricane (Including Tropical Storms and Kona Storms)* hazard profile.
- **September 2016** – This rain event resulted in a presidential disaster declaration and an estimated $15 million in damages. It is estimated that water surged to an estimated 3 billion gallons/day from a typical 100 gallons/day. Flooding was so significant along the Wailuku River that it changed its course. The event also caused major damage to the Iao Valley State Monument.[143]

Further, there have been eight Presidential Disaster Declarations for flood-related events in Maui County since 1963 (not including declarations related to hurricanes, tropical storms, and tsunamis). This figure includes the 2007 Kona storm event.

Coastal Flooding

In addition to the flood events described above, Maui County experiences flooding from specifically high surf/high wave and King Tide events. Several sources were consulted for historic high wave events, including the NCEI Storm Events Database and data from Hawaiʻi Sea Grant.

High Wave

The NCEI Storm Events Database reported over 552 days with high surf events in Maui County between 2004 and April 2020, indicating that high surf events are a common occurrence in Maui County. No

[143] Star Advertiser (2016). *Obama declares federal disaster on Maui after floods*. Retrieved from https://www.staradvertiser.com/2016/10/06/breaking-news/obama-declares-federal-disaster-on-maui-after-floods/

deaths, injuries, or damages were reported with these events. Not all reported high surf events result in coastal flood events.

King Tides

University of Hawaiʻi Sea Grant provides data on King Tide flood occurrences in Hawaiʻi from July 2015 to December 2019.[144] In Maui County, 446 areas were recorded as being impacted by 16 King Tide events. Impacted areas were recorded as part of King Tides occurring on:[145]

- July 2-3, 2016
- November 17-18, 2016
- April 17, 2017
- May 25-27, 2017
- June 22-24, 2017
- July 21-22, 2017
- November 8, 2017
- June 14, 2018
- July 11-13, 2018
- August 9, 2018
- June 8-16, 2019
- June 30-July 2, 2019
- July 13-14, 2019
- July 31, 2019
- October 28-29, 2019
- December 3, 2019

[144] University of Hawaiʻi Sea Grant (2019). *Hawaiʻi and pacific island King Tides Project (metadata).* Retrieved from https://catalog.data.gov/harvest/object/b32743bf-54c8-4787-a5a4-a4adf22318eb/html.

[145] Based on the timing of these events, it is possible that some are not true King Tides, but rather impactful high tides.

Some community planning areas were documented as experiencing more King Tide flooding impacts than others, namely Kīhei-Mākena and West Maui. The table below presents the number of recorded King Tide impacts captured in each community planning area.

Table 38. Number of Recorded King Tide Impacts in Maui County Community Planning Areas (2015-2019).

Community Planning Area	Number of King Tide Records
Hāna	27
Kīhei-Mākena	216
Lānaʻi	0
Makawao-Pukalani-Kula	N/A
Molokaʻi	19
Pāʻia-Haʻikū	1
Wailuku-Kahului	12
West Maui	191
MAUI COUNTY TOTAL	**446**

The figures below show recorded King Tide impacts on Maui and Molokaʻi islands.

Figure 80. Areas Impacted by King Tides on Maui Island (2015-2019).

Figure 81. Areas Impacted by King Tides on Moloka'i Island (2015-2019).

The figures below show examples of impacts from King Tides in Maui County.[146]

[146] Photos provided from PacIOOS via the Hawai'i Sea Grant King Tides Project.

Figure 82. Minor King Tide Flooding at Kealia Costal Boardwalk Parking Lot, July 2018 (Kīhei-Mākena).

Figure 83. Waves and Erosion at Ukumehame Beach Park, August 2019 (West Maui).

NFIP Insured Structures

Maui County participates in the NFIP, as well as CRS. As of May 15, 2020, Maui County has over 12,500 policies in force providing almost $2.8 billion in flood insurance coverage. According to data from FEMA, Maui County has had 579 paid claims since January 1, 1978. This is a notable increase from the 2015 Hazard Mitigation Plan, which recorded 292 claims between January 1, 1978 and January 31, 2015. Conversely, the number of policies has stayed roughly the same, with 12,567 polices in 2015 and 12,575 in 2020. Total losses paid are approximately $6.9 million, an average of roughly $11,960 per claim. Table 39 provides NFIP statistics for Maui County.

Notably, properties built before a FIRM is adopted are typically more vulnerable to flooding because they do not meet code or are located in hazardous areas. The first FIRMs in the planning area were available in June 1981.

Table 39. Maui County NFIP Statistics as of May 15, 2020.

Date of Entry Initial FIRM Effective Date	06/01/1981
Policies in Force	12,575
Insurance in Force	$2,780,834,300
Number of Paid Losses	579
Total Losses Paid	$6,923,653
Average Claim Amount	$11,960
Substantial Damage Claims since 1978	16

Repetitive Loss Properties

A repetitive loss (RL) property is any insurable building for which two or more claims of more than $1,000 were paid by the NFIP within any rolling ten-year period since 1978 (the year at which consistent claims data collection began). Therefore, a building with paid NFIP claims of more than $1,000 in 1979 and again in 1980 is considered a repetitive loss property until that building's flood problem is mitigated.

Severe repetitive loss (SRL) properties are another class of repetitive loss. These properties, defined under the 2004 Flood Insurance Reform Act, are those buildings that either have four or more claims of $5,000 or more, or have at least two claims that cumulatively exceed the building's value.

A repetitive loss designation runs with a building even if ownership of the building changes. The repetitive loss designation for a building will remain on a community's list even if the insurance policy has lapsed, has been terminated, or the building's risk has been mitigated. There are more 5.3 million NFIP policies across the United States in more than 22,000 communities. About 160,000 of these properties have suffered repetitive losses as of 2015. Since 1978, approximately $9 billion have been paid to these properties, which represents about one quarter of all flood insurance claims payments.[147]

[147] NFIP/CRS (2017). Developing a Repetitive Loss Area Analysis. FEMA. Retrieved from https://crsresources.org/files/500/rlaa-guide-2017.pdf.

The county's floodplain manager provided repetitive loss data as of 2017 (most up to date list available). The data showed 34 unmitigated repetitive loss properties in Maui County (two former repetitive loss properties have been mitigated). Two of these 34 properties are severe repetitive loss properties. The previous version of this plan listed the same number of repetitive loss and severe repetitive loss properties, indicating no increase in repetitive loss properties. All but one repetitive loss property in Maui County have been identified as residential structures (e.g., single family, multi-family, condominiums). Repetitive loss data is presented in Table 40.

Table 40. Repetitive Loss Data for Maui County.

Number of Repetitive Loss Properties	34
Number of Severe Repetitive Loss Properties	2
Types of Properties	Single Family, Multi-Family, Condominium, Other Residential, Other Non-Residential
Total Number of Losses	87
Total Building Payments ($)	$2,089,748
Total Content Payments ($)	$285,941
Total Payments ($)	$2,375,689
Average Payment ($)	$27,307

Within community planning areas, there are 22 repetitive loss properties in Kīhei-Mākena, one in Wailuku-Kahului, and 11 in West Maui.

Areas of Natural Floodplain Functions

Environmental assets are important to consider when assessing flood risk and potential mitigation actions. Environmental assets may be used to leverage additional drainage or water storage capacity. Environmental assets also offer co-benefits. For example, wetland areas protect sensitive wildlife habitat while slowing and storing floodwater, and natural areas can serve both as recreation and water storage. Vegetation areas such as forests allow stormwater to infiltrate into the ground, reducing overall stormwater volume within a watershed and reducing the likelihood of flooding.

Maui County has many natural resources that are considered environmental assets. For example, the county is home to many natural beaches, as well as forested areas with streams and waterfalls. Many of these areas in Maui County are preserved or conserved as forest reserves, wildlife sanctuaries, and parks. Further, wetlands are areas in which soils are permanently or intermittently saturated. Wetlands are considered waters of the United States and are subject to the jurisdiction of the USACE as well as Hawai'i DLNR. The U.S. Fish and Wildlife Service (USFWS) may also have authority over any wetlands that provide habitat for endangered species.

Wetlands provide many valuable ecological services, including benefits to water quality, wildlife protection, recreation, and lastly, natural hazard mitigation. Wetlands provide water storage during flood peaks and slowly release floodwaters downstream. The flow of water is reduced in wetlands by soils, rocks, and vegetation. The reduction in floodwater velocity reduces the rate at which sediments are eroded and may even allow sediments and other pollutants to settle out of the water column. However, wetlands cannot perform these functions when they become severely degraded or are filled and covered with impervious material. Therefore, protecting wetlands in their natural state, through parks, open space, or natural preserves, aids in flood mitigation.

Wetlands are often found in floodplains and low-lying areas of a watershed. Maui County is home to many wetlands, including freshwater forested/shrub, emergent, riverine, lake, and pond wetlands, as well has estuarine and marine wetlands including mangroves (though most are not indigenous to the islands). Wetlands within the county, as reported by the USFWS's National Wetland Inventory (NWI), are presented in Figure 84, overlaid by the county's protected natural areas. In addition, Figure 85, Figure 86, and Figure 87 show floodplains that are within protected natural areas on Maui, Molokaʻi, and Lānaʻi, respectively. Maui County has over 2,350 acres of open space in the floodplain, which accounts for approximately 10% of SFHAs in Maui County.

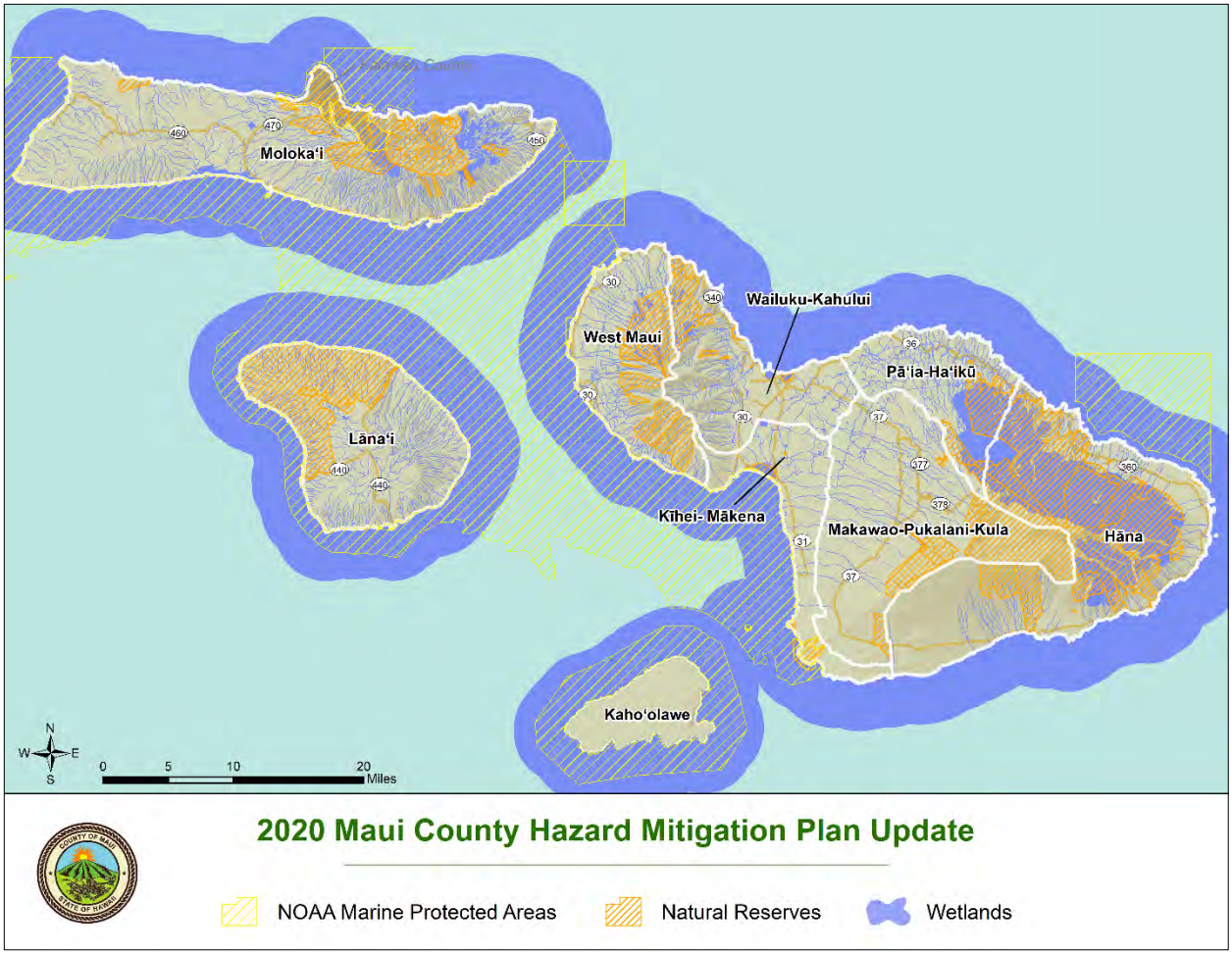

Figure 84. Wetlands and Protected Areas within Maui County.

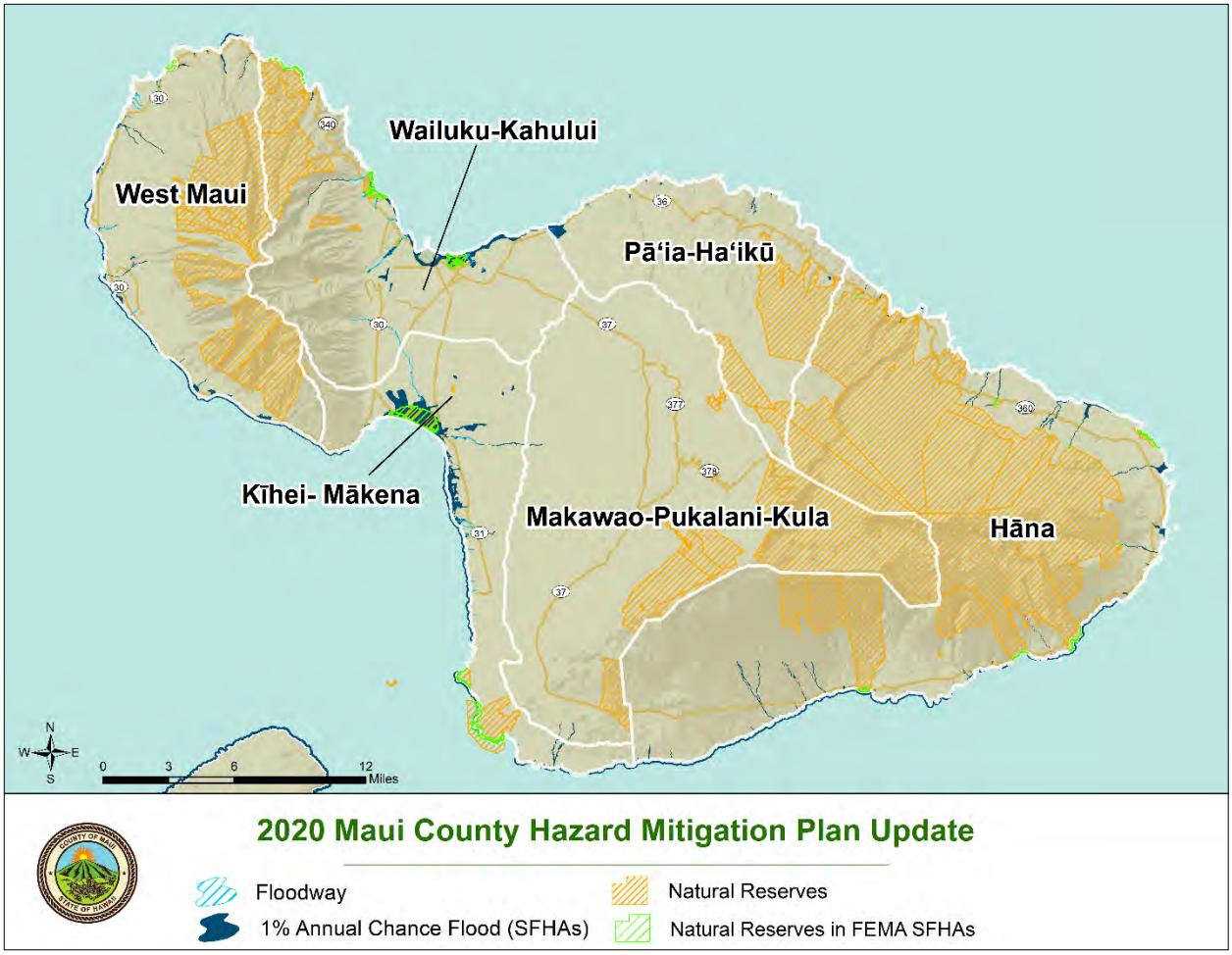

Figure 85. Natural Reserves within FEMA Special Flood Hazard Areas, Maui Island.

Figure 86. Natural Reserves within FEMA Special Flood Hazard Areas, Moloka'i Island.

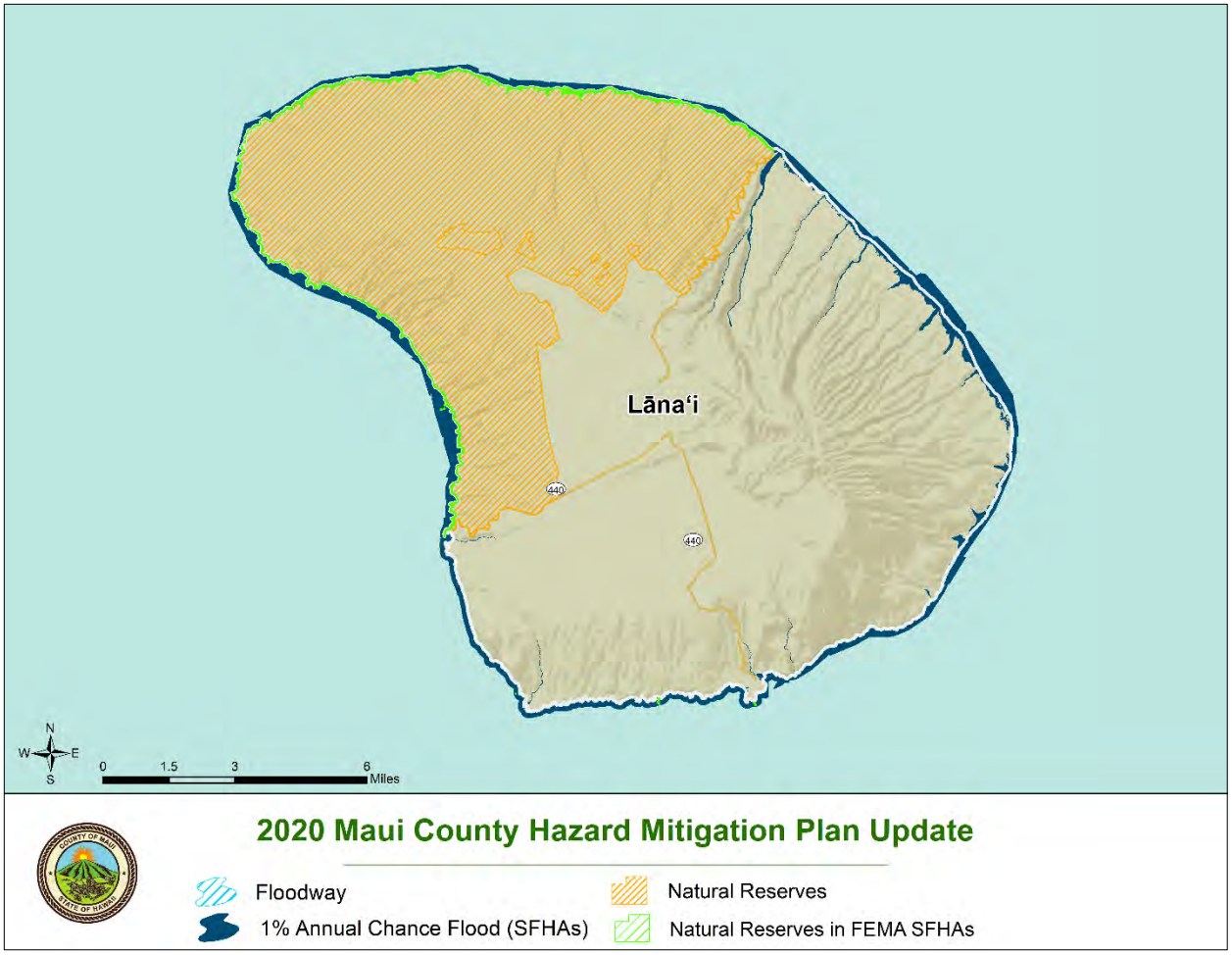

Figure 87. Natural Reserves within FEMA Special Flood Hazard Areas, Lānaʻi Island.

Extent

Flood extent, or magnitude, can be defined in several ways including peak flow or discharge rate (cubic feet per second), height of flood waters, and damages. United States Geological Survey stream gage data can often be used to determine the above factors. Peak flows for streams within Maui County are provided in Table 41.[148] The largest peak flow recorded for a stream in Maui County was 107 cubic feet/second on Honopou Stream near Huelo.

[148] USGS (2020). Peak Streamflow for Hawai'i (Maui County). Retrieved from https://nwis.waterdata.usgs.gov/hi/nwis/peak?county_cd=15009&format=station_list&group_key=NONE&set_logscale_y=1&date_format=YYYY-MM-DD&rdb_compression=file&hn2_compression=file&list_of_search_criteria=county_cd.

Table 41. Peak Flows for Streams.

Gage	Name	Period of Record Begin Date	Period of Record End Date	Peak Flow (cubic ft/s)
16587000	Honopou Stream near Huelo, Maui, HI	9/30/1911	11/10/2018	107
16620000	Honokohau Stream near Honokohau, Maui, HI	9/22/1914	2/14/2019	101
16508000	Hānawi Stream near Nahiku, Maui, HI	12/4/1914	2/14/2019	100
16518000	West Wailuaiki Stream near Keʻanae, Maui, HI	4/27/1915	2/14/2019	99
16400000	Halawa Stream near Halawa, Molokaʻi, HI	4/4/1918	11/10/2018	94
16618000	Kahakuloa Stream near Honokohau, Maui, HI	5/12/1940	10/20/2018	73
16607000	Wailuku River at Wailuku, Maui, HI	12/3/1950	2/14/2019	69
16570000	Nailiilihaele Stream near Huelo, Maui, HI	9/6/1914	11/21/1974	61
16585000	HOOLAWANUI STREAM NR HUELO, MAUI, HI	12/3/1912	4/23/1971	57
16545000	PUOHOKAMOA STR AB SPRECKELS DITCH NR HUELO, MAUI	8/4/1914	4/23/1971	56
16500100	Kepuni Gulch near Kahikinui House, Maui, HI	9/17/1963	2/19/2019	55
16603800	Kaluapulani Gulch Trib near Pukalani, Maui, HI	3/5/1963	2/14/2019	55
16638500	Kahoma Stream at Lahaina, Maui, HI	5/13/1960	2/14/2019	54
16501000	PALIKEA STREAM BL DIV DAM NR KIPAHULU, MAUI, HI	11/18/1927	11/24/1982	53
16414000	Kaunakakai Gulch at Kaunakakai, Molokaʻi, HI	8/15/1950	10/29/2000	51
16647500	Malalowaiaole Gulch near Māʻalaea, Maui, HI	1/7/1964	2/14/2019	51
16502000	HAHALAWE GULCH NEAR KIPAHULU, MAUI, HI	2/18/1928	4/1/1977	49
16536000	HAIPUAENA STR AB SPRECKELS DITCH NR HUELO, MAUI	8/4/1914	10/15/1966	49
16643300	Kauaula Stream nr mouth nr Lahaina, Maui, HI	5/13/1960	11/18/2008	48
16646200	Olowalu Stream at Olowalu, Maui, HI	11/2/1961	11/18/2008	48
16500800	Kukuiula Gulch near Kipahulu, Maui, HI	9/17/1963	12/27/2008	47
16502800	Moomoonui Gulch at Hāna, Maui, HI	5/14/1963	12/27/2008	47
16630200	Honokowai Stream at Honokowai, Maui, HI	11/2/1961	2/3/2009	47
16415400	Wawaia Gulch at Kamalo, Molokaʻi, HI	7/24/1964	12/11/2008	46
16527000	Honomanu Stream near Keʻanae, Maui, HI	5/1/1916	11/9/1963	45
16619700	Poelua Gulch near Kahakuloa, Maui, HI	2/4/1965	3/9/2009	45
16411640	Halena Gulch near Maunaloa, Molokaʻi, HI	4/13/1965	12/11/2008	44
16502400	Pukuilua Gulch near Hāna, Maui, HI	3/13/1963	3/2/2006	44
16502900	Kawaipapa Gulch at Hāna, Maui, HI	2/3/1965	12/27/2008	44
16419500	Papio Gulch at Halawa, Molokaʻi, HI	1/2/1964	3/31/2006	43
16603700	Kalialinui Gulch Trib near Pukalani, Maui, HI	7/23/1964	12/27/2008	43
16500300	Hawelewele Gulch near Kaupo, Maui, HI	3/24/1967	12/31/2008	42

Gage	Name	Period of Record Begin Date	Period of Record End Date	Peak Flow (cubic ft/s)
16586000	HOOLAWALIILII STREAM NEAR HUELO, MAUI, HI	5/8/1914	11/22/1957	42
16603850	Kalialinui Gulch near Kahului, Maui, HI	3/24/1967	2009	42
16658500	Waiakoa Gulch Trib near Waiakoa, Maui, HI	1964	12/5/2007	42
16413500	Manawainui Gulch near Kualapuu, Molokaʻi, HI	12/20/1964	2/14/2019	40
16419000	Pohakupili Gulch near Halawa, Molokaʻi, HI	1/2/1964	10/23/2005	40
16510000	Kapaula Gulch near Nahiku, Maui, HI	12/13/1921	12/14/1962	40
16659000	Waiakoa Gulch at Kīhei, Maui, HI	1/16/1963	2009	40
16660000	Kulanihakoi Gulch near Kīhei, Maui, HI	1/16/1963	12/5/2007	39
16515000	Waiohue Gulch near Nahiku, Maui, HI	12/13/1921	1/8/1963	38
16411320	Kakaako Gl ab Kamakahi Gl nr Maunaloa,Molokaʻi,HI	1/7/1964	3/30/2001	37
16557000	ALO STREAM NEAR HUELO, MAUI, HI	10/27/1912	11/22/1957	37
16577000	Kailua Stream near Huelo, Maui, HI	8/4/1914	11/22/1957	37
16411600	Kaunala Gulch near Maunaloa, Molokaʻi, HI	1/7/1964	11/2/2000	36
16604500	Wailuku River at Kepaniwai Park, Maui, HI	12/25/1983	2/14/2019	36
16614000	Waihee Rv abv Waihee Dtch intk nr Waihee, Maui, HI	7/20/1984	10/19/2018	36
16565000	KAAIEA GULCH NEAR HUELO, MAUI, HI	1/31/1922	3/12/1962	35
16411800	Kaluapeelua Gulch at Hoolehua, Molokaʻi, HI	1/7/1964	2006	34
16517000	East Wailuaiki Stream near Keʻanae, Maui, HI	1/18/1916	11/22/1957	34
16520000	East Wailuanui Stream near Keʻanae, Maui, HI	4/28/1915	10/14/1956	34
16603300	Unnamed Gulch at Maliko Bay, Maui, HI	5/14/1963	2001	34
16650500	Waikapu Stream near Kīhei, Maui, HI	1/16/1963	1/4/1997	34
16516000	Kopiliula Stream near Keʻanae, Maui, HI	4/27/1915	11/22/1957	33
16519000	WEST WAILUANUI STREAM NEAR KEʻANAE, MAUI, HI	4/27/1915	8/24/1957	32
16555000	WAIKAMOI STR AB WAILOA DITCH NR HUELO, MAUI,HI	1/14/1923	11/22/1957	31
16616500	Unnamed Gulch at Maluhia Camp, Maui, HI	2/4/1965	3/23/2006	31
16411300	Kakaako Gulch at HWY 46 nr Maunaloa, Molokaʻi, HI	3/26/1964	12/11/2008	30
16402000	PULENA STREAM NEAR WAILAU, MOLOKAʻI, HI	12/24/1920	10/14/1956	28
16404000	PELEKUNU STREAM NR PELEKUNU, MOLOKAʻI, HI	12/24/1920	1/7/1982	28

Gage	Name	Period of Record Begin Date	Period of Record End Date	Peak Flow (cubic ft/s)
16404200	PILIPILILAU STREAM NR PELEKUNU, MOLOKAʻI, HI	11/28/1968	3/30/1996	28
16403000	WAIAKEAKUA STREAM NEAR WAILAU, MOLOKAʻI, HI	12/24/1920	4/14/1957	27
16405000	LANIPUNI STREAM NEAR PELEKUNU, MOLOKAʻI, HI	12/24/1920	4/4/1957	27
16411400	Kakaako Gulch near Maunaloa, Molokaʻi, HI	1/7/1964	2/11/1989	26
16501200	Oheo Gulch at dam near Kipahulu, Maui, HI	12/6/1988	10/7/2018	26
16415000	EF Kawela Gulch nr Kamalo, Molokaʻi, HI	10/10/1946	11/25/1970	25
16416000	PUNAULA GULCH NR PUKOO, MOLOKAʻI, HI	4/2/1948	1/24/1972	25
16552800	Waikamoi Str abv Kula PL intake nr Olinda, Maui,HI	1/5/1954	2/14/2019	25
16566000	OOPUOLA STREAM NEAR HUELO, MAUI, HI	1/18/1932	11/22/1957	25
16623400	HONOKEANA GULCH NEAR HONOKAHUA, MAUI, HI	1964	1985	22
16531100	HAIPUAENA STR AT KULA PL INTK NR OLINDA,MAUI,HI	12/16/1946	4/18/1968	20
16411900	KALUAPELUA GLCH TRIB NR MOLOKAʻI AIRPORT,MOLOKAʻI	1/7/1964	3/31/1982	18
16414200	Kaunakakai Gulch at altitude 75 feet, Molokaʻi, HI	11/27/2001	1/31/2019	18
16415600	Kawela Gulch near Moku, Molokaʻi, HI	11/27/2001	6/26/2019	18
16509000	HĀNAWI STREAM BL GOVT RD NR NAHIKU, MAUI, HI	12/31/1932	11/16/1994	16
16543000	M B PUOHOKAMOA STR AT HAʻIKŪ-UKA BDRY NR KAILIILI	3/22/1920	11/29/1968	15
16524000	HONOMANU STR AT HAʻIKŪ-UKA BDRY NR KAILIILI,MAUI	1/16/1921	11/29/1968	14
16647100	Ukumehame Gulch at mouth nr Olowalu, Maui, HI	7/11/1965	2/14/2019	14
16617000	LEFT BR MAKAMAKAOLE STREAM NR WAIHEE, MAUI, HI	5/12/1940	12/31/1951	13
16636000	Kanaha Stream ab PL Intake nr Lahaina, Maui, HI	12/21/1916	11/18/1930	13
16663500	KAMAOLE GULCH AT KAMAOLE, MAUI, HI	1/10/1980	1/20/1997	13
16664000	LIILIOHOLO GULCH AT KAMAOLE, MAUI, HI	1/10/1980	1/20/1997	13

Gage	Name	Period of Record Begin Date	Period of Record End Date	Peak Flow (cubic ft/s)
16554000	WAIKAMOI STR AT HAʻIKŪ-UKA BDRY NR KAILIILI, MAUI	12/6/1918	12/1/1933	11
16574000	KAILUA STR AT HAʻIKŪ-UKA BDRY NR KAILIILI,MAUI,HI	8/16/1918	12/1/1933	11
16414100	KAMILOLOA GULCH AT KAUNAKAKAI, MOLOKAʻI, HI	4/13/1965	1973	9
16574500	KAILUA STREAM NR KAILIILI, MAUI, HI	7/1/1963	12/2/1970	9
16411200	Pohakumauliuli Gulch near Kepuhi, Molokaʻi, HI	2012	2019	8
16411500	Poolau Gulch near Kepuhi, Molokaʻi, HI	2012	2019	8
16415700	Kamalo Gulch near Kamalo, Molokaʻi, HI	3/8/2012	11/10/2018	8
16504500	Honomaele Gulch near Hāna, Maui, HI	3/8/2012	2/14/2019	8
16650200	Waikapu Stream at Waikapu, Maui, HI	1/26/2002	8/12/2009	8
16664200	Unnamed Gulch near Mākena, Maui, HI	2012	5/5/2019	8
16602400	AWALAU GULCH AT KAILIILI, MAUI, HI	4/5/1965	1/19/1971	7
16619600	OWALUHI GULCH NEAR KAHAKULOA, MAUI, HI	2/4/1965	1/14/1970	5
16527500	Honomanu Stream near Hāna Hwy, Maui, HI	9/13/2016	11/17/2018	4
16623500	Kaopala Gulch near Napili, Maui, HI	9/13/2016	2/2/2019	4
16657000	Keahuaiwi Gulch near Kula, Maui, HI	3/25/2016	11/17/2018	4
16521300	Waiokamilo Stream at Dam 3 near Keʻanae, Maui, HI	2/2/2008	11/26/2009	3
16681000	Hakioawa Gulch at alt. 75 ft, Kahoolawe, HI	10/16/2006	1/27/2009	3
16682000	Kaulana Gulch at alt. 100 ft, Kahoolawe, HI	10/16/2006	1/27/2009	3
16403900	KAWAINUI STREAM NR PELEKUNU, MOLOKAʻI, HI	3/1/1995	3/30/1996	2
16605500	Wailuku River at Iao Valley Road, Maui, HI	12/20/2017	2/14/2019	2
16417000	Ahaino Gulch near Pukoo, Molokaʻi, HI	7/29/2013	7/29/2013	1
16595100	Div. Ditch at intake, Honopou Str near Huelo, Maui, HI	10/4/2009	10/4/2009	1

Greater floods are possible, especially with increasing precipitation and sea level rise due to climate change and development pressure along coastal areas. Increasing impervious cover results in increased runoff volumes and consequently, increased flooding. In addition, development within floodplains can, over time, increase base flood elevations as well as increasing the number of people and businesses located in flood hazard areas, resulting in more property damage, injuries, and loss of life.

Probability of Future Events

Land designated as FEMA special flood hazard area is subject to an approximate annual probability of flooding of at least 1.0 percent. Similarly, certain areas within FEMA Zone X are designated as having an approximate annual probability of 0.2%.

Historic events can also be used to infer the likelihood of flood events. In the 49-year period from 1971 to March 2020, 137 flood events were reported in Maui County. This indicates three flood events occurring within Maui County per year, on average. Further, it is likely that flood events will increase in the future with climate change, as ENSO extremes become more frequent, meaning extreme rain events, including hurricanes and Kona storms, will also become more frequent.

Likelihood of coastal flooding can also be inferred from historic events and projected future conditions. According to NCEI, Maui County experienced over 550 high wave days in 16 years, averaging 16 days per year with high surf, but not all high wave events result in flood events. Similarly, Maui County experienced 16 recorded King Tide events in 5 years, averaging three events per year. Coastal flooding due to high waves and King Tides is expected to increase overtime as sea levels continue to rise with climate change.

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Based on historic events and expected future conditions, the flood hazard was assigned a probability of highly likely (greater than 90% annual chance) in Maui County. However, based on the locations of past

flood event (inland and coastal), not all community planning areas have same likelihood of experiencing flooding in a given year. The table below presents flood probabilities for each community planning area.

Table 42. Flood Probabilities for Maui County Community Planning Areas.

Community Planning Area	Flood Probability (Inland and Coastal)
Hāna	Highly Likely (greater than 90% annual chance)
Kīhei-Mākena	Highly Likely (greater than 90% annual chance)
Lānaʻi	Possible (1% to 10% annual chance)
Makawao-Pukalani-Kula	Likely (10% to 90% annual chance)
Molokaʻi	Highly Likely (greater than 90% annual chance)
Pāʻia-Haʻikū	Likely (10% to 90% annual chance)
Wailuku-Kahului	Highly Likely (greater than 90% annual chance)
West Maui	Highly Likely (greater than 90% annual chance)

Vulnerability

With a growing population and increasing development, Maui County is susceptible to increased flooding. Flooding can result in a variety of impacts, such as death and injury, property damage, inability to access areas and road closures. While buildings, infrastructure, and populations within FEMA-designated SFHAs are considered vulnerable to flooding, areas of county outside of FEMA SFHAs are also impacted by flooding, such as flash flooding and urban flooding and events that exceed boundaries of the 1% annual chance flood hazard extents. Therefore, all current and future buildings, infrastructure, and populations in Maui County are considered at risk to flood hazards. Specific impacts to buildings, infrastructure, socially vulnerable populations, life safety, public heath, and the economy from these hazards are described below. Climate-related impacts to the tsunami events are also described.

Building and Infrastructure Impacts (including Critical Facilities)
All current and future buildings and infrastructure, including critical facilities are considered at risk to flooding. Floods can impact coastal and inland areas of Maui County. Riverine, sheet flow, urban flooding, and flash flooding may impact inland areas, while coastal flooding may be caused by high waves, King Tides, sea level rise and storm surge (addressed under the *Hurricane* profile).

Structures exposed to flooding, including critical facilities, can be severely damaged. Building contents can be lost, damaged, or destroyed, and structures themselves can be compromised by floodwaters. Pressure from floodwater, especially as seepage through soil, can damage building foundations. During coastal floods, waves may batter structures or erode soils, undermining building foundations. After a flood, wooden structures may rot. Mold is common in structures that have been inundated by floodwaters and can grow within 24 to 48 hours after a flood. Mold can be costly to safely and properly treat and presents serious public health risks if left untreated (as detailed further in the *Public Health* section of this profile). Building built before the County had a FIRM in place (1981) may also have increased vulnerability as they may be built in more flood-prone areas and not to current building code.

FEMA Flood Zone Analysis

GIS analysis was used to determine buildings and infrastructure within FEMA flood hazards areas, using FEMA FIRM data, building footprints, critical facilities data, and parcel data from county tax assessor records.

For buildings, the determination of assessed building value at-risk was calculated by summing the total assessed building values for building footprints that were confirmed to be located within or partially within a FEMA SFHAs (1% annual chance). Exposure to less frequent flooding (the 1% annual chance flood) was also assessed. The number of parcels, building footprints, and their associated value are presented by community planning district in Table 43. In order to consider coastal flooding and inland flooding for decision making processes, FEMA riverine flooding zones (Zone As) and coastal flood zones (Zone Vs) are detailed separately in the table below.[149] In total, Maui County has 3,116 buildings estimated to be within the FEMA 1% annual chance regulatory floodplain. This is an approximate analysis for planning purposes. This analysis does not account for building elevations or other protections.

Table 43. Potentially At-Risk Parcels, Buildings, and Improvement Value in FEMA Flood Hazard Areas.

FEMA Annual Chance Flood Hazard Area	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Hāna								
1% (Riverine)	262	13%	63	3%	$4,235,654	$2,117,827	$6,353,481	2%
1% (Coastal)	386	19%	62	3%	$7,914,396	$3,957,197	$11,871,593	4%
1% (all)	537	26%	123	6%	$11,951,673	$5,975,836	$17,927,509	5%
Floodway	0	0%	0	0%	$0	$0	$0	0%
0.2%	45	2%	25	1%	$2,255,937	$1,127,969	$3,383,906	1%
Kīhei-Mākena								
1% (Riverine)	5447	30%	1,002	12%	$1,299,145,768	$649,572,895	$1,948,718,663	11%
1% (Coastal)	2030	11%	44	1%	$337,184,648	$168,592,327	$505,776,975	3%
1% (all)	6957	38%	1,043	12%	$1,634,757,824	$817,378,926	$2,452,136,750	14%
Floodway	634	3%	58	1%	$77,766,499	$38,883,252	$116,649,751	1%
0.2%	353	2%	80	1%	$87,622,123	$43,811,060	$131,433,183	1%
Lānaʻi								
1% (Riverine)	18	1%	5	0%	$723,762	$361,880	$1,085,642	0%
1% (Coastal)	49	3%	12	1%	$544,699	$272,351	$817,050	0%
1% (all)	51	3%	17	1%	$1,268,461	$634,231	$1,902,692	0%
Floodway	0	0%	0	0%	$0	$0	$0	0%

[149] Coastal Zone As, which are not an official FEMA flood zone, are grouped with riverine Zone As as they are not differentiated by FEMA SFHA zone.

FEMA Annual Chance Flood Hazard Area	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
0.2%	0	0%	0	0%	$0	$0	$0	0%
Makawao-Pukalani-Kula								
1% (Riverine)	5	0%	0	0%	$0	$0	$0	0%
1% (Coastal)	2	0%	0	0%	$0	$0	$0	0%
1% (all)	6	0%	0	0%	$0	$0	$0	0%
Floodway	1	0%	0	0%	$0	$0	$0	0%
0.2%	1	0%	0	0%	$0	$0	$0	0%
Molokaʻi								
1% (Riverine)	1774	29%	422	17%	$145,356,600	$72,678,300	$218,034,900	18%
1% (Coastal)	764	12%	32	1%	$6,958,300	$3,479,150	$10,437,450	1%
1% (all)	1964	32%	447	18%	$151,177,900	$75,588,950	$226,766,850	19%
Floodway	299	5%	34	1%	$26,034,900	$13,017,450	$39,052,350	3%
0.2%	191	3%	100	4%	$22,043,300	$11,021,650	$33,064,950	3%
Pāʻia-Haʻikū								
1% (Riverine)	109	2%	57	1%	$25,127,326	$12,563,663	$37,690,989	2%
1% (Coastal)	79	2%	36	0%	$7,265,951	$3,632,973	$10,898,924	1%
1% (all)	160	3%	81	1%	$29,144,411	$14,572,204	$43,716,615	2%
Floodway	49	1%	12	0%	$14,576,207	$7,288,104	$21,864,311	1%
0.2%	0	0%	0	0%	$0	$0	$0	0%
Wailuku-Kahului								
1% (Riverine)	1166	7%	580	3%	$172,871,087	$86,435,550	$259,306,637	3%
1% (Coastal)	729	4%	268	2%	$165,936,195	$82,968,089	$248,904,284	3%
1% (all)	1375	8%	811	5%	$312,167,931	$156,083,963	$468,251,894	5%
Floodway	148	1%	30	0%	$3,932,575	$1,966,290	$5,898,865	0%
0.2%	63	0%	55	0%	$7,494,819	$3,747,411	$11,242,230	0%
West Maui								
1% (Riverine)	5,560	31%	471	7%	$2,036,902,281	$1,018,451,151	$3,055,353,432	16%
1% (Coastal)	7390	41%	162	3%	$1,595,752,755	$797,876,377	$2,393,629,132	12%
1% (all)	8847	49%	589	9%	$2,612,780,286	$1,306,390,153	$3,919,170,439	20%
Floodway	1173	6%	47	1%	$339,306,307	$169,653,153	$508,959,460	3%
0.2%	163	1%	110	2%	$50,751,994	$25,376,000	$76,127,994	0%
1.0% ACF (all) TOTAL	**19,897**	**25%**	**3,111**	**5%**	**$4,753,248,486**	**$2,376,624,263**	**$7,129,872,749**	**13%**
0.2% ACF (all) TOTAL	**816**	**1%**	**370**	**1%**	**$170,168,173**	**$85,084,090**	**$255,252,263**	**0%**

*Buildings partially within a flood zone are were considered to be in that flood zone.

*Buildings partially within the 1% ACF and the 0.2% ACF were considered to be in the 1% ACF.

*Some buildings are in both the riverine (Zone As) and coastal (Zone Vs); this is accounted for under 1%ACF (all).

Community planning areas within Maui County have varying exposure to FEMA flood hazard areas. The Makawao-Pukalani-Kula community planning area has no buildings within FEMA flood hazard areas. Moloka‘i has the greatest proportion of its buildings within SFHAs, at 18%. However, Kīhei-Mākena has the greatest number of building in SFHAs, with 1,043 buildings in 1% annual chance flood areas. West Maui has the most exposure to FEMA flood hazards in term of building value, with an estimated $3.9 billion potentially at-risk within flood hazard areas. The figures below show buildings within these impact areas for each community planning area.

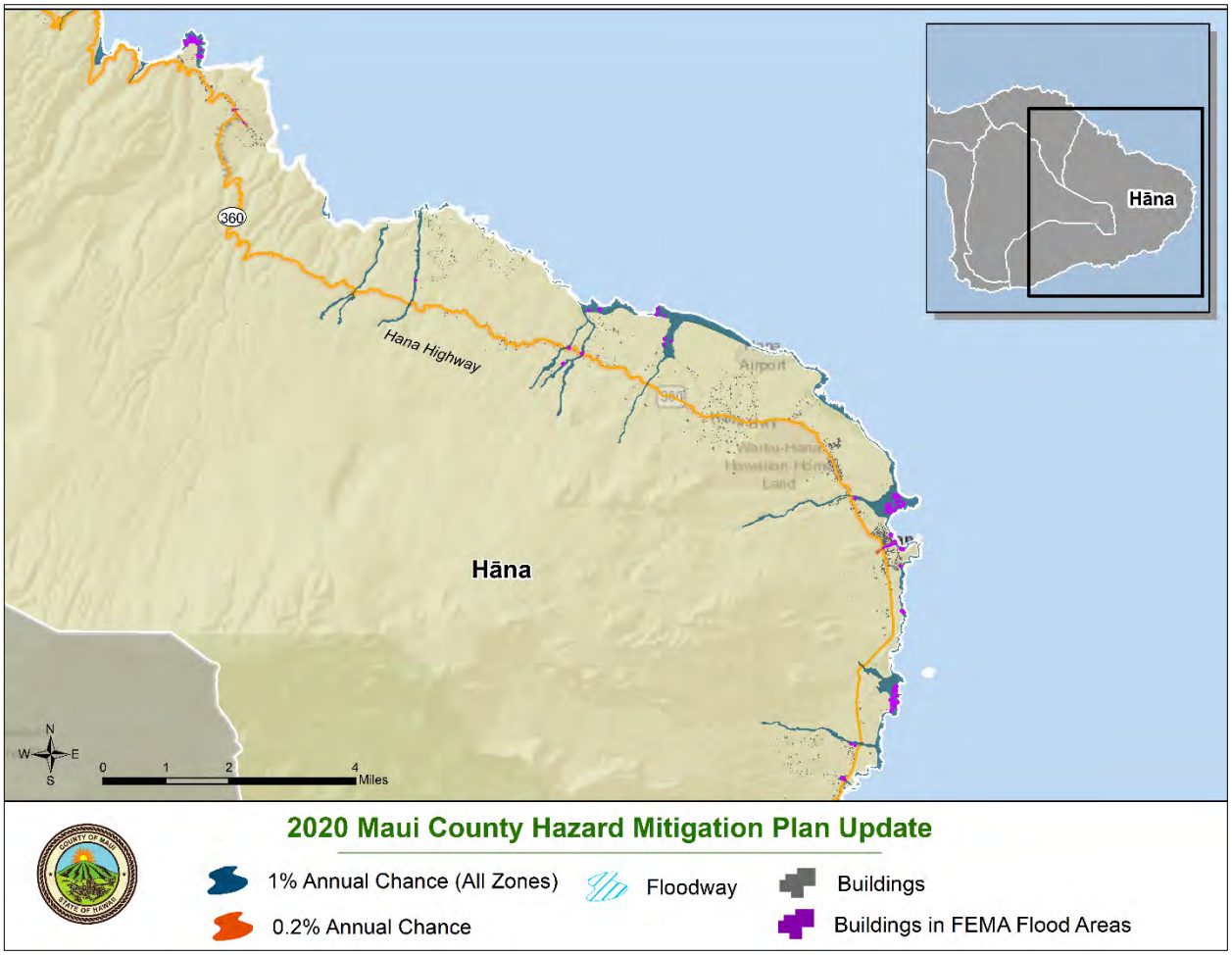

Figure 88. Buildings in FEMA Flood Hazard Areas in the Hāna Community Planning Area.

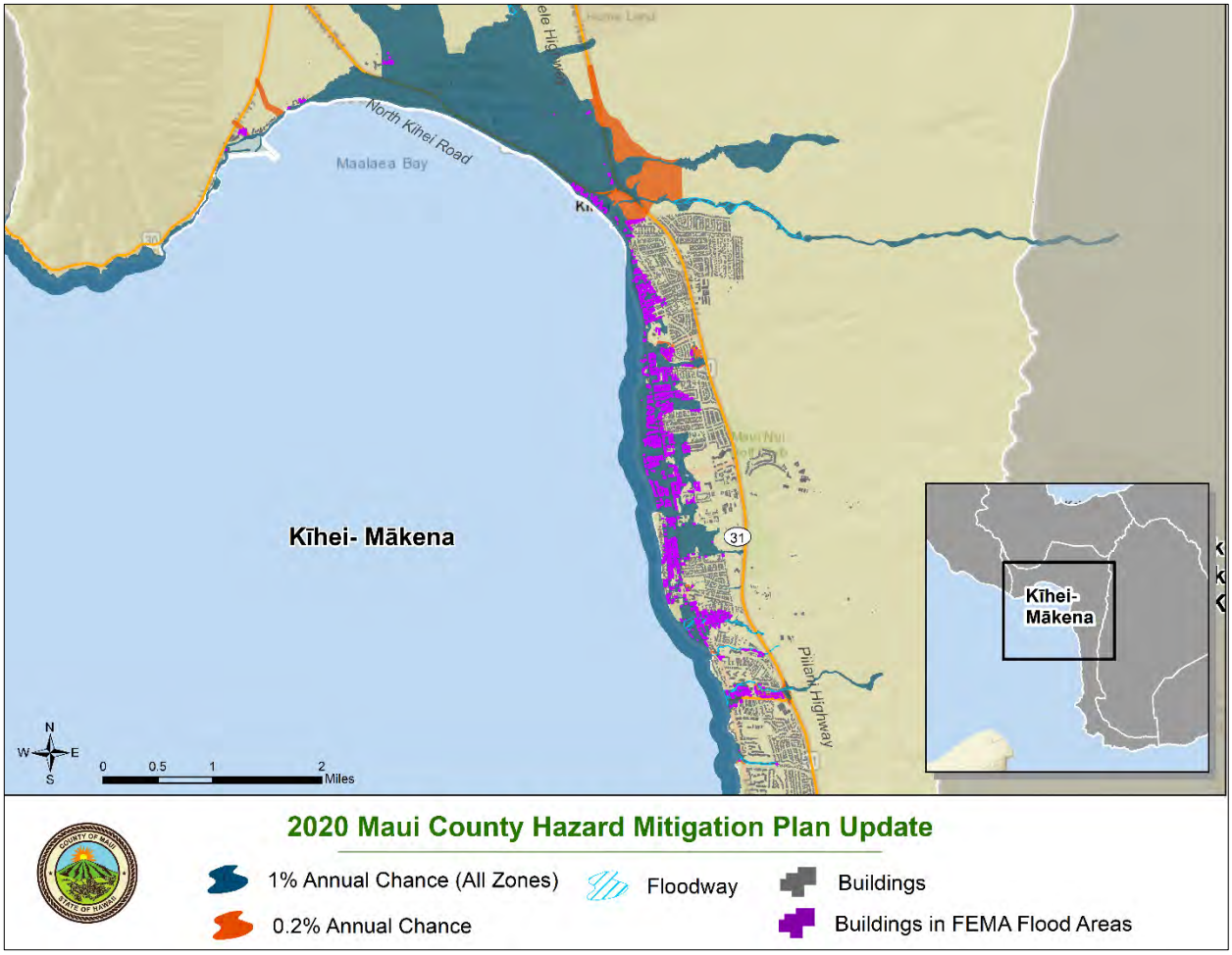

Figure 89. Buildings in FEMA Flood Hazard Areas in the Northern Kīhei-Mākena Community Planning Area.

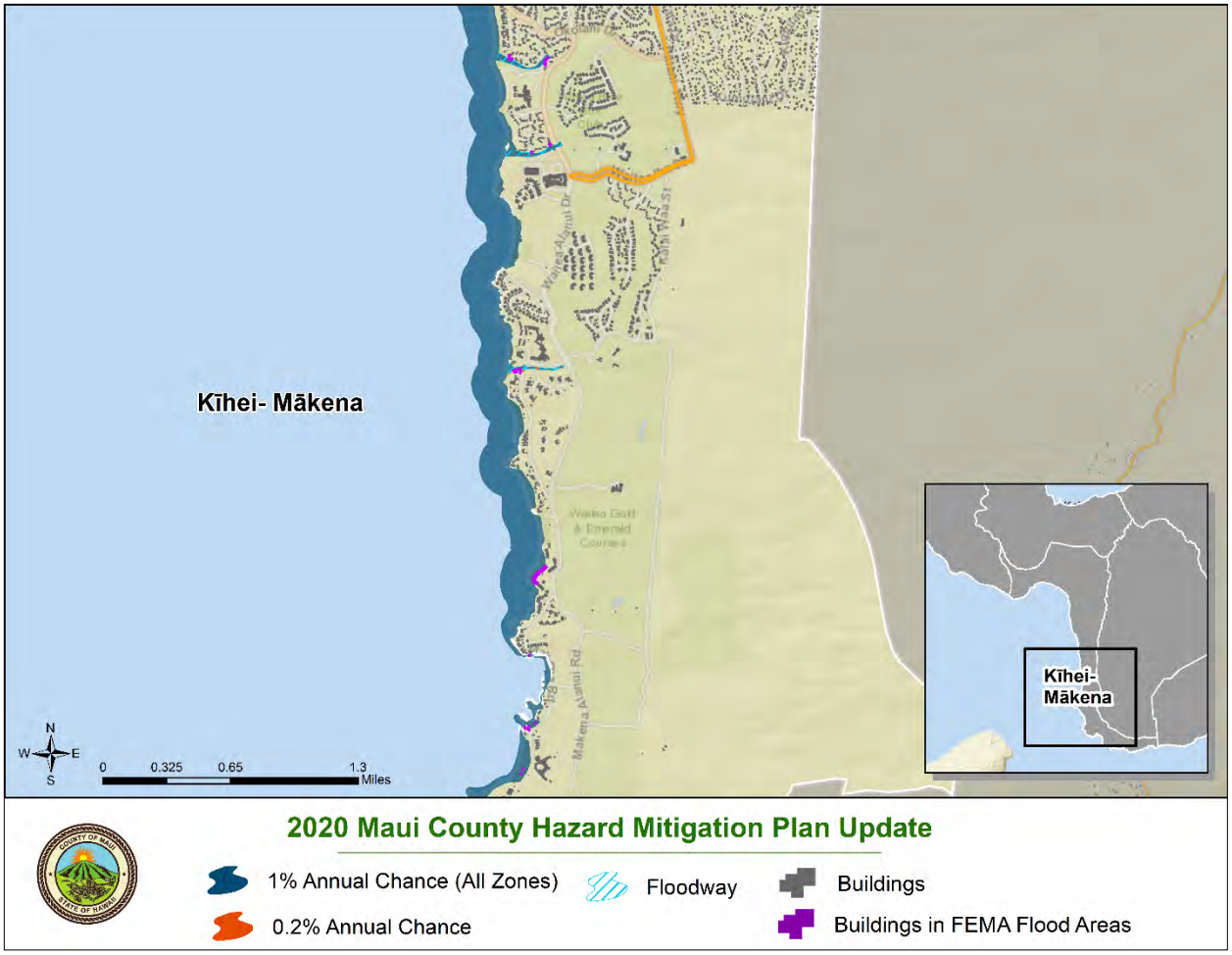

Figure 90. Buildings in FEMA Flood Hazard Areas in the Southern Kīhei-Mākena Community Planning Area.

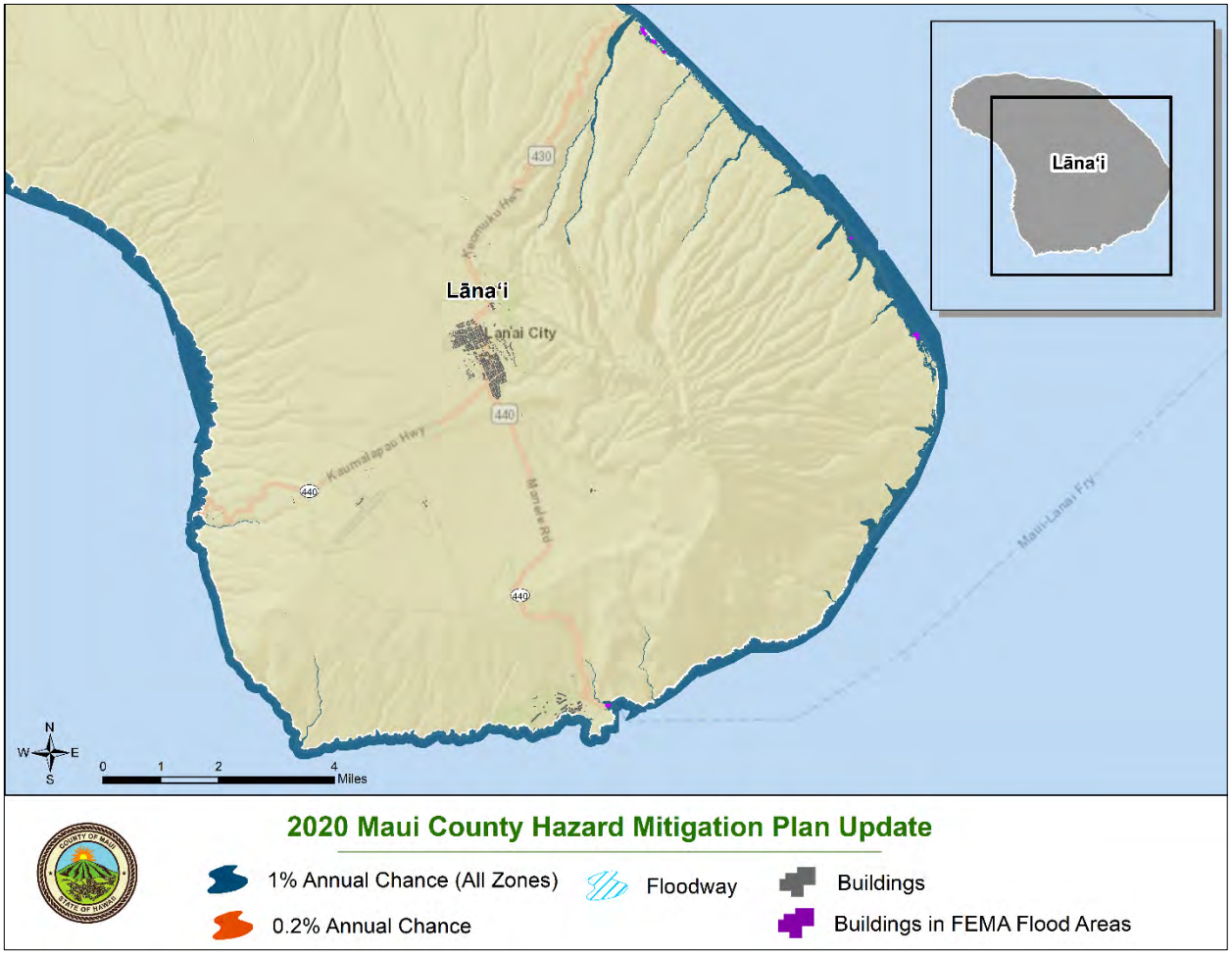

Figure 91. Buildings in FEMA Flood Hazard Areas in the Lānaʻi Community Planning Area.

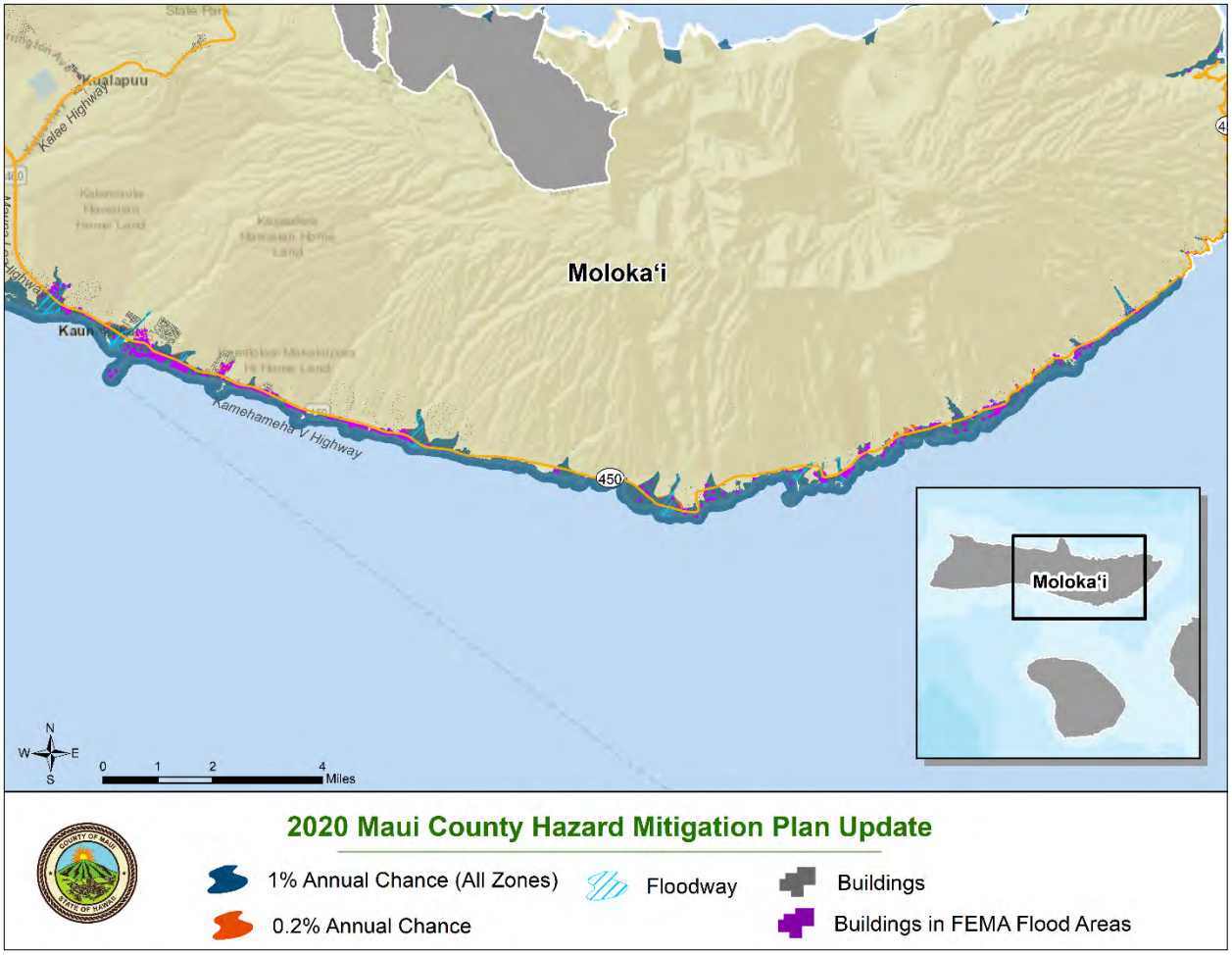

Figure 92. Buildings in FEMA Flood Hazard Areas in the Moloka'i Community Planning Area.

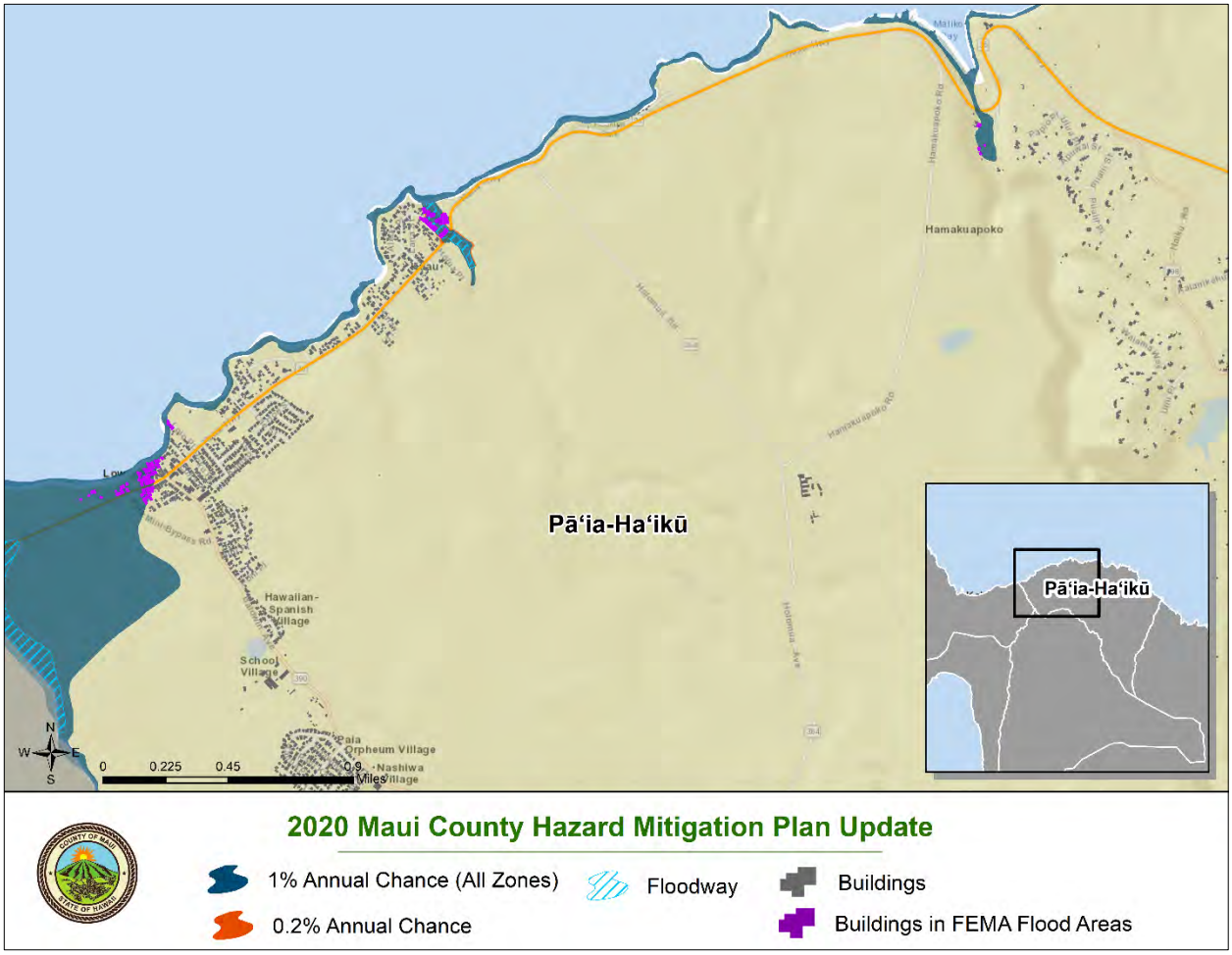

Figure 93. Buildings in FEMA Flood Hazard Areas in the Pāʻia-Haʻikū Community Planning Area.

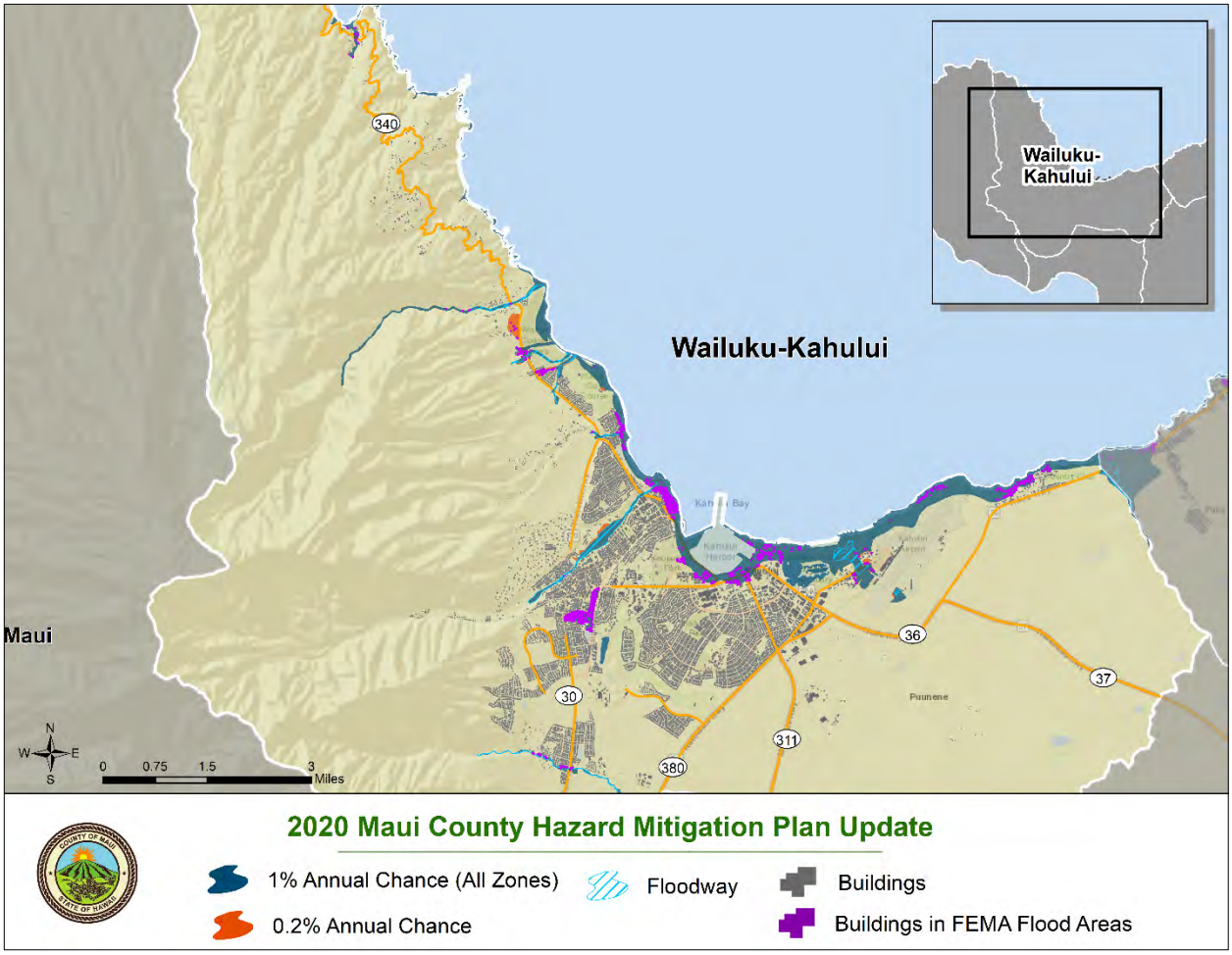

Figure 94. Buildings in FEMA Flood Hazard Areas in the Wailuku-Kahului Community Planning Area.

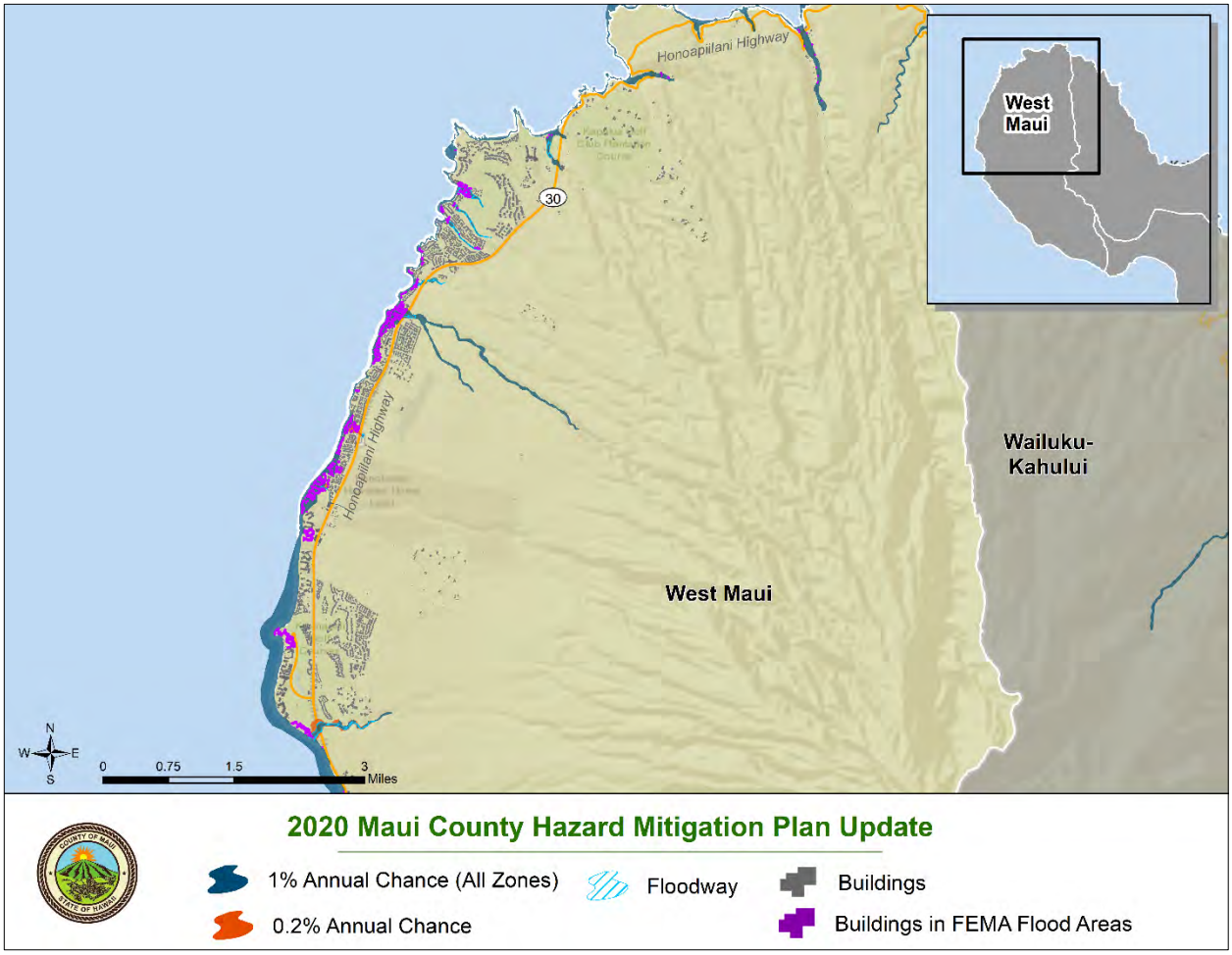

Figure 95. Buildings in FEMA Flood Hazard Areas in the Northern West Maui Community Planning Area.

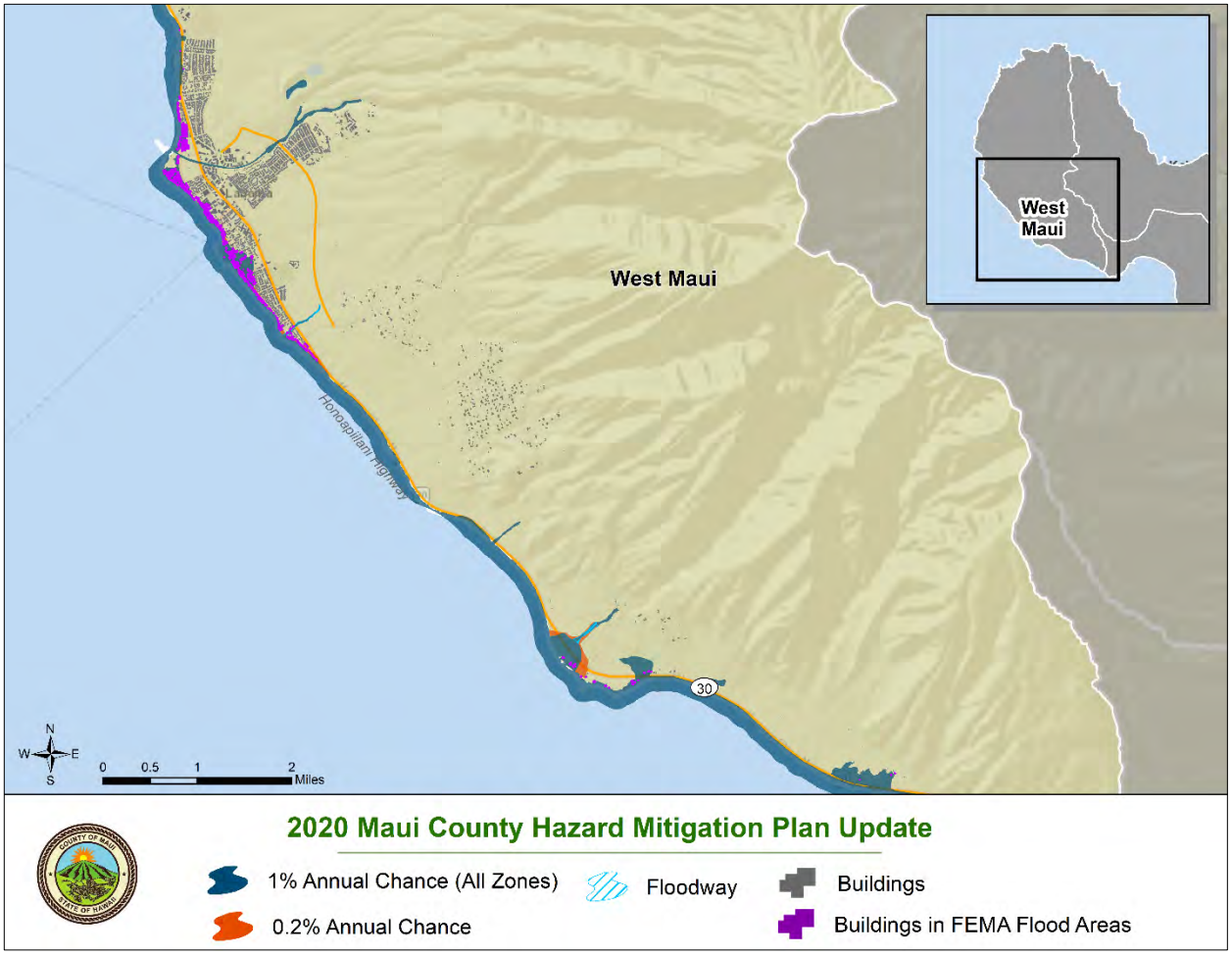

Figure 96. Buildings in FEMA Flood Hazard Areas in the Southern West Maui Community Planning Area.

GIS analysis was used to determine number of critical facilities within the FEMA 1% annual chance regulatory floodplain. The table below presents the number of critical facilities within these impact areas for each community planning area. Overall, there are 38 potentially at-risk critical facilities within Maui County special flood hazard areas.

Table 44. Potentially At-Risk Critical Facilities in FEMA Special Flood Hazard Areas.

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Commercial Facilities	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A	**0 (0%)**
Communications Facilities	0	0	0	0	1	N/A	0	N/A	**1 (13%)**

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Emergency Services	0	2	0	0	1	0	0	1	**4 (11%)**
Energy	0	N/A	N/A	N/A	0	N/A	0	N/A	**0 (0%)**
Food and Agriculture	0	0	N/A	N/A	N/A	N/A	0	N/A	**0 (0%)**
Government Facilities	N/A	N/A	N/A	N/A	0	N/A	0	N/A	**0 (0%)**
Healthcare and Public Health	0	2	0	0	2	0	0	0	**4 (8%)**
Mass care	1	2	0	0	1	0	0	0	**4 (5%)**
Transportation	0	N/A	0	N/A	1	N/A	9	0	**10 (37%)**
Water and Wastewater Systems	0	5	N/A	0	1	0	5	4	**15 (19%)**
TOTAL	**1 (7%)**	**11 (33%)**	**0 (0%)**	**0 (0%)**	**7 (22%)**	**0 (0%)**	**14 (13%)**	**5 (10%)**	**38 (13%)**

In addition to those above, five facilities are located within the FEMA 1% annual chance flood area, including:

- Kīhei-Mākena – 1 water, waste and wastewater system facility and 1 mass care support facility;
- Molokaʻi – 2 water, waste and wastewater system facilities and 1 emergency services facility; and,
- West Maui – 2 water, waste and wastewater system facilities.

The figures below show critical facilities in Maui County FEMA flood hazard areas by community planning area.

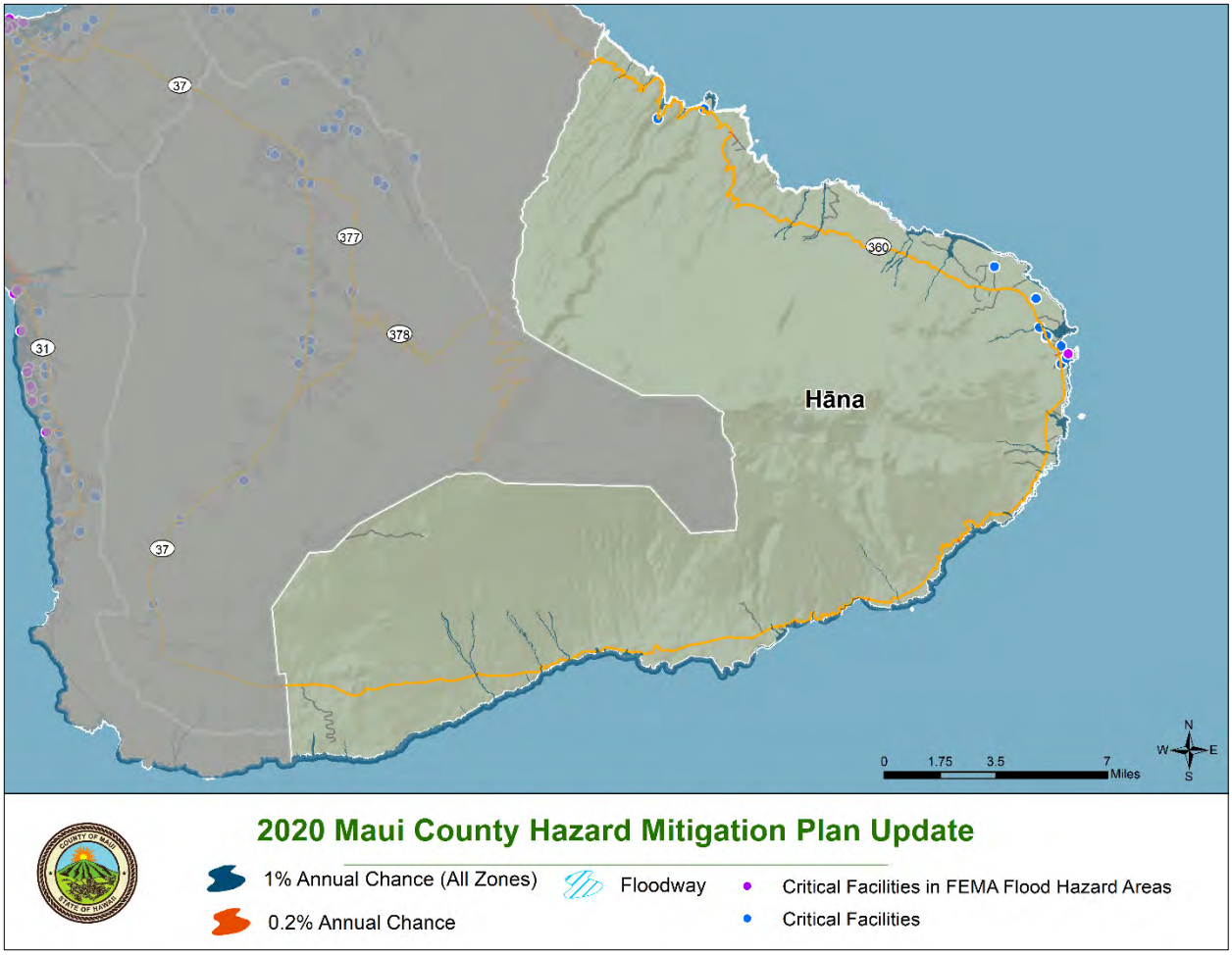

Figure 97. Critical Facilities in FEMA Flood Hazard Areas in the Hāna Community Planning Area.

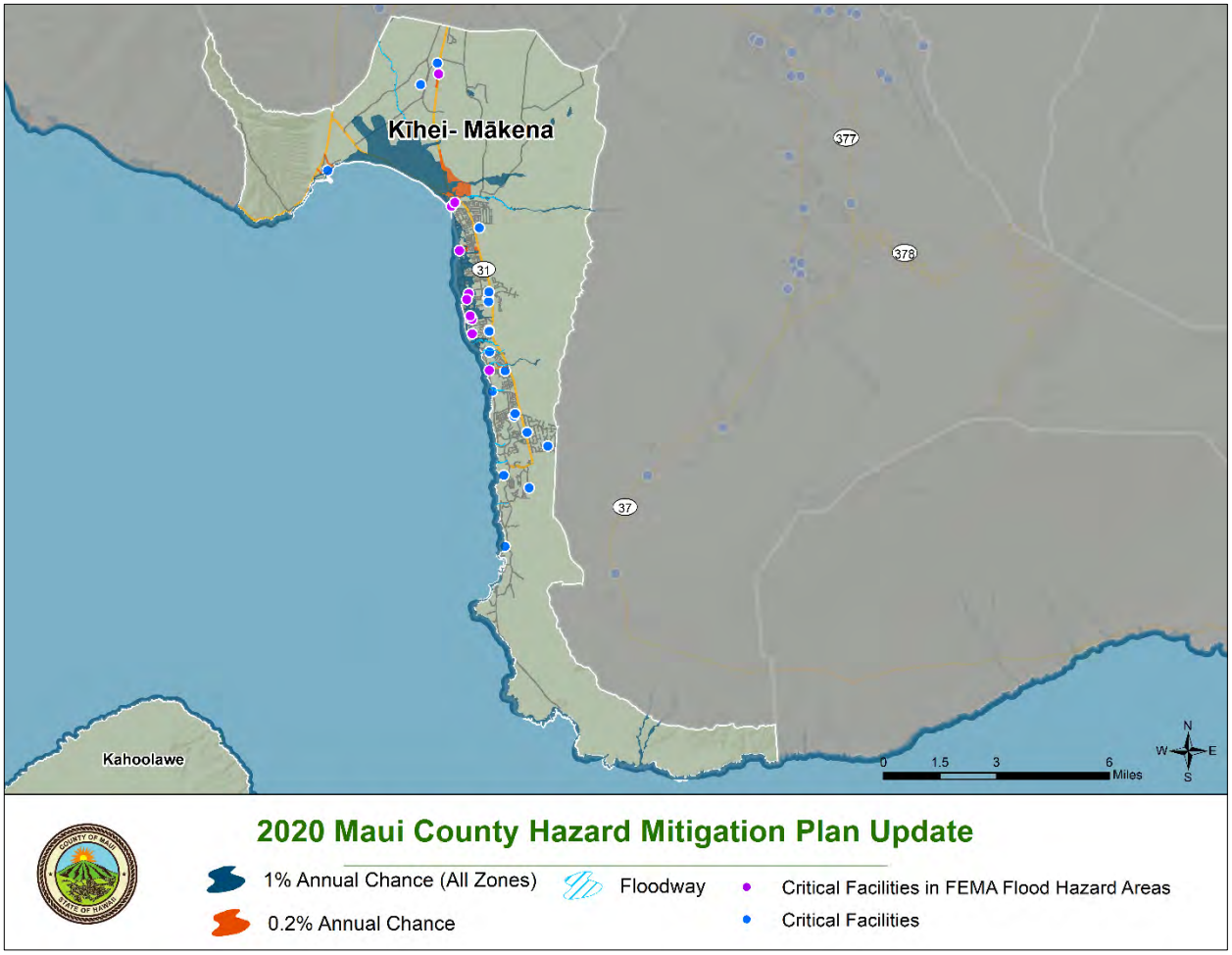

Figure 98. Critical Facilities in FEMA Flood Hazard Areas in the Kīhei-Mākena Community Planning Area.

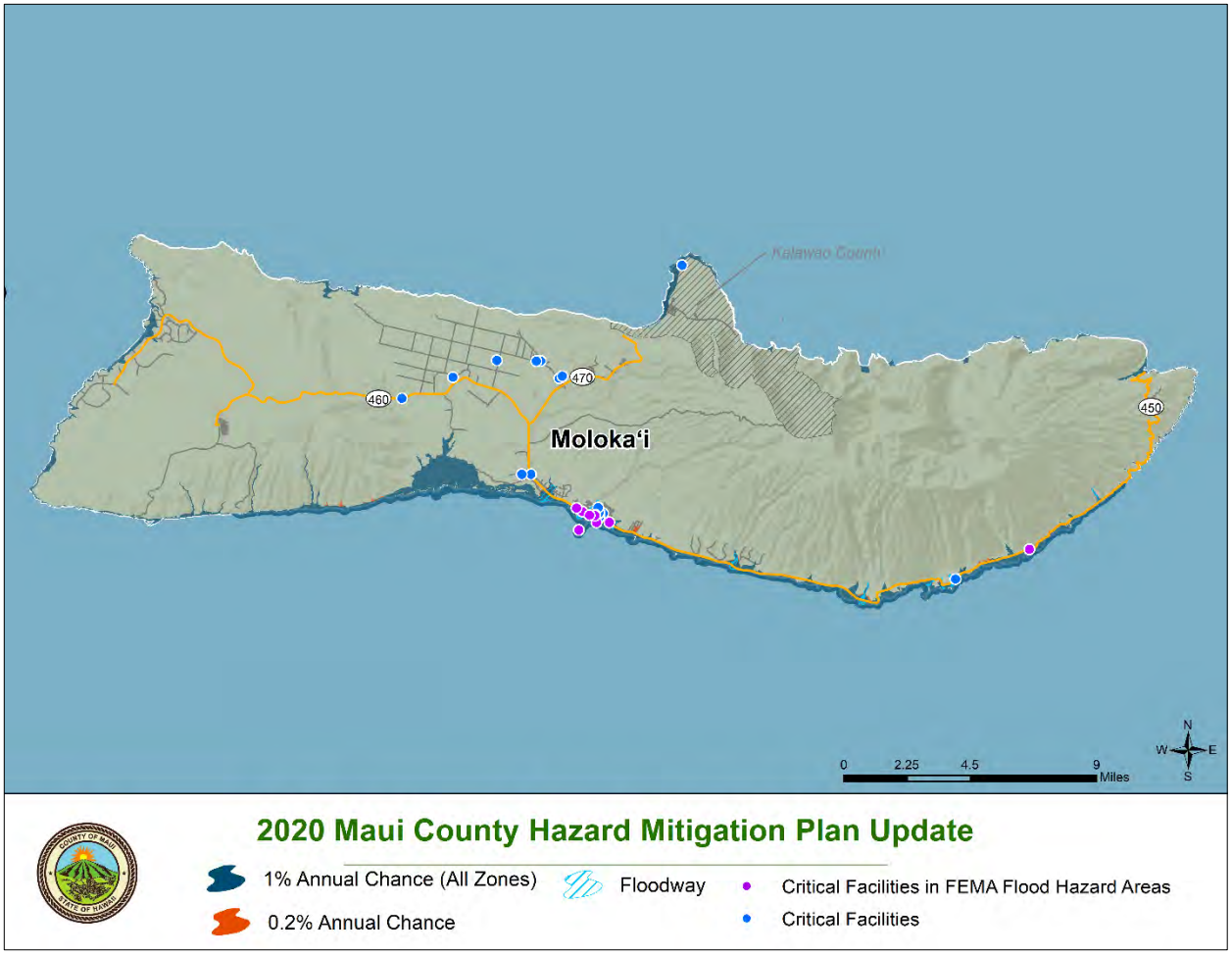

Figure 99. Critical Facilities in FEMA Flood Hazard Areas in the Moloka'i Community Planning Area.

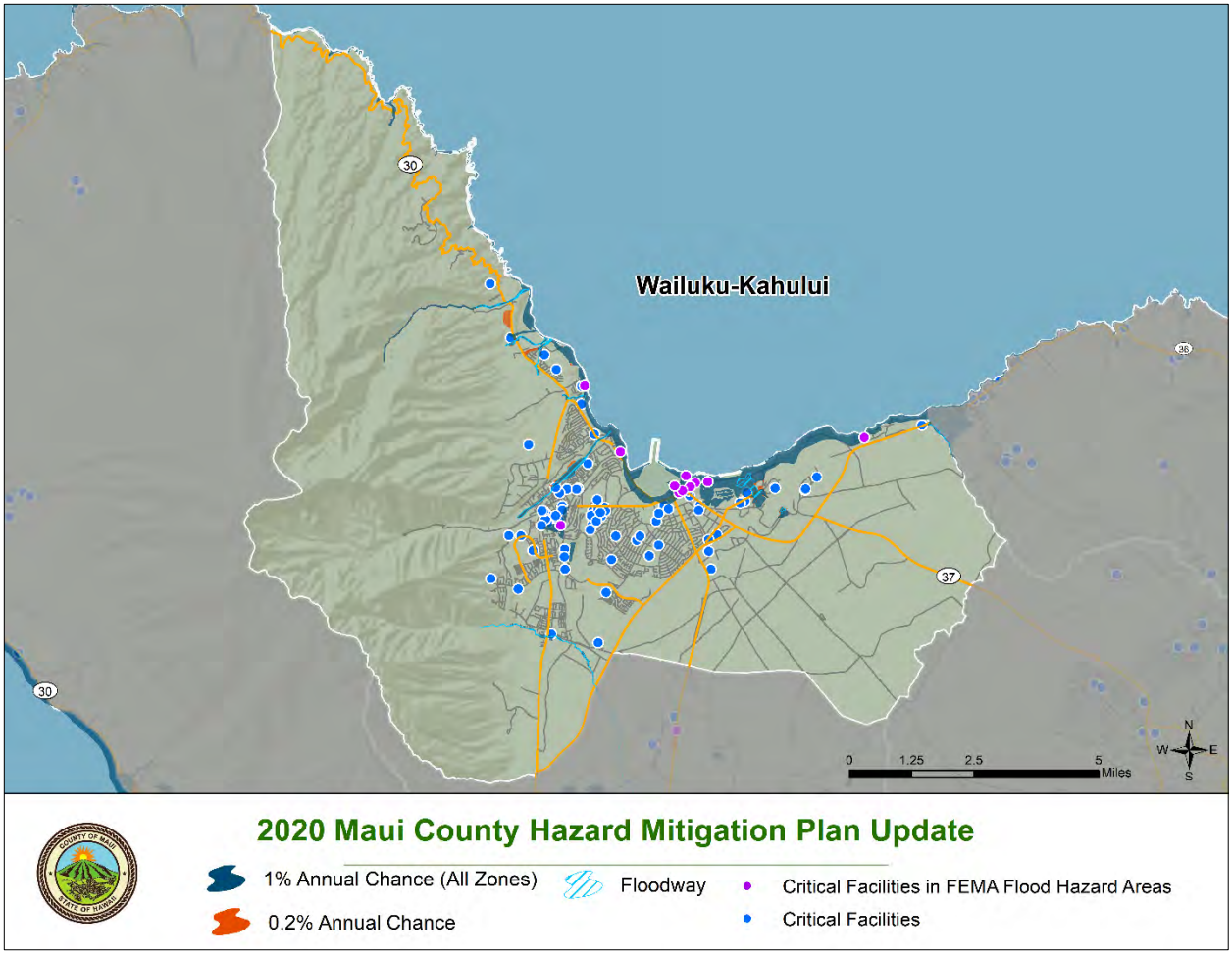

Figure 100. Critical Facilities in FEMA Flood Hazard Areas in the Wailuku-Kahului Community Planning Area.

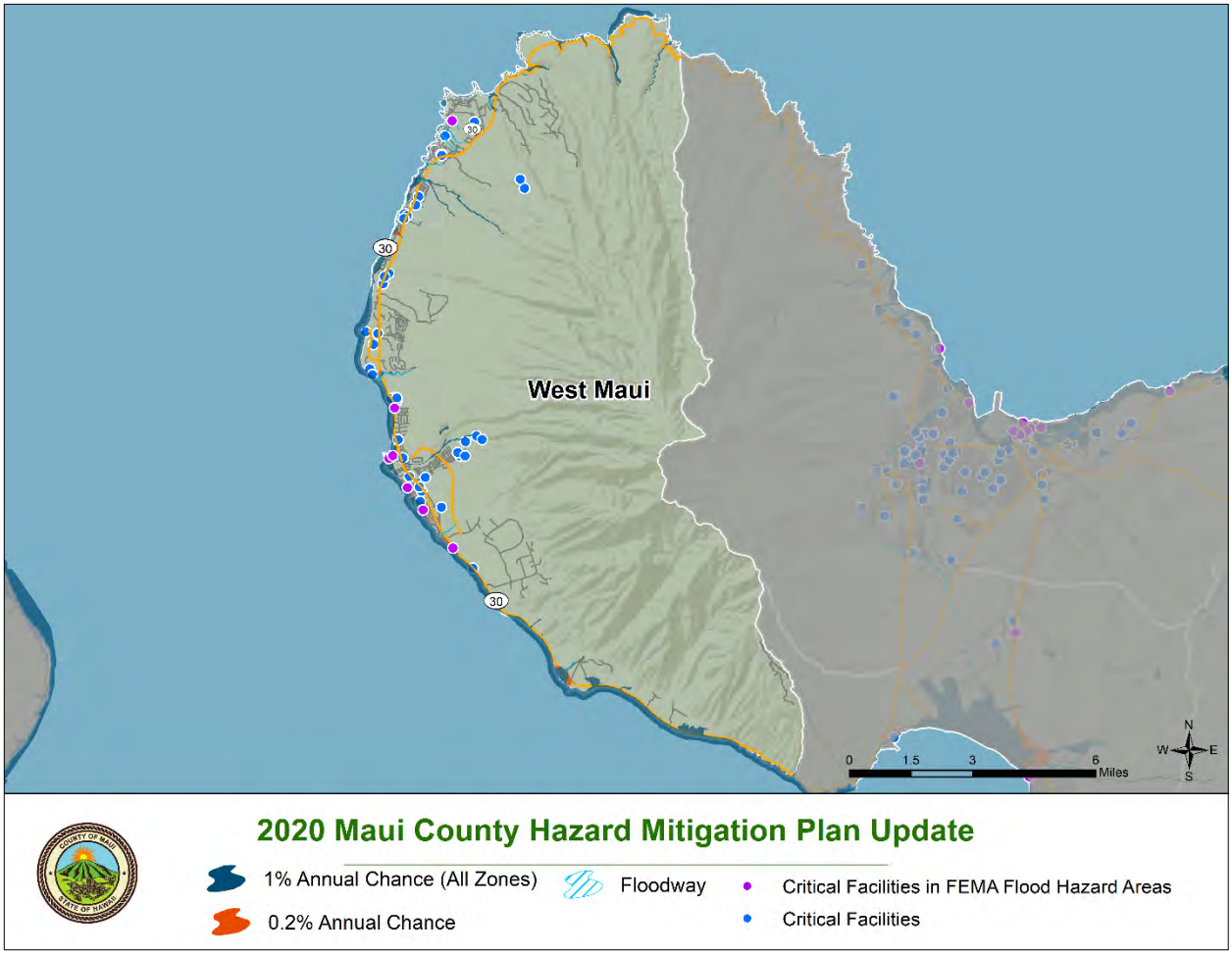

Figure 101. Critical Facilities in FEMA Flood Hazard Areas in the West Maui Community Planning Area.

Hazus-MH Loss Estimates

Hazus-MH 4.2 was used to estimate the potential of complete structural damage due to flooding. A baseline of dollar exposure for all buildings and their contents for Maui County was reviewed, as detailed in the table below. These dollar values reflect a combination of building value from parcel data and building footprints provided by Maui County. This information provides a baseline of how much property, in terms a dollar value, is at risk. Exposure for the identified buildings where a majority of residents reside is approximately $54 billion.

Due to Hazus limitations with built-in stream discharge values in this study area, floodplains were generated for the 1.0% annual chance flood in both riverine and coastal areas using the effective SFHA, cross section water surface elevation values, and a 10-square meter digital elevation model (DEM). Losses are presented in terms of building losses and content losses. The results presented in the table below reflect the building and content loss to structures within each community planning area. The SFHA defined by Hazus, along with impacted buildings and loss estimates, are presented in Figure 102.

Table 45. Hazus-MH 4.2 Building and Content Loss.

1% Annual Chance Flood

	Building Loss	Content Loss	Total Loss
Hāna	$100,053	$50,723	$150,776
Kīhei-Mākena	$105,948,425	$53,432,335	$159,380,760
Lānaʻi	$541,995	$270,192	$812,187
Makawao-Pukalani-Kula	$0	$0	$0
Molokaʻi	$14,759	$7,505	$22,264
Pāʻia-Haʻikū	$5,763,711	$3,203,519	$8,967,230
Wailuku-Kahului	$3,202,440	$1,626,929	$4,829,369
West Maui	$268,960,293	$134,929,911	$403,890,203
Total	**$384,531,676**	**$193,521,114**	**$578,052,790**

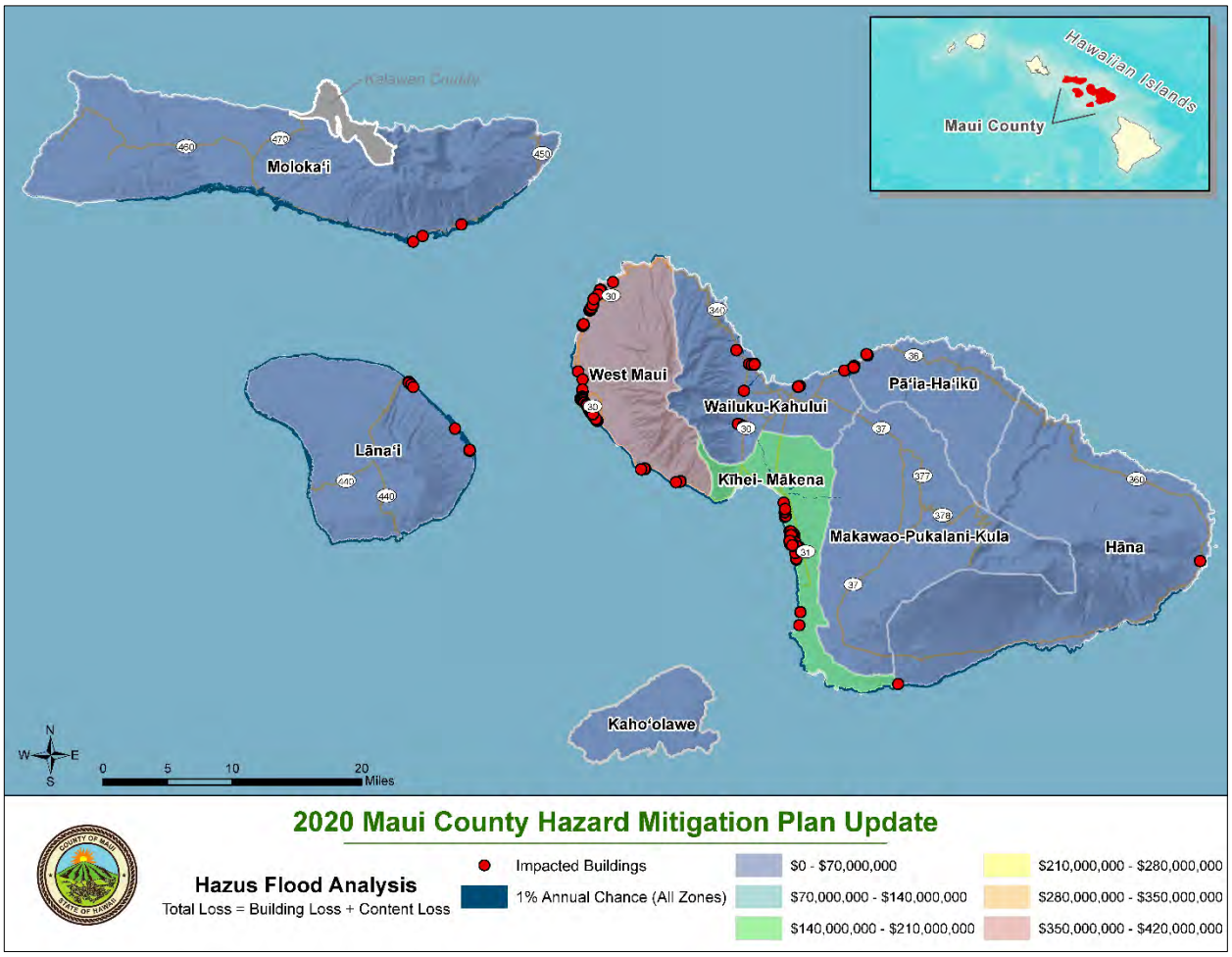

Figure 102. Hazus analysis 1.0% ACF impacted buildings and loss estimates by community planning area.

In addition to buildings and identified critical facilities, utility lines, roads, and bridges are vulnerable to the impact of floods. Flooding can scour and undermine bridges, wash-out roads, overwhelm stormwater infrastructure, and damage water, sewer and gas lines. When utility lines are damaged by flood, functionality of water, sewer, gas, and electricity systems may be compromised. Flooding may trigger landslides that block or damage roadways. For instance, during Hurricane Lane, Hāna Highway was blocked in several places due to landslides.

Because of their geographic extent, roads, and utility lines can have a greater chance of being impacted by flood events. Further, if any section of a road or utility line is damaged or flooded during a hurricane, the entire system may be impacted. For instance, a hurricane that causes one area of a road or a bridge to be impassible may block accessibility to other roads or locations until waters recede, debris is removed, or in the case of damage (e.g., undermining, scour, or washing out), until repairs can be completed. The majority of reported flood impacts in Maui County are road closures.

Table 46 presents the number of bridges in each community planning area that are within FEMA flood areas (1% and 0.2% annual chance). Figure 103 and Figure 104 present bridges within FEMA Flood hazard areas on the Islands of Maui and Molokaʻi. There are no NBI bridges on the Island of Lānaʻi.

Table 46. Number of NBI Bridges in Maui County Community Planning Areas in FEMA Flood Hazard Areas.

Community Planning Area	Number of (NBI) Bridges
Hāna	13
Kīhei-Mākena	6
Lānaʻi	N/A
Makawao-Pukalani-Kula	0
Molokaʻi	14
Pāʻia-Haʻikū	1
Wailuku-Kahului	6
West Maui	10
MAUI COUNTY TOTAL	**50 (7%)**

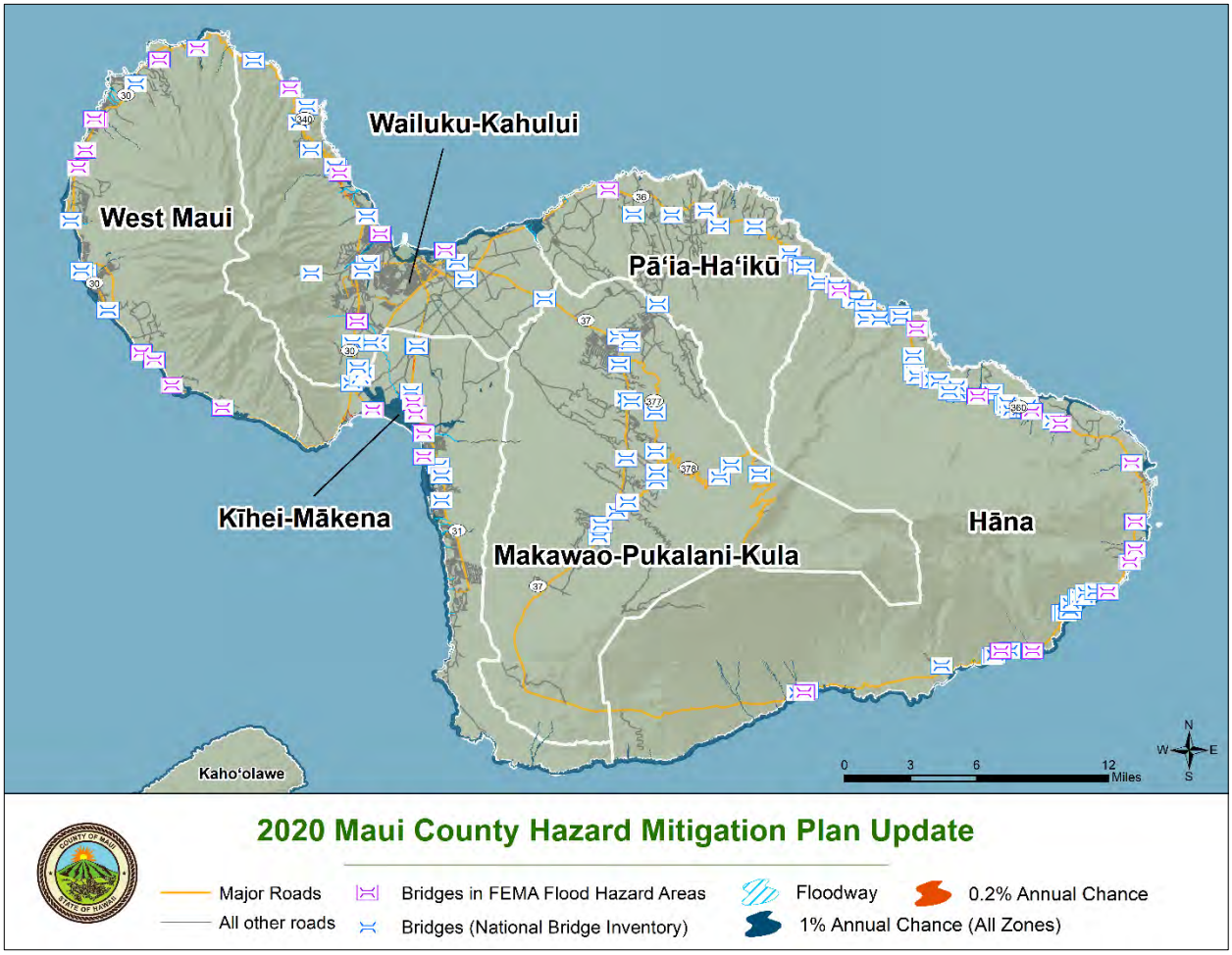

Figure 103. Bridges in FEMA Flood Hazard Areas on Maui Island.

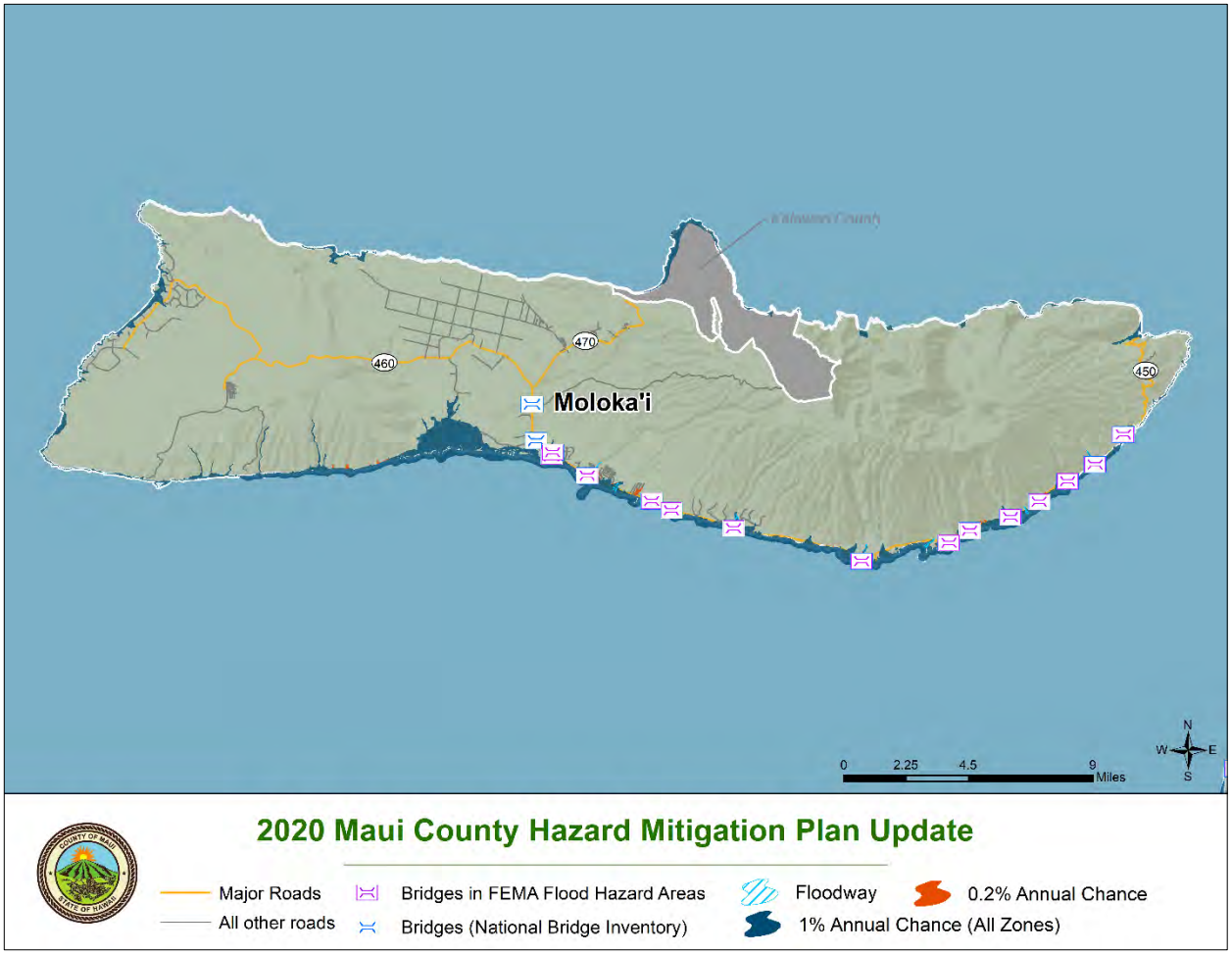

Figure 104. Bridges in FEMA Flood Hazard Areas on Molokaʻi Island.

Further, the maps below show roads, county-owned and others, within FEMA flood hazard areas. Many roads may have one or more segments within a flood hazard area. Major routes identified as having segments within flood hazard areas include:

- Honoapiilani Highway in West Maui;
- North and South Kīhei Road, Mokulele Highway, and Piilani Highway, and Kanakanui Road in Kīhei-Mākena;
- Hāna Highway in Hāna and Pāʻia-Haʻikū;
- Honoapiilani Highway, Kaahumanu Avenue, South Puunene Avenue, and Waiehu Beach Road in Wailuku-Kahului; and,
- Maunaloa Highway and Kamehameha V Highway in Molokaʻi.

Further, many county-owned local streets are also within flood hazard areas within these planning areas.

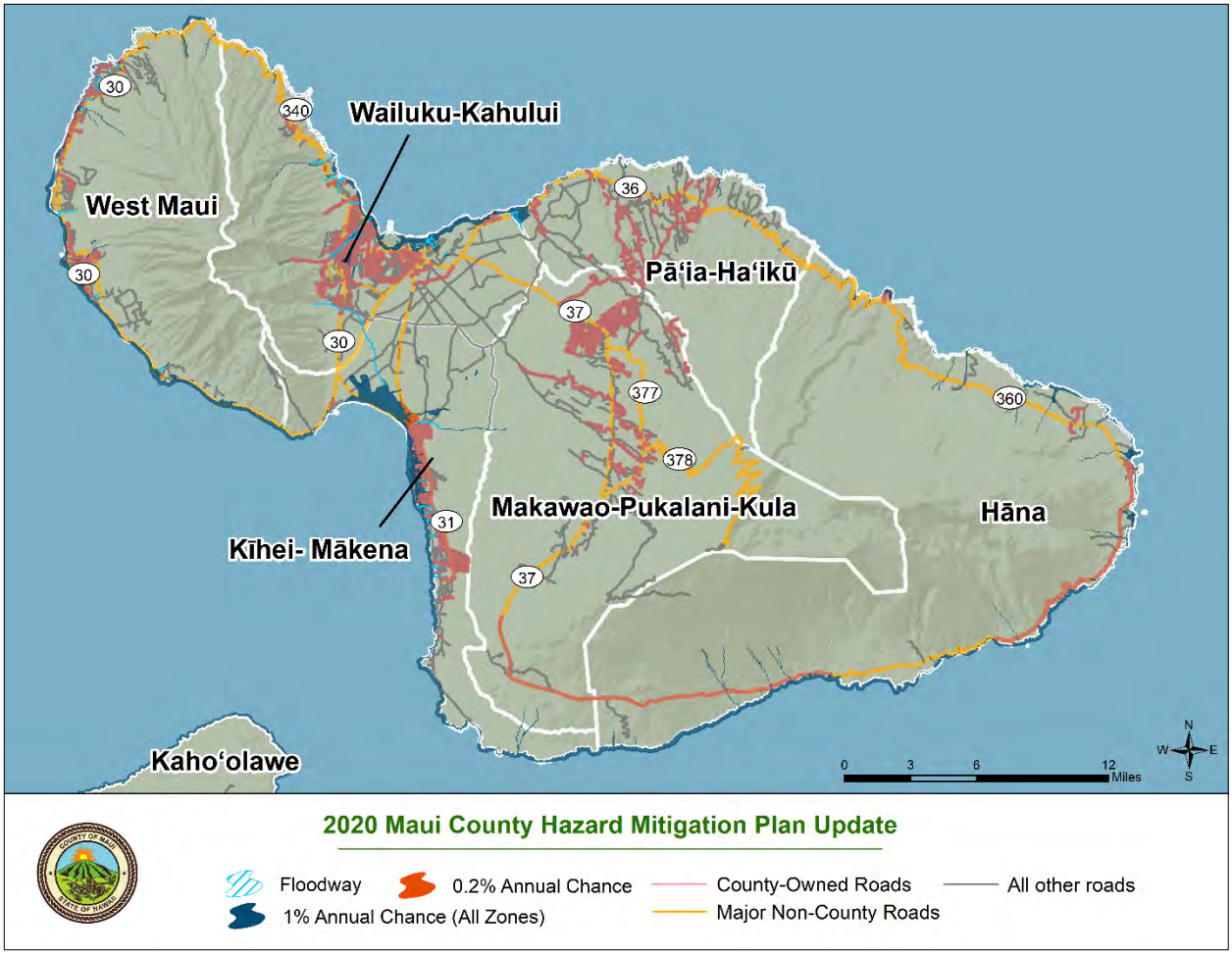

Figure 105. Roads and Flood Hazard Areas on Maui Island.

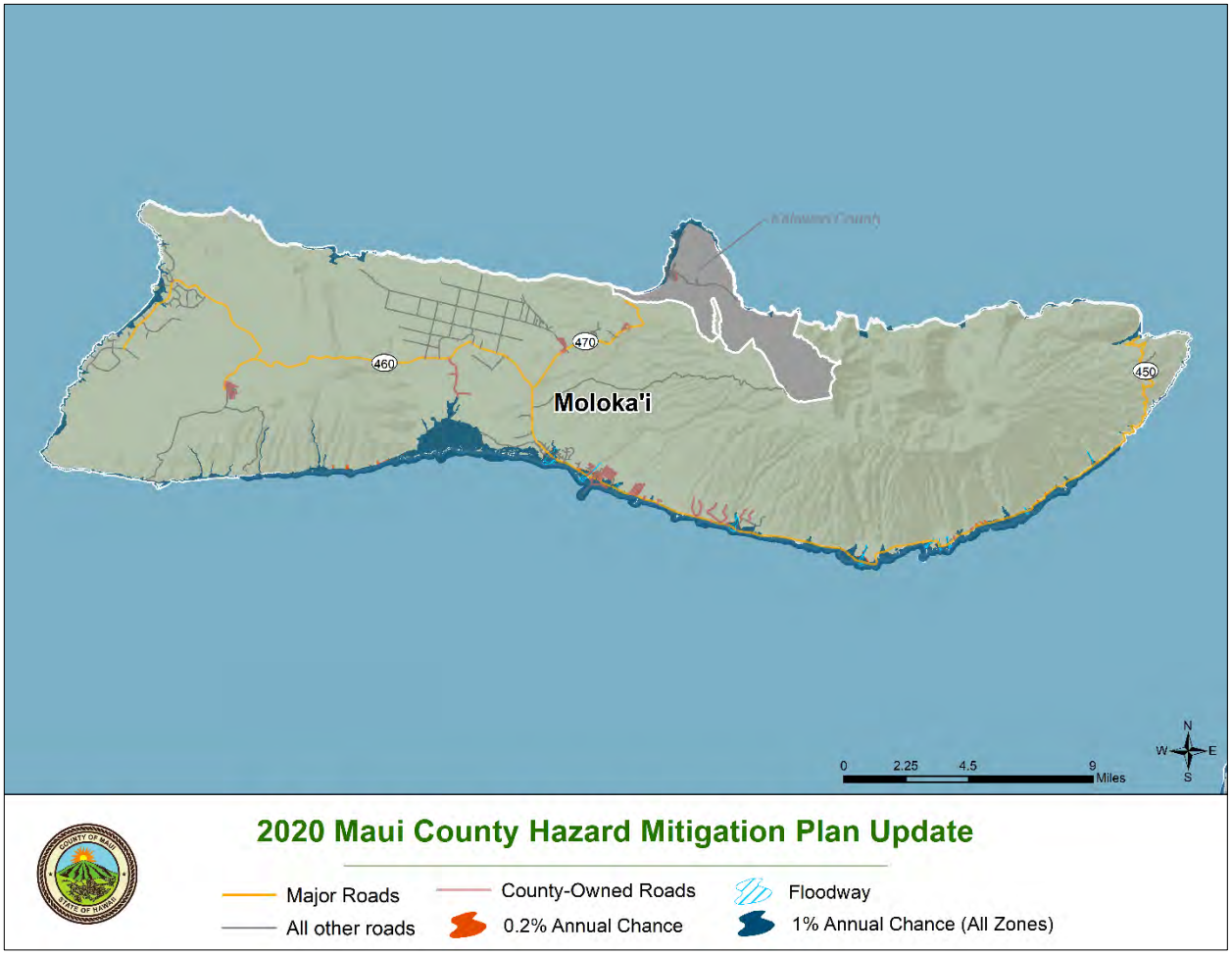

Figure 106. Roads and Flood Hazard Areas on Moloka‘i Island.

Sea Level Rise (Passive)

In addition to FEMA flood hazard areas, GIS analysis was used to determine buildings and infrastructure within modeled areas of future sea level rise. PacIOOS has developed sea level rise data for Hawai‘i, including Maui County, that aggregates the impacts from passive sea level rise, annual high wave flooding, and coastal erosion. The GIS analysis was performed for four sea level rise scenarios (years 2030, 2050, 2075, and 2100) using PacIOOS exposure data, building footprints, critical facilities data, and parcel data from county tax assessor records.

For buildings, the determination of assessed value at-risk (exposure) was calculated by summing the total assessed building values for building footprints that were confirmed to be located within or partially within an identified areas of sea level rise. The number of parcels, building footprints, and their associated value are presented by community planning district in the table below. This is an approximate analysis for planning purposes. This analysis does not account for building elevations, seawalls, or backshore armoring.

Table 47. Potentially At-Risk Parcels, Buildings, and Improvement Value in FEMA Flood Hazard Areas.

Aggregated SLR Hazard Area	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Hāna								
2030	244	12%	0	0%	$0	$0	$0	0%
2050	252	12%	2	0%	$90,316	$45,158	$135,474	0%
2075	262	13%	5	0%	$486,897	$243,449	$730,346	0%
2100	279	13%	7	0%	$597,017	$298,509	$895,526	0%
Kīhei-Mākena								
2030	2,533	14%	105	1%	$677,211,840	$338,605,922	$1,015,817,762	6%
2050	3,330	18%	151	2%	$787,239,504	$393,619,754	$1,180,859,258	7%
2075	3,725	20%	228	3%	$1,136,516,509	$568,258,255	$1,704,774,764	10%
2100	5,135	28%	326	4%	$1,447,970,629	$723,985,322	$2,171,955,951	13%
Lānaʻi								
2030	22	1%	0	0%	$0	$0	$0	0%
2050	22	1%	0	0%	$0	$0	$0	0%
2075	22	1%	0	0%	$0	$0	$0	0%
2100	25	2%	0	0%	$0	$0	$0	0%
Makawao-Pukalani-Kula								
2030	2	0.02%	0	0%	$0	$0	$0	0%
2050	2	0.02%	0	0%	$0	$0	$0	0%
2075	2	0.02%	0	0%	$0	$0	$0	0%
2100	2	0.02%	0	0%	$0	$0	$0	0%
Molokaʻi								
2030	364	6%	10	0%	$1,873,000	$936,500	$2,809,500	0%
2050	395	6%	14	1%	$2,827,400	$1,413,700	$4,241,100	0%
2075	581	9%	30	1%	$4,708,200	$2,354,100	$7,062,300	1%
2100	1,180	19%	180	7%	$34,302,600	$17,151,300	$51,453,900	4%
Pāʻia-Haʻikū								
2030	139	3%	27	0%	$11,180,689	$5,590,344	$16,771,033	1%
2050	144	3%	46	1%	$24,209,879	$12,104,938	$36,314,817	2%
2075	161	3%	67	1%	$27,295,771	$13,647,882	$40,943,653	2%
2100	189	4%	98	1%	$38,320,379	$19,160,185	$57,480,564	3%
Wailuku-Kahului								
2030	571	3%	71	0%	$46,234,313	$23,117,156	$69,351,469	1%
2050	588	3%	94	1%	$70,452,047	$35,226,021	$105,678,068	1%
2075	631	4%	126	1%	$88,523,192	$44,261,593	$132,784,785	2%
2100	690	4%	185	1%	1$11,218,637	$55,609,316	$166,827,953	2%
West Maui								

Aggregated SLR Hazard Area	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
2030	7,891	44%	223	3%	$2,371,152,164	$1,185,576,084	$3,556,728,248	18%
2050	7,969	44%	280	4%	$2,706,423,537	$1,353,211,773	$4,059,635,310	21%
2075	9,046	50%	408	6%	$3,262,383,510	$1,631,191,761	$4,893,575,271	25%
2100	9,408	52%	632	10%	$5,300,249,172	$2,650,124,592	$7,950,373,764	41%
MAUI COUNTY TOTAL								
2030	**11,766**	**15%**	**436**	**1%**	**3,107,652,006**	**1,553,826,006**	**4,661,478,012**	**9%**
2050	**12,702**	**16%**	**587**	**1%**	**3,591,242,683**	**1,795,621,344**	**5,386,864,027**	**10%**
2075	**14,168**	**18%**	**864**	**1%**	**4,519,914,079**	**2,259,957,040**	**6,779,871,119**	**13%**
2100	**16,908**	**21%**	**1,428**	**2%**	**6,932,658,434**	**3,466,329,217**	**10,398,987,651**	**19%**

*Analysis in Lānaʻi and Molokaʻi is based on passive sea level rise only

Community planning areas within Maui County have varying exposure to projected sea level rise impacts. The Makawao-Pukalani-Kula community planning area has no buildings potentially at-risk to future sea level rise, as it is a non-coastal community planning area. Similarly, Lānaʻi has no structures considered at-risk, as most of the island's developed areas are away from the coast. West Maui has the greatest exposure, with up to 10% of its current buildings in future sea level rise areas, which account for over 40% of the total building value in West Maui, indicating that some of West Maui's most valuable buildings are on the coast and within areas subject to potential sea level rise. The figures below show buildings within these impact areas for each community planning area.

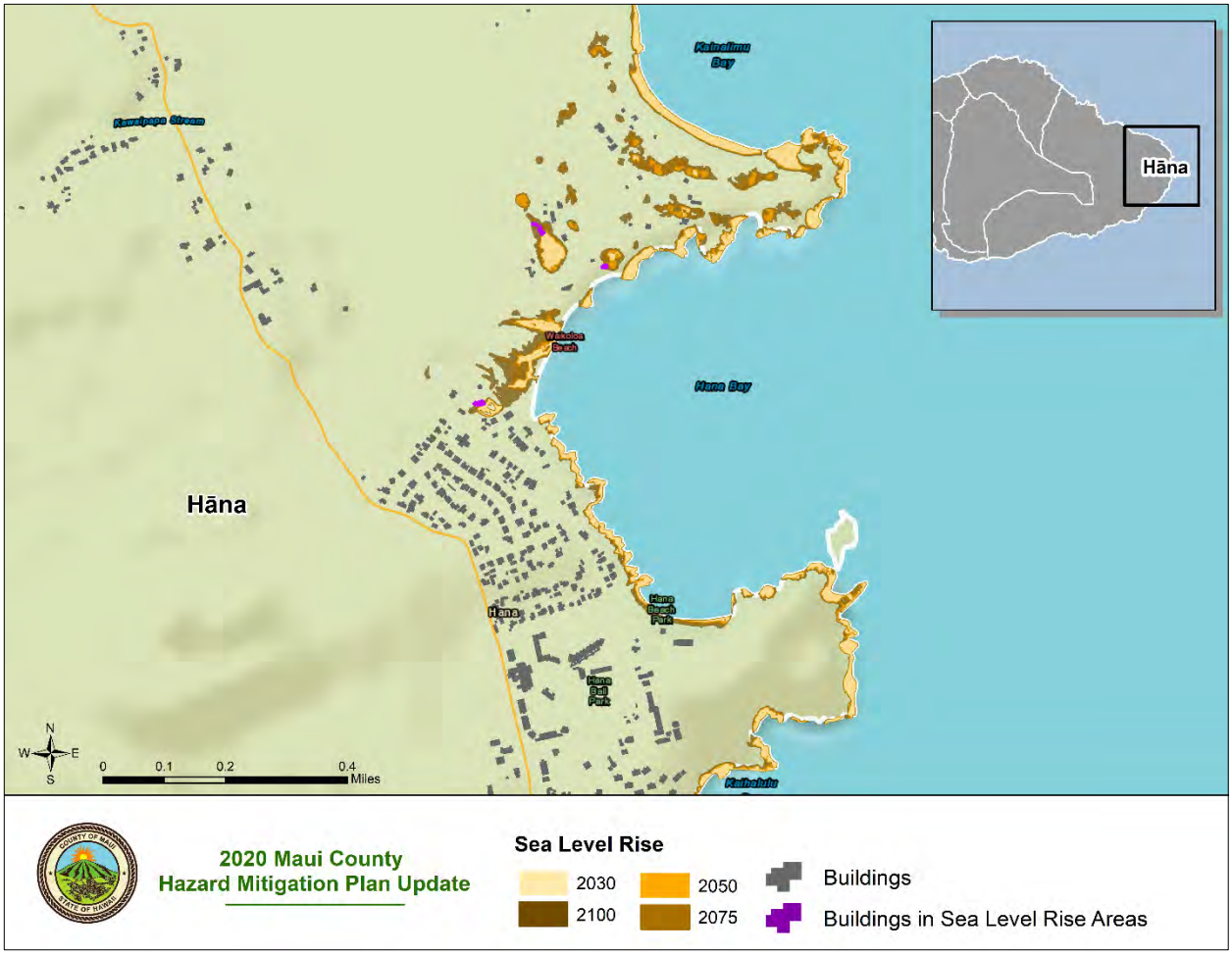

Figure 107. Buildings in Future Sea Level Rise Areas in the Hāna Community Planning Area.

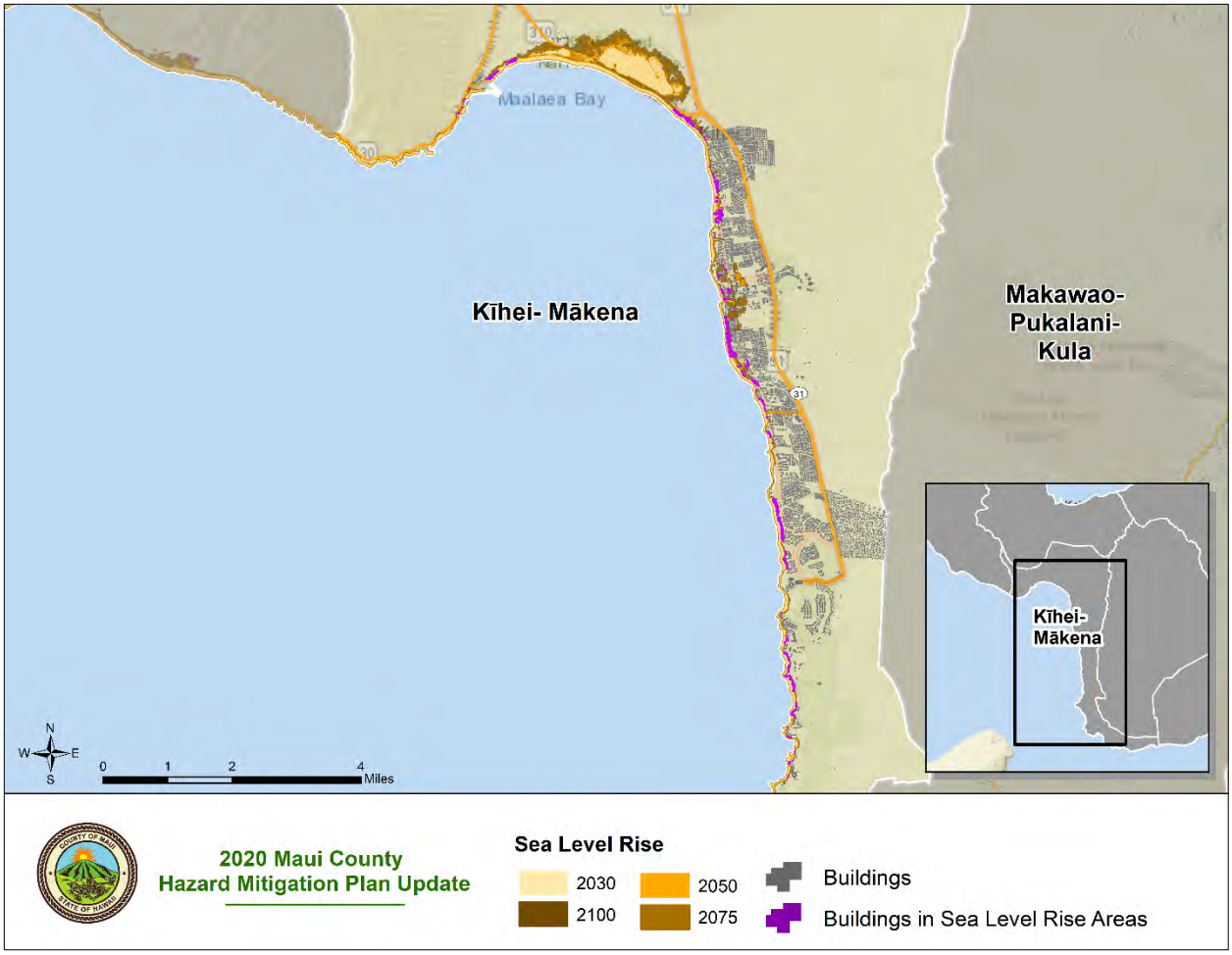

Figure 108. Buildings in Future Sea Level Rise Areas in the Kīhei-Mākena Community Planning Area.

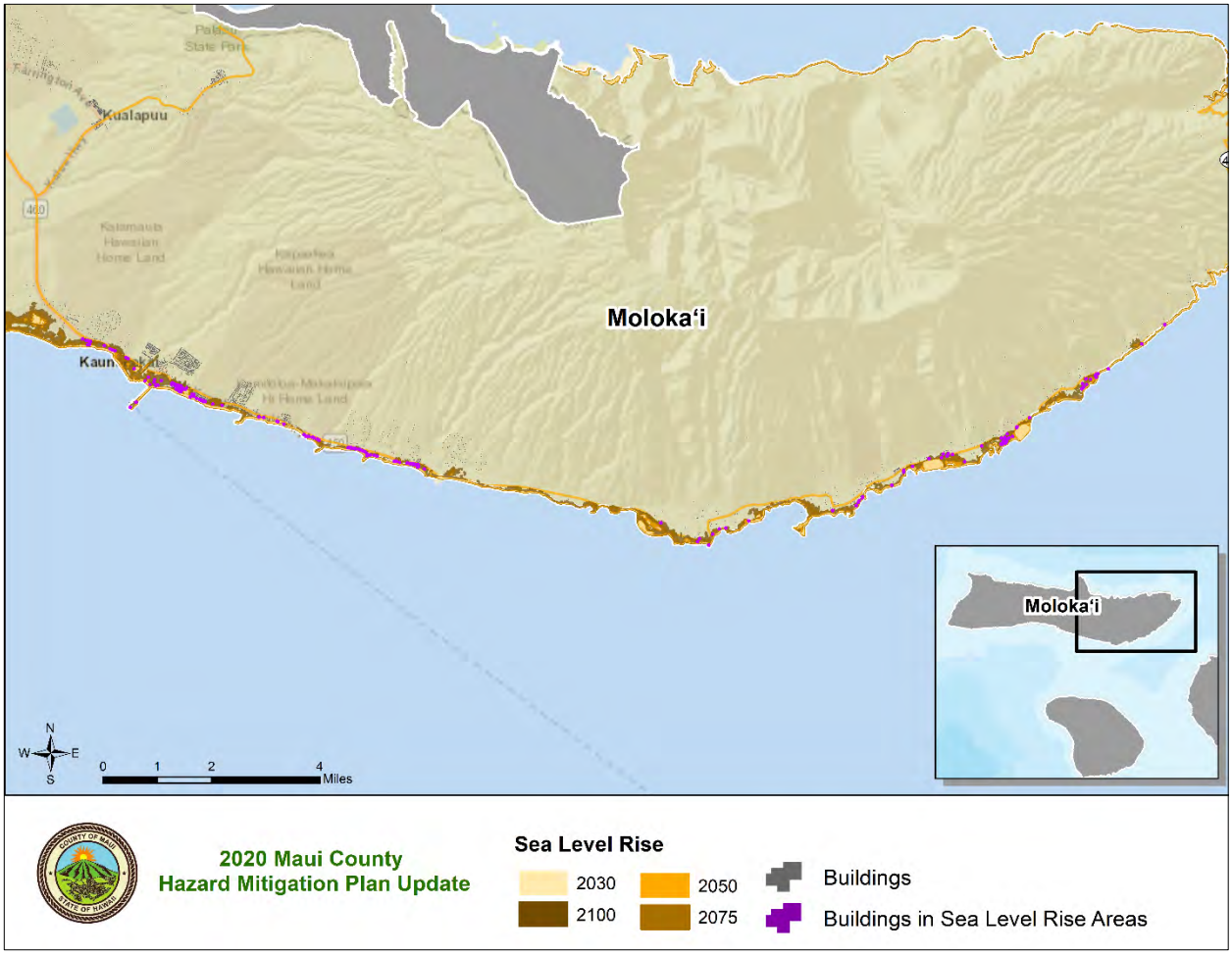

Figure 109. Buildings in Future Sea Level Rise Areas in the Moloka'i Community Planning Area.

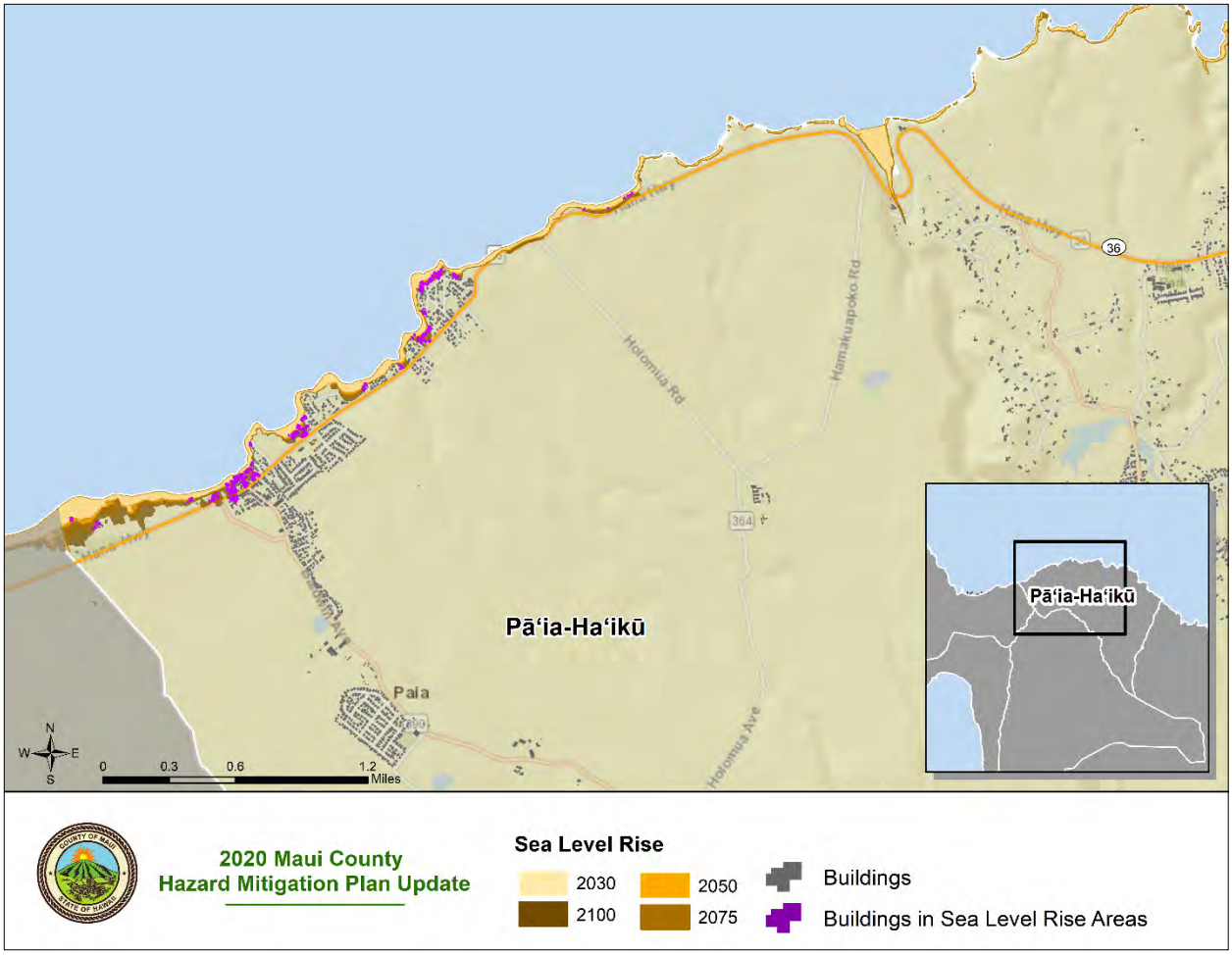

Figure 110. Buildings in Future Sea Level Rise Areas in the Pāʻia-Haʻikū Community Planning Area.

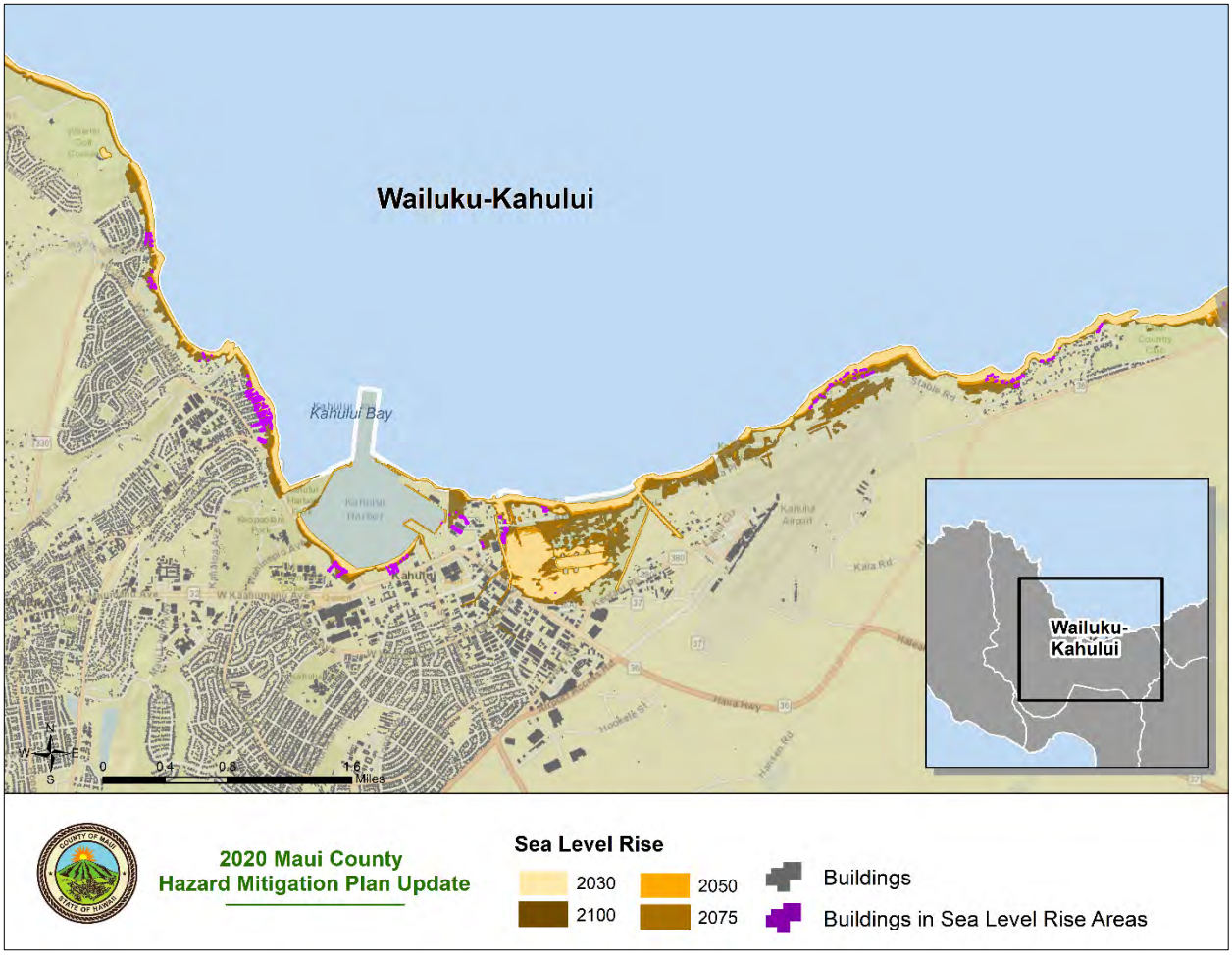

Figure 111. Buildings in Future Sea Level Rise Areas in the Wailuku-Kahului Community Planning Area.

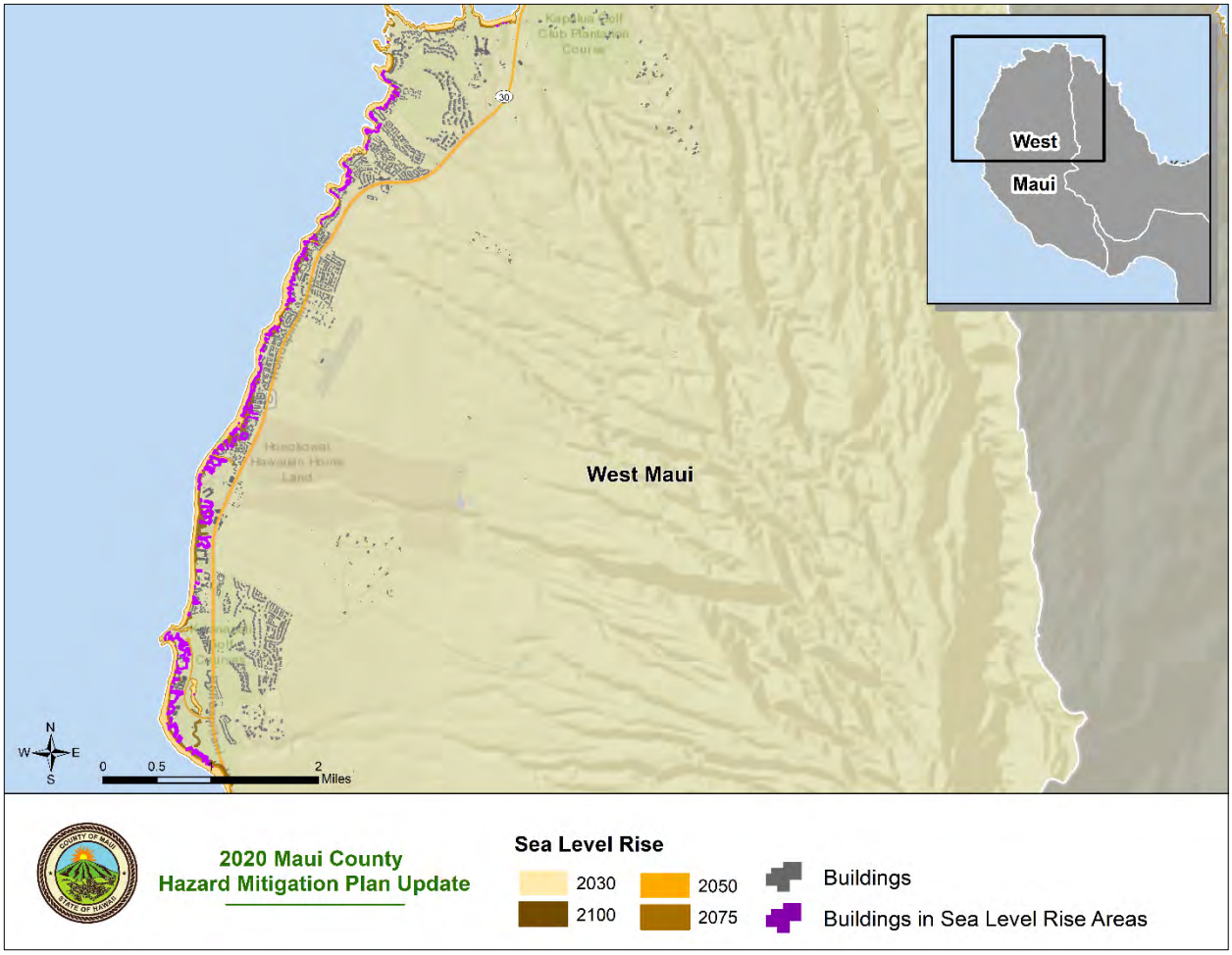

Figure 112. Buildings in Future Sea Level Rise Areas in the Northern West Maui Community Planning Area.

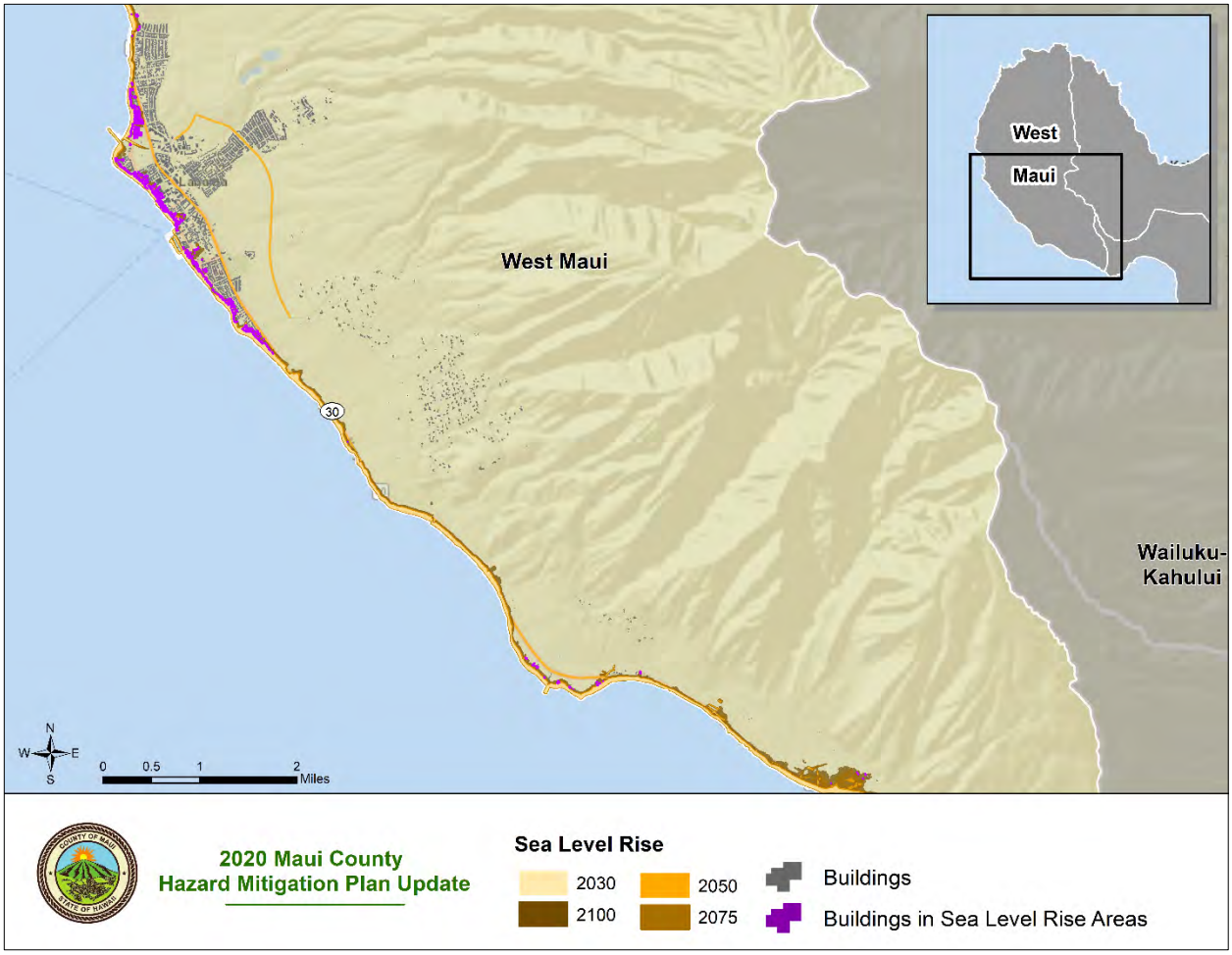

Figure 113. Buildings in Future Sea Level Rise Areas in the Southern West Maui Community Planning Area.

GIS analysis was used to determine number of critical facilities within future sea level rise hazard areas. Overall, there are nine critical facilities within future sea level rise in Maui County, including:

- Kīhei-Mākena: one emergency services facility
- Wailuku-Kahului: one water, waste, and wastewater system facility and two transportation facilities
- West Maui: three water, waste, and wastewater system facilities and two emergency services facilities

These facilities are shown in the figures below.

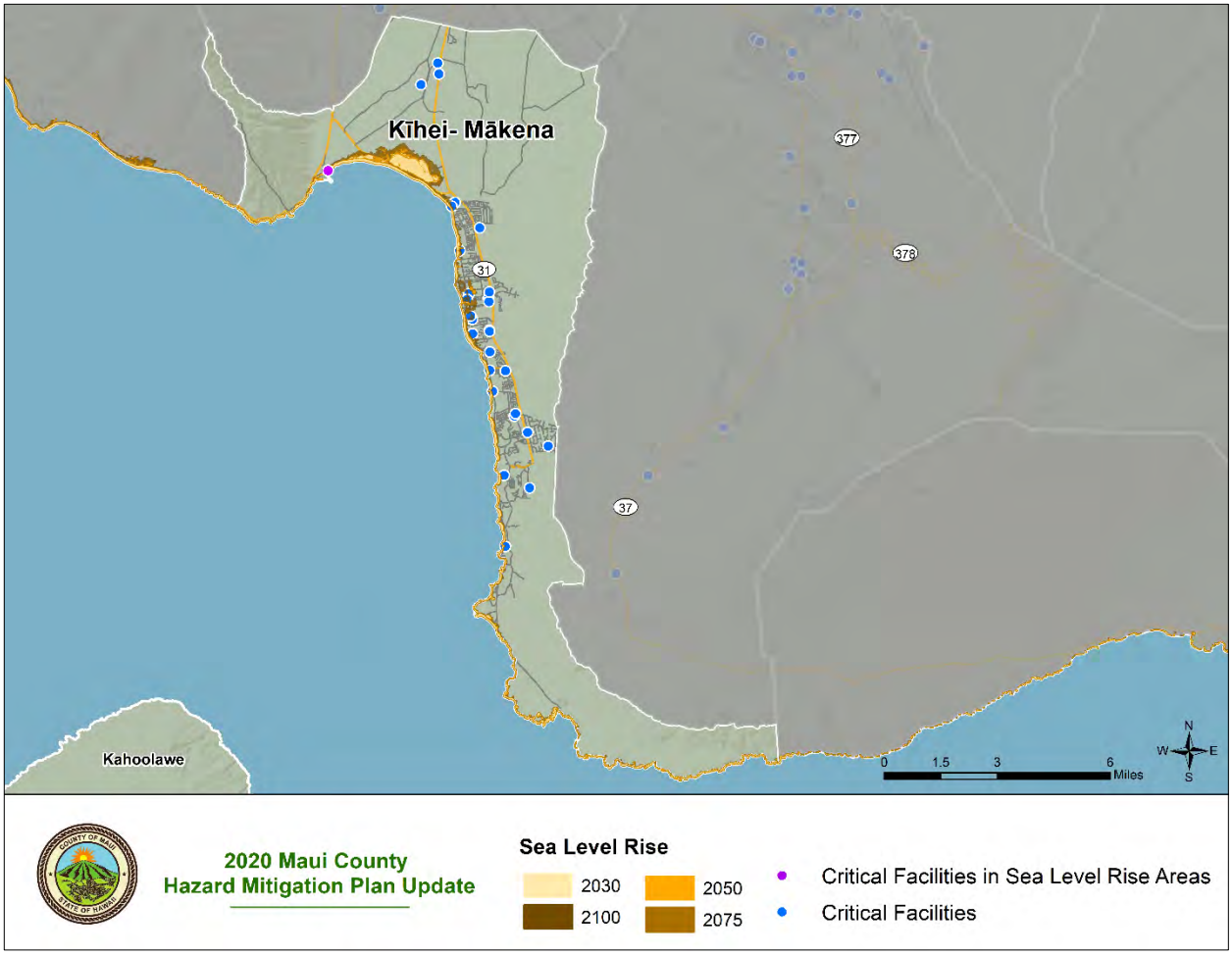

Figure 114. Critical Facilities in Future Sea Level Rise Areas in the Kīhei-Mākena Community Planning Area.

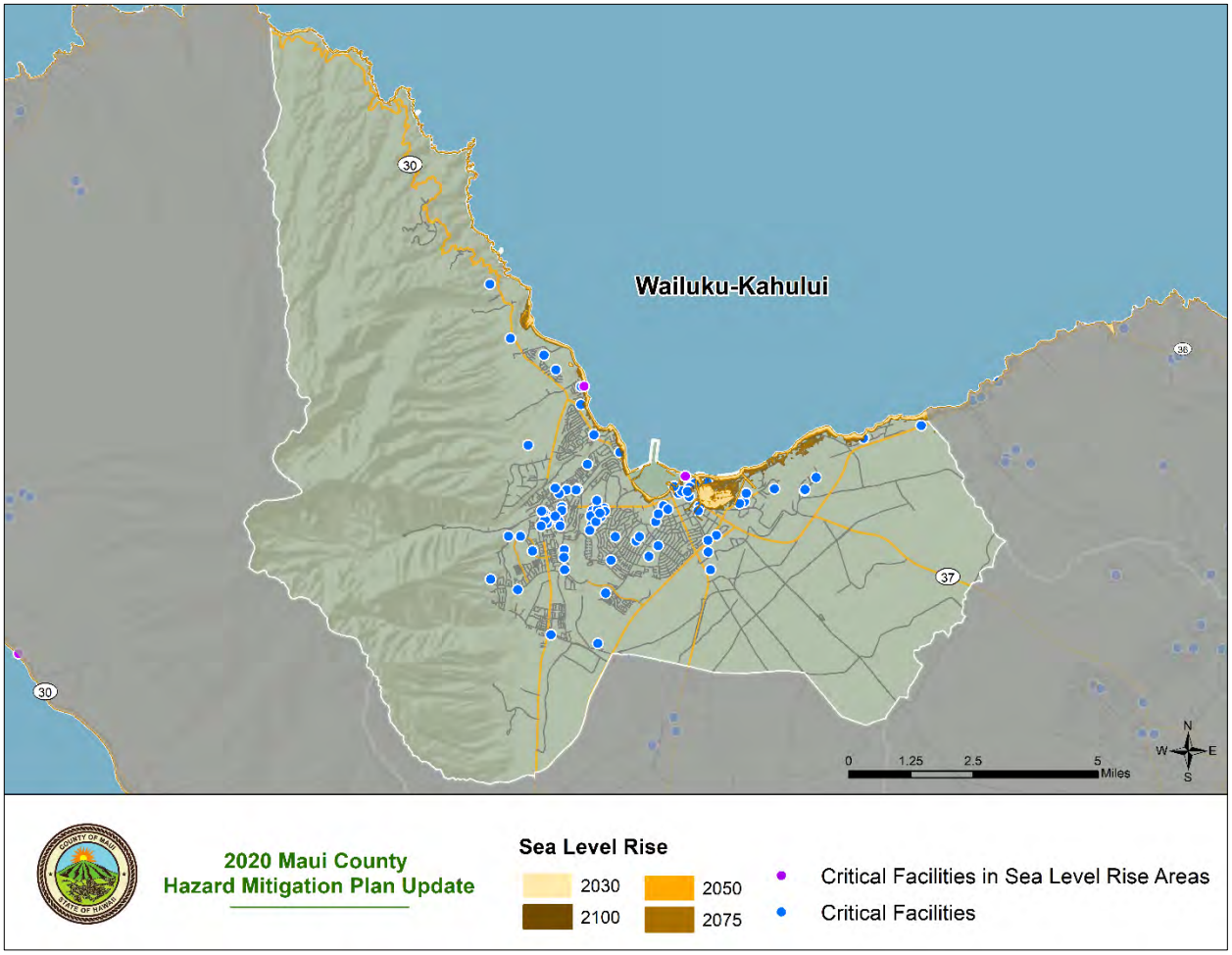

Figure 115. Critical Facilities in Future Sea Level Rise Areas in the Wailuku-Kahului Community Planning Area.

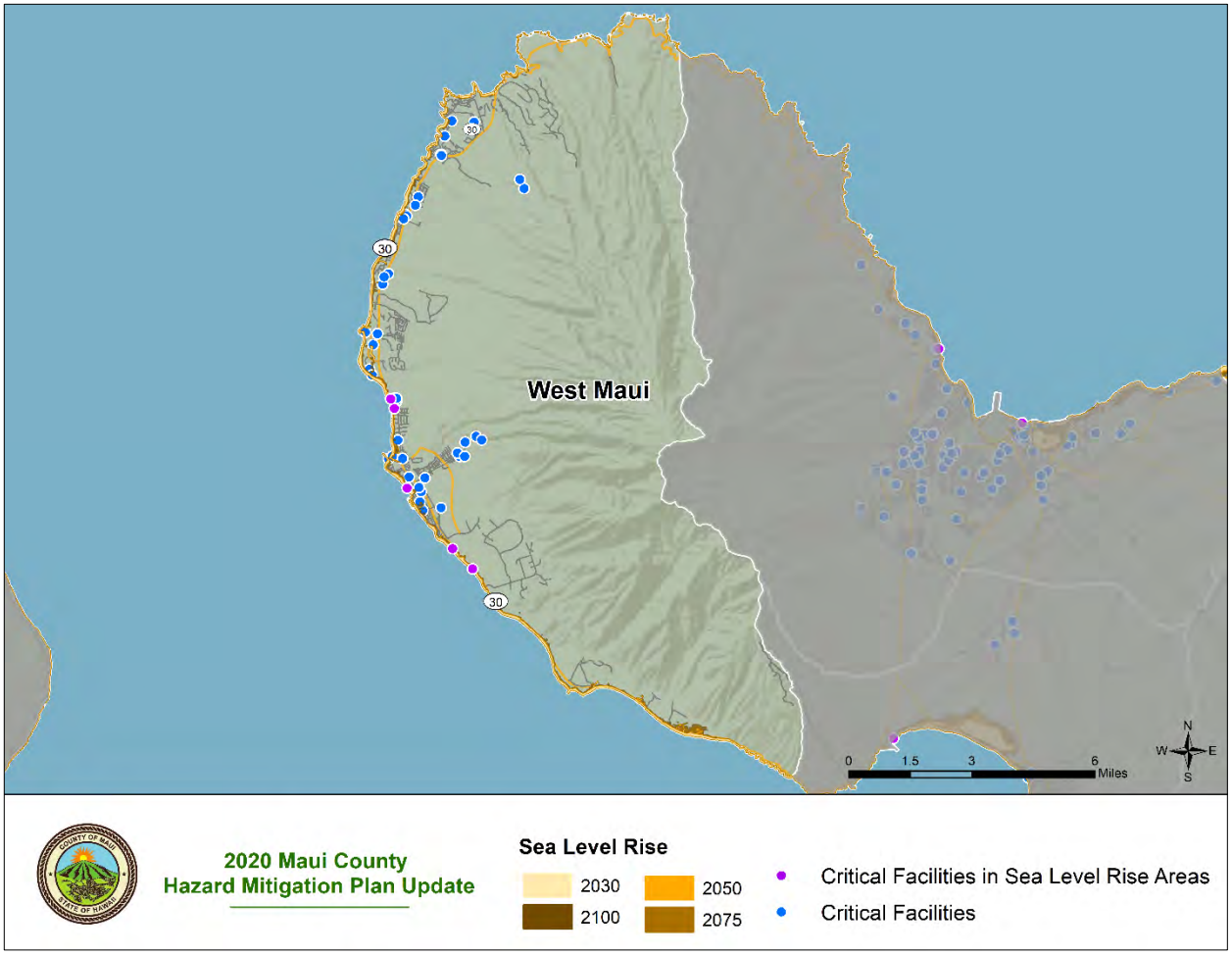

Figure 116. Critical Facilities in Future Sea Level Rise Areas in the West Maui Community Planning Area.

As described above, utility lines, roads, and bridges are vulnerable to the impact of flood, including sea level rise. Table 48 presents the number of bridges in each community planning area that are within future sea level rise area (through 2100). Figure 117 and Figure 118 present bridges within sea level rise hazard areas on the Islands of Maui and Molokaʻi. There are no NBI bridges on the Island of Lānaʻi.

Table 48. Number of NBI Bridges in Maui County Community Planning Areas in Sea Level Rise Areas.

Community Planning Area	Number of (NBI) Bridges
Hāna	0
Kīhei-Mākena	1
Lānaʻi	N/A
Makawao-Pukalani-Kula	N/A
Molokaʻi	3
Pāʻia-Haʻikū	0
Wailuku-Kahului	0
West Maui	3
MAUI COUNTY TOTAL	**7 (4%)**

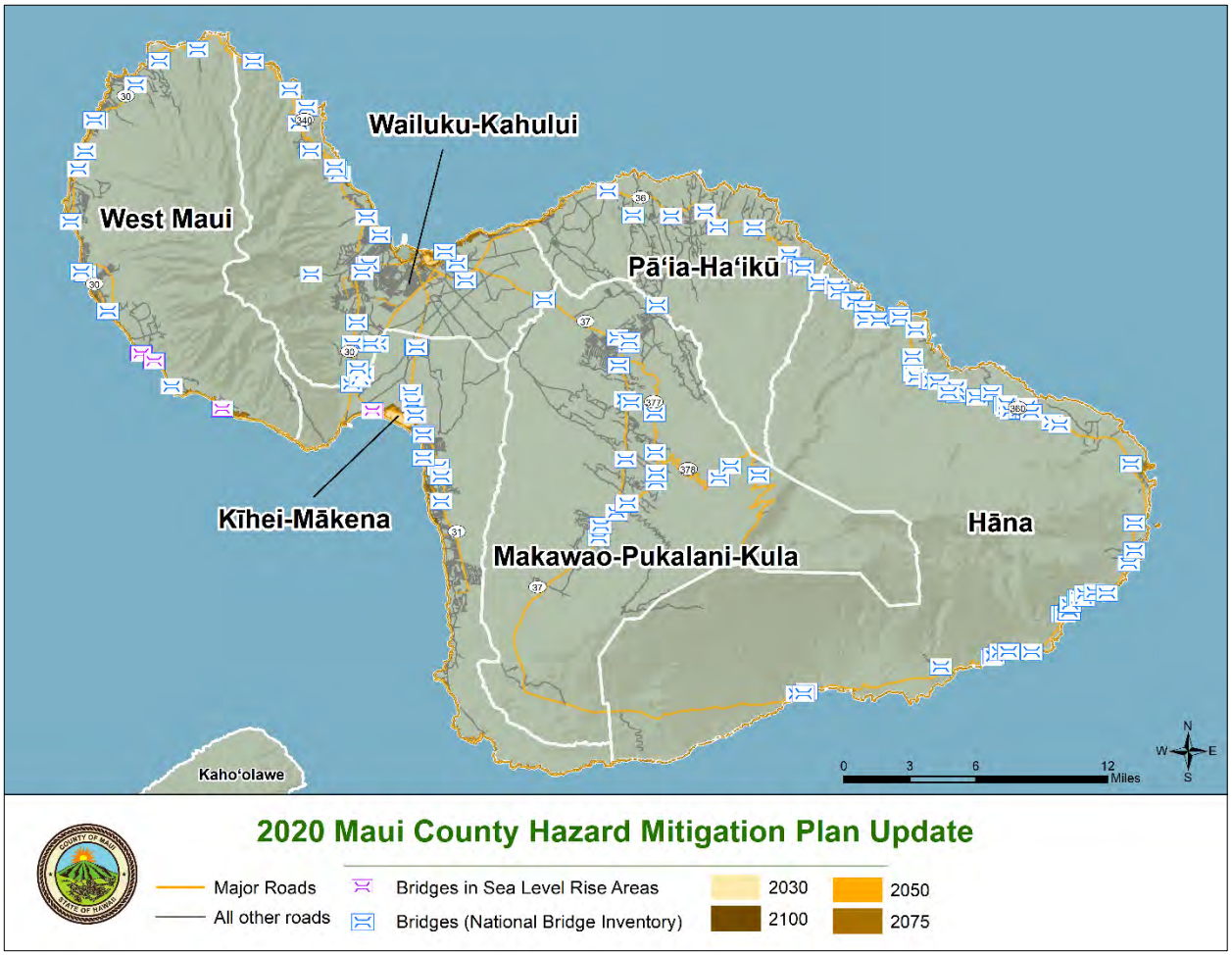

Figure 117. Bridges in Future Sea Level Rise Areas on Maui Island.

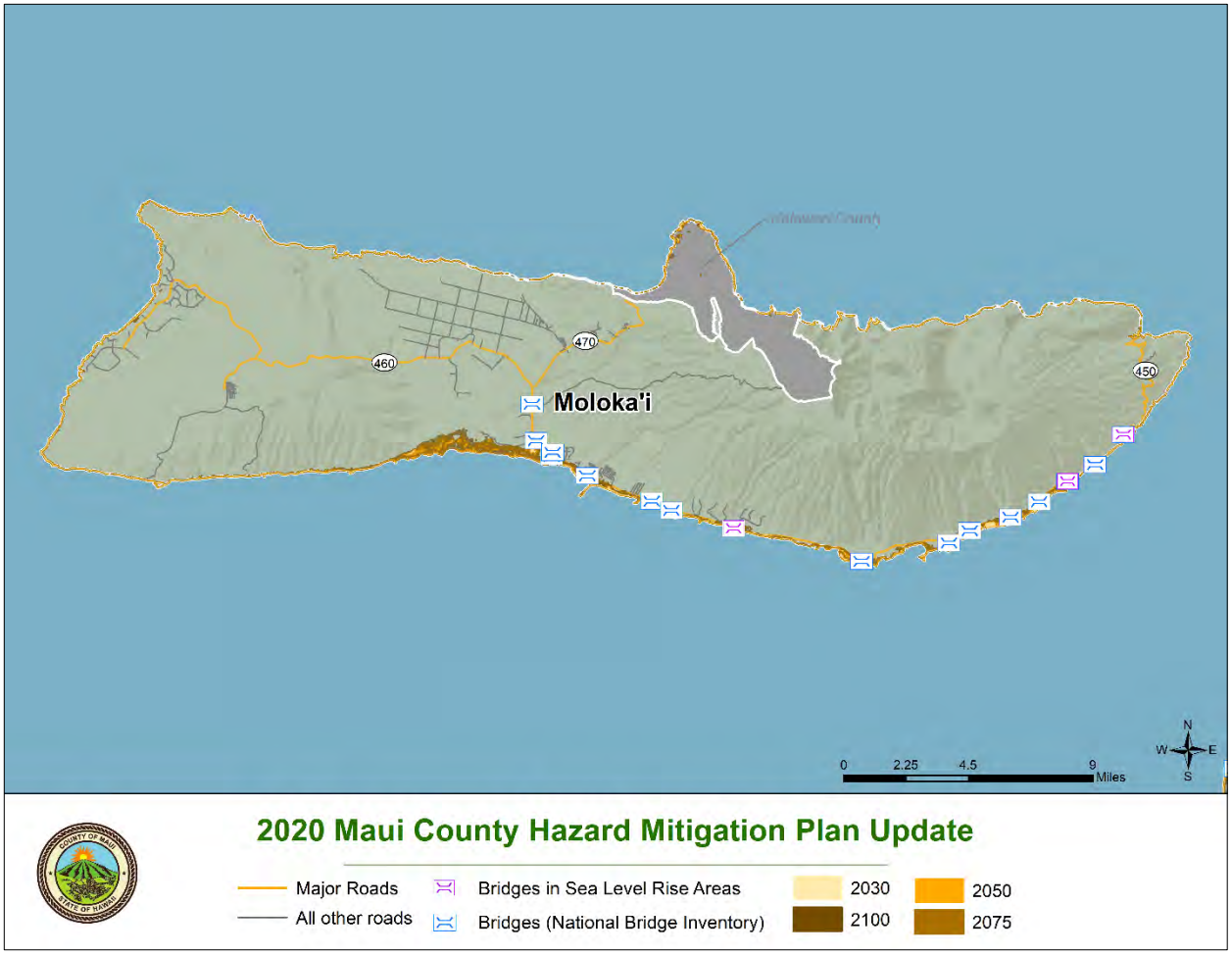

Figure 118. Bridges in Future Sea Level Rise Areas on Molokaʻi Island.

Further, many roads may have more or more segments within a potential future sea level rise areas. Major routes identified as having segments within future sea level rise hazard areas include Honoapiilani Highway in West Maui, North and South Kīhei Road in Kīhei-Mākena, Hāna Highway in Pāʻia-Haʻikū, and Kahului Beach Road in Wailuku-Kahului. On Molokaʻi, Maunaloa Highway near Kaunakakai is within future sea level rise areas. Kamehameha V Highway is within future sea level rise areas as it hugs the coast from Kaunakakai in central Molokaʻi to Hālawa Beach Park on Molokaʻi's eastern tip. Many county-owned local streets are also within surge areas within these planning areas.

Sea Level Rise (Episodic Coastal Flood)

While sea level rise leads to chronic coastal flooding as land is lost due to rising seas, sea level rise will also contribute to exacerbated flooding during episodic or event-based flooding events. The 1% annual chance coastal flood zone will expand with sea level rise meaning that more land area will be exposed to damaging wave impacts from a 100-year flood event. Therefore, 1% coastal flood zone with 3.2 feet of sea level rise was utilized to assess mid- to late-century sea level rise on coastal event-based flooding. It

is important to note that the event-based flood hazard discussed in the *FEMA Flood Zone Analysis* section above assesses the entire Special Flood Hazard Area (V- and A-zones). Sea level rise effects on event-based flooding only includes the coastal flood zones. GIS analysis was used to determine buildings and infrastructure within modeled coastal flood areas with 3.2 feet of sea level rise. This dataset was developed for Hawai'i, including Maui County.[150] The GIS analysis was performed using building footprints, critical facilities data, and parcel data from county tax assessor records.

For buildings, the determination of assessed value at-risk (exposure) was calculated by summing the total assessed building values for building footprints that were confirmed to be located within or partially within an identified coastal flood areas with 3.2 feet of sea level rise. The number of parcels, building footprints, and their associated value are presented by community planning district in the table below. This is an approximate analysis for planning purposes. This analysis does not account for building elevations, seawalls, or backshore armoring.

Table 49. Potentially At-Risk Parcels, Buildings, and Improvement Value in 100-Year Flood Hazard Areas with 3.2-feet of Sea Level Rise (Year 2100).

Community Planning Area	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Hāna	330	16%	30	2%	$6,349,601	$3,174,800	$9,524,402	3%
Kīhei-Mākena	5,996	33%	954	11%	$1,369,753,592	$684,876,796	$2,054,630,388	12%
Lāna'i	51	3%	18	1%	$1,425,009	$7,125,045	$8,550,054	1%
Makawao-Pukalani-Kula	2	0%	0	0%	$0	$0	$0	0%
Moloka'i	1,904	31%	518	21%	$167,391,600	$83,695,800	$251,087,400	21%
Pā'ia-Ha'ikū	126	2%	17	0%	$1,587,302	$793,651	$2,380,953	0%
Wailuku-Kahului	1,059	6%	497	3%	$436,357,756	$218,178,878	$654,536,634	7%
West Maui	7,761	43%	254	4%	$300,096,994	$150,048,497	$450,145,491	2%
Maui County Total	**17,229**	**22%**	**2,288**	**4%**	**$2,282,961,854**	**$1,147,893,468**	**$3,430,855,322**	**6%**

Kīhei-Makena, Moloka'i, and Wailuku-Kahului has the greatest number of buildings within the 1% coastal flood – 3.2ft SLR zone, with Kīhei-Makena having over $2 billion potentially at risk. Overall, there are 2,288 buildings within the 1% coastal flood-3.2 SLR zone in Maui County, with an estimated value of 43.4 billion. The figures below show buildings within 1% coastal flood zones with 3.2 feet of sea level rise by community planning area.

[150] Tetra Tech, Inc. and Sobis, Inc. (2017). *1% coastal flood zone with 3.2 feet of sea level rise digital data (1%-CFZ-3.2).* Developed under DLNR Contract 64064. Data requests to the HI-EMA Mitigation Section.

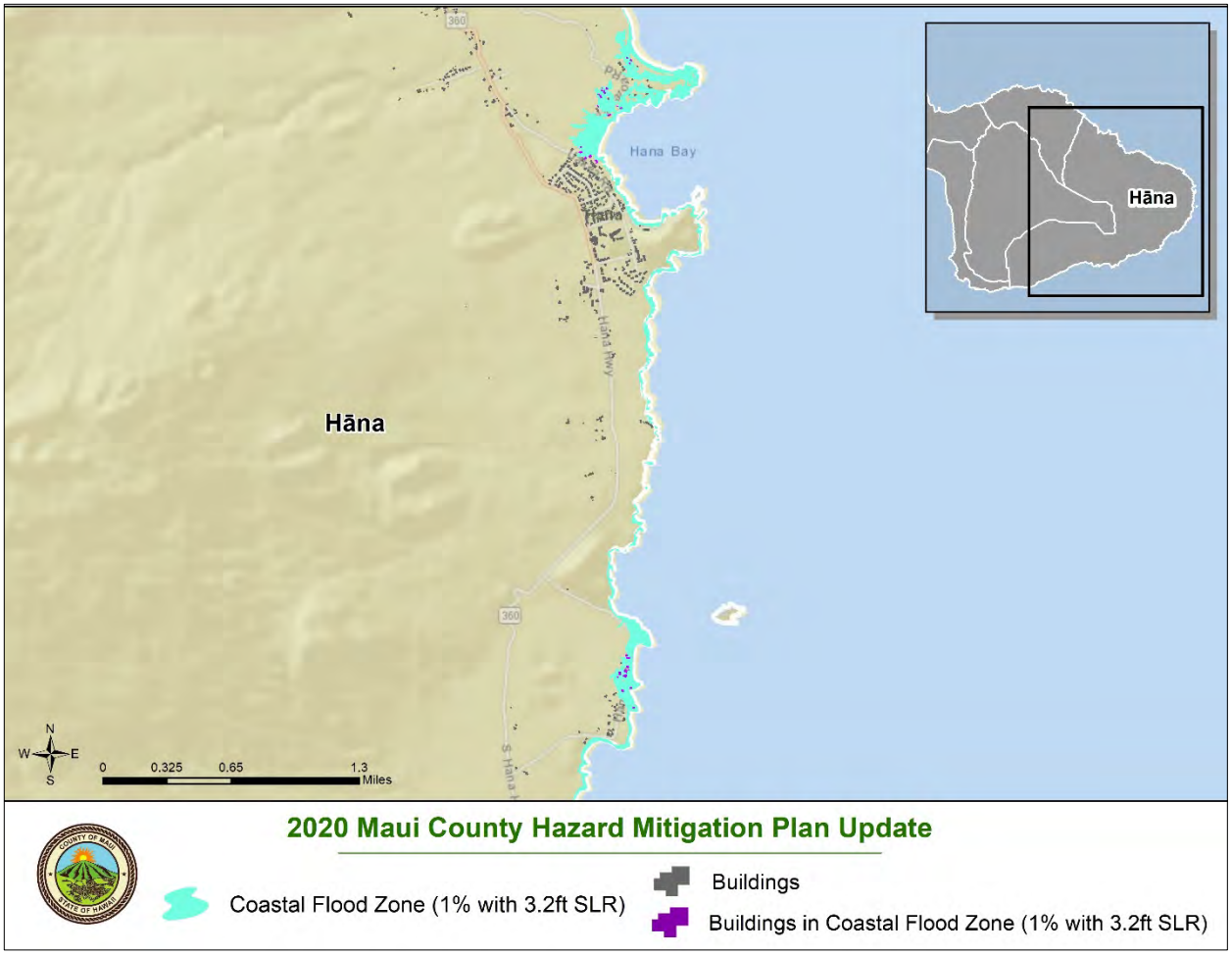

Figure 119. Buildings in 1% Coastal Flood Areas with 3.2ft Sea Level Rise in the Hāna Community Planning Area.

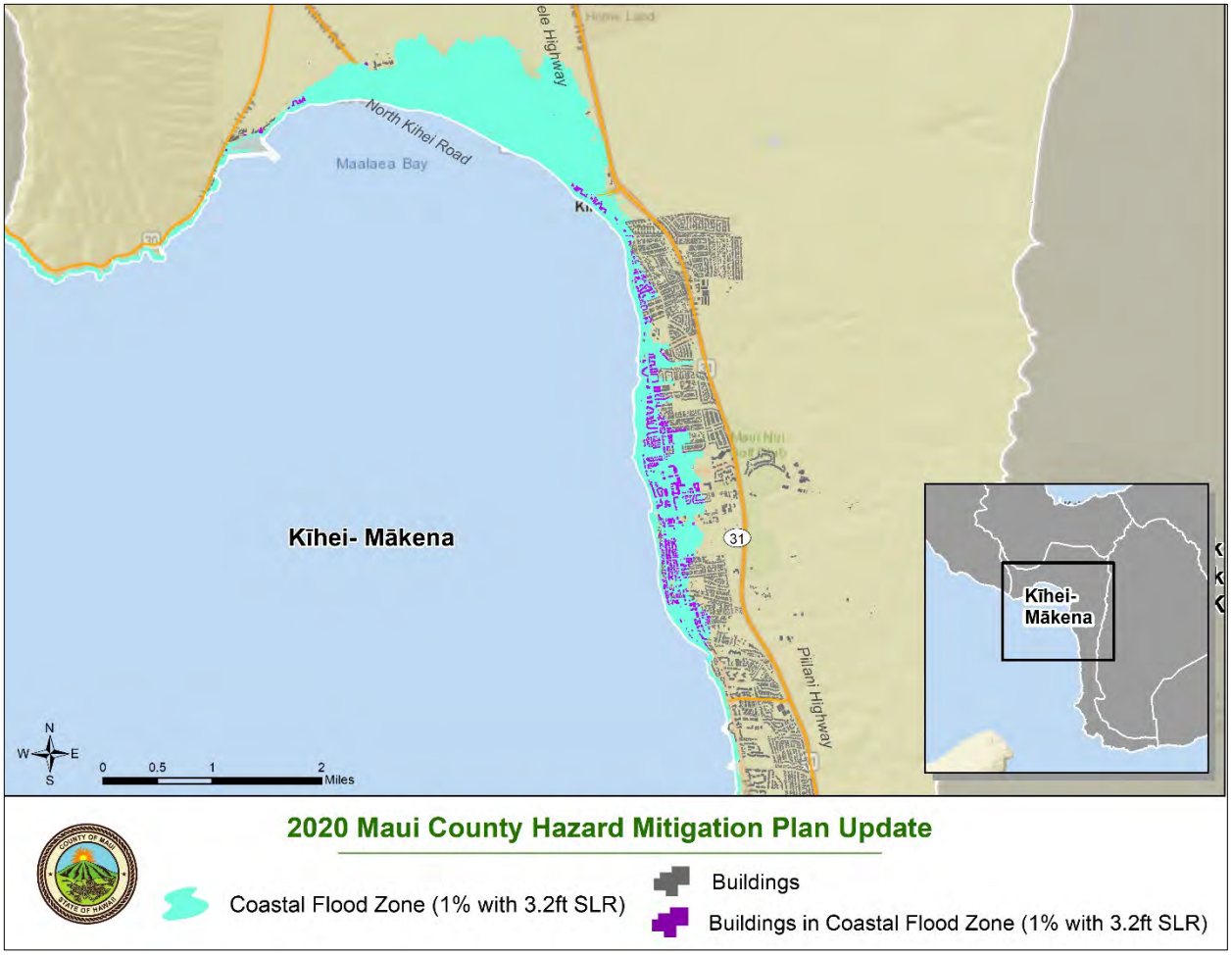

Figure 120. Buildings in 1% Coastal Flood Areas with 3.2ft Sea Level Rise in the Kīhei-Mākena Community Planning Area.

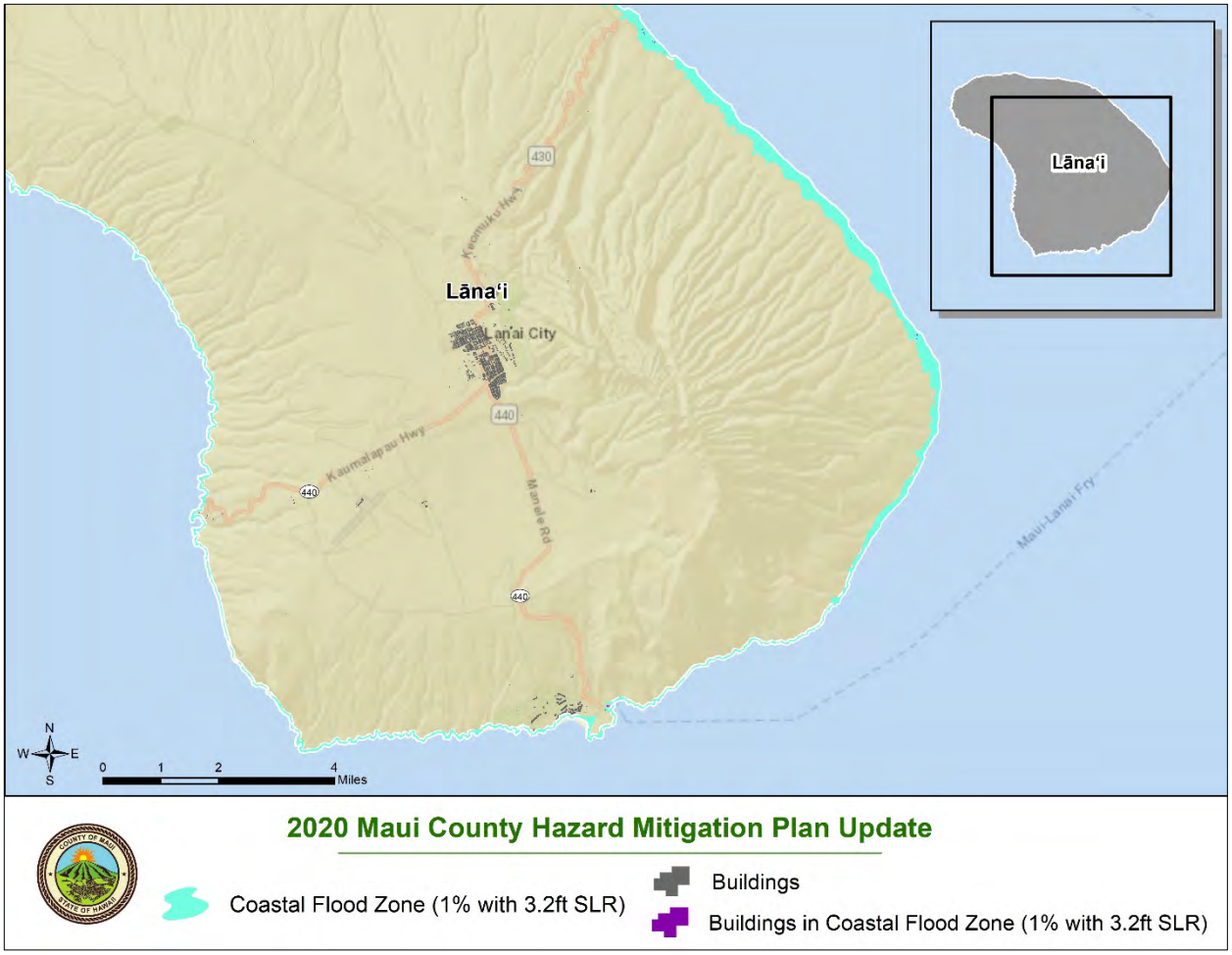

Figure 121. Buildings in 1% Coastal Flood Areas with 3.2ft Sea Level Rise in the Lānaʻi Community Planning Area.

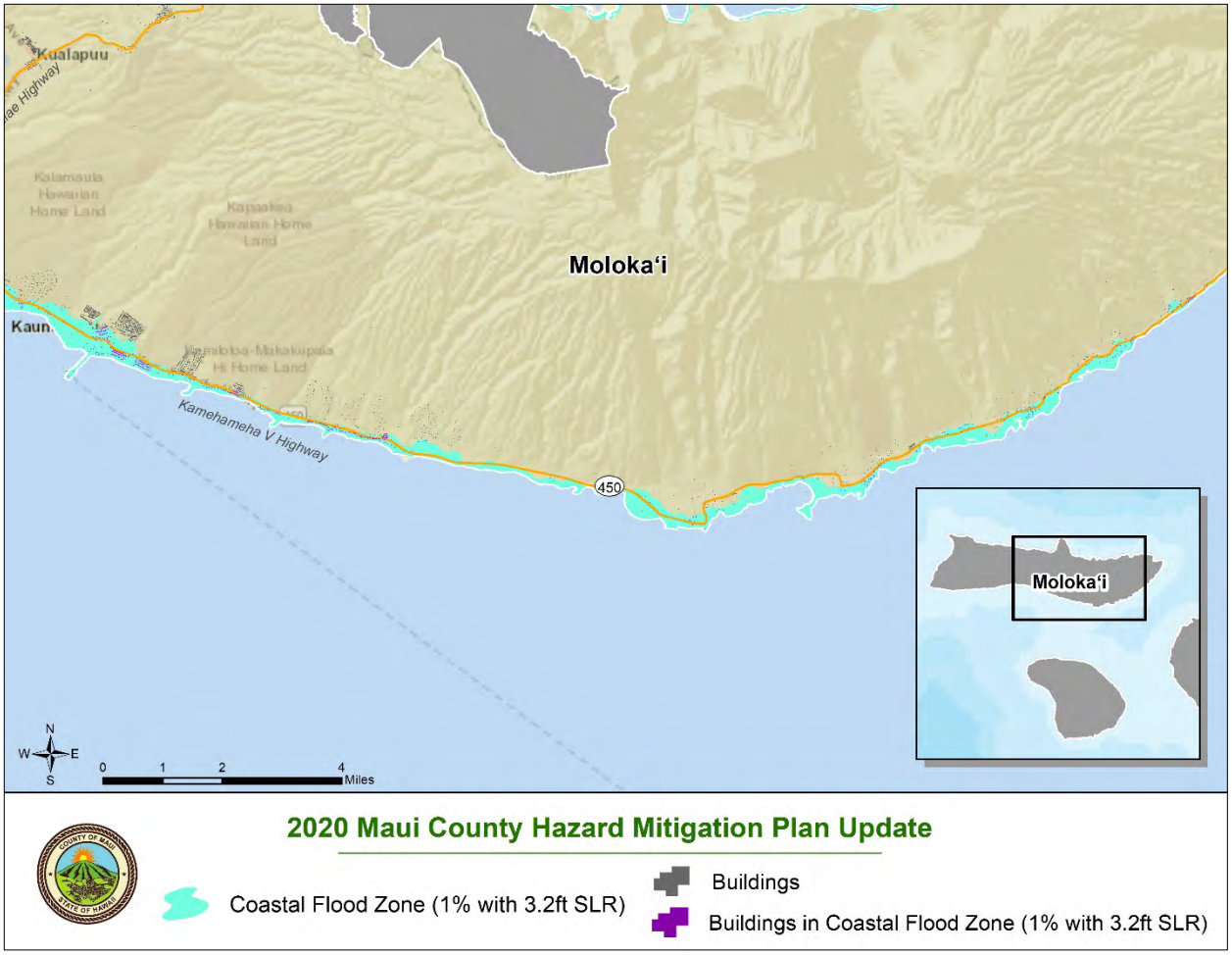

Figure 122. Buildings in 1% Coastal Flood Areas with 3.2ft Sea Level Rise in the Moloka'i Community Planning Area.

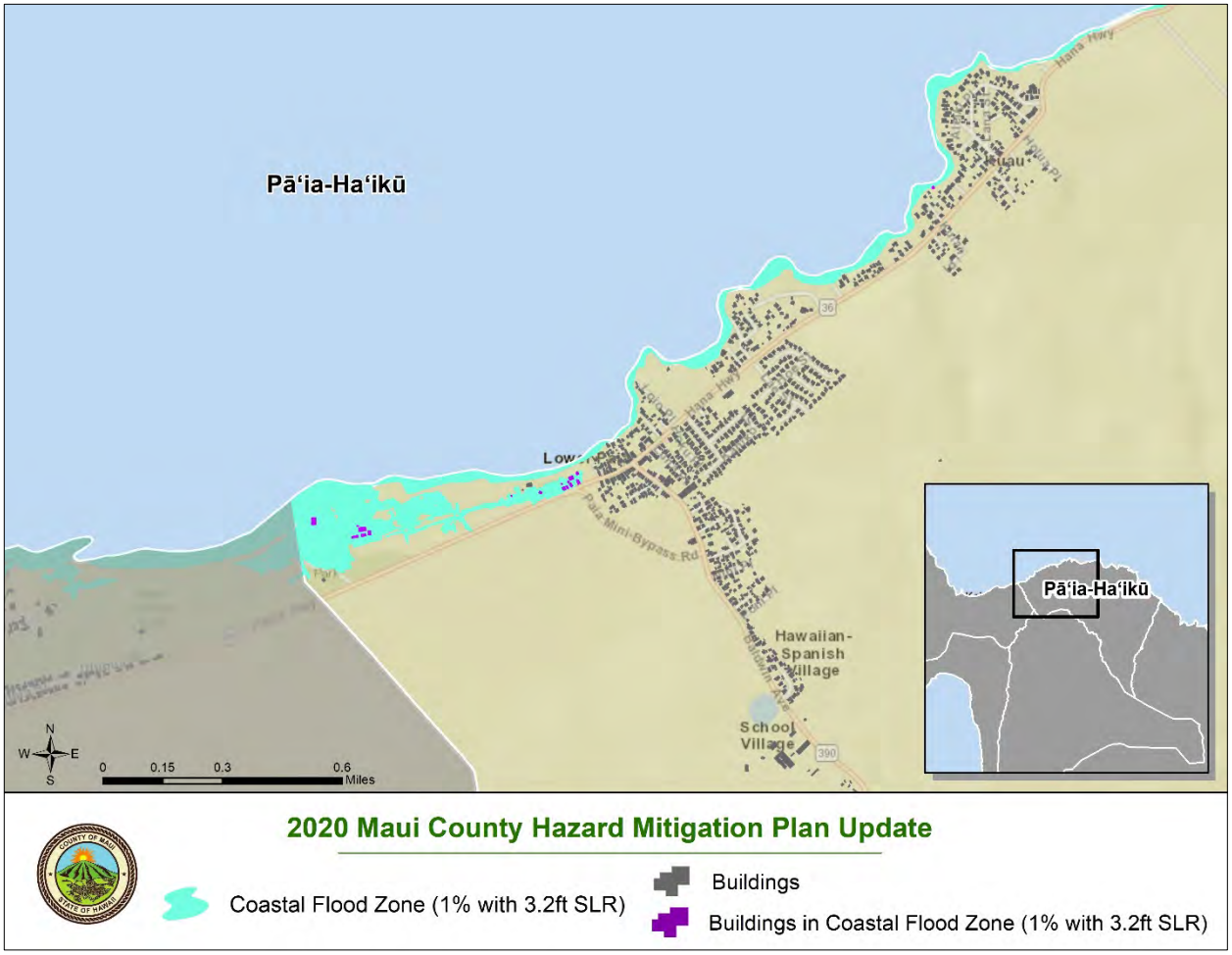

Figure 123. Buildings in Future Sea Level Rise Areas in the Pāʻia-Haʻikū Community Planning Area.

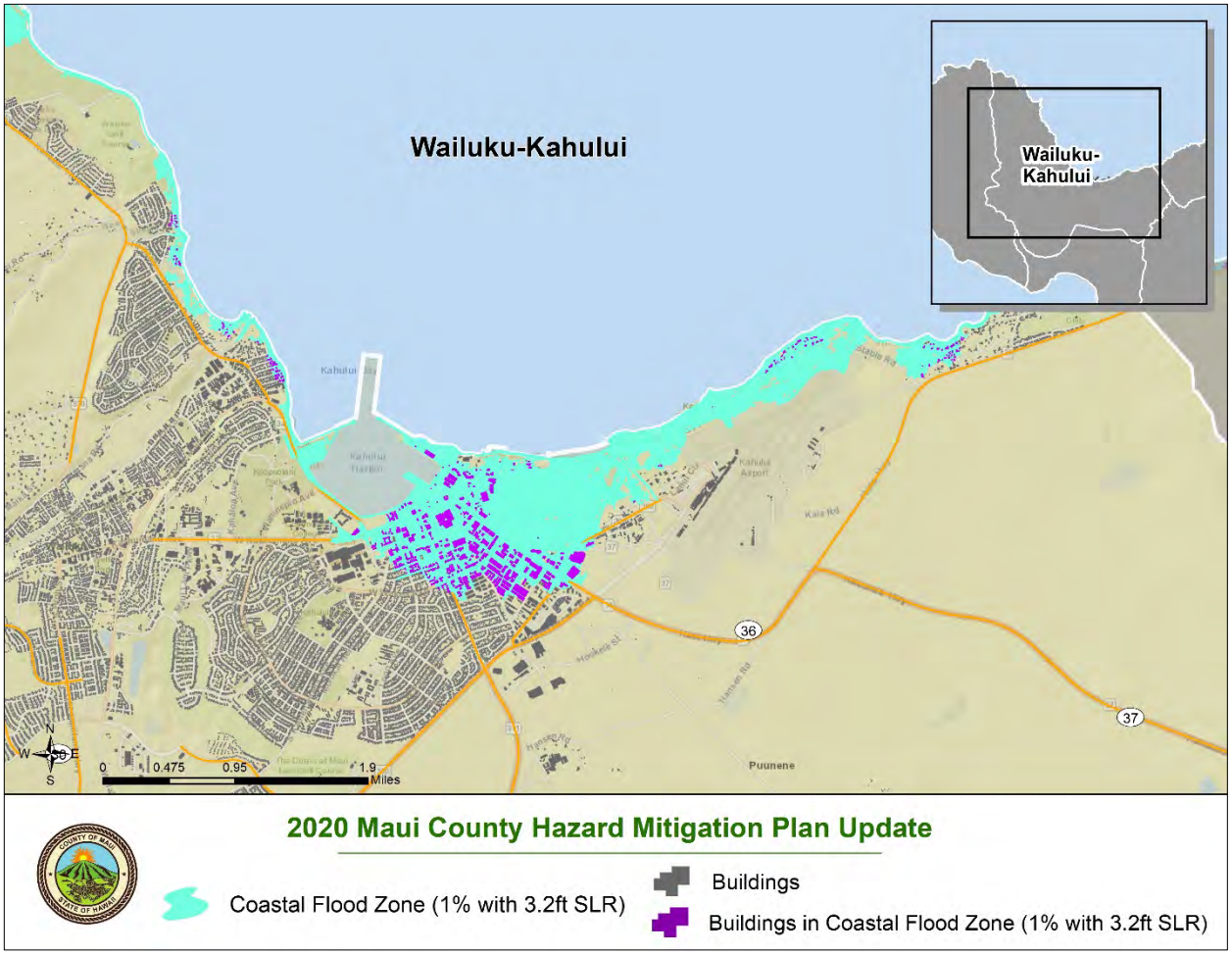

Figure 124. Buildings in 1% Coastal Flood Areas with 3.2ft Sea Level Rise in the Wailuku-Kahului Community Planning Area.

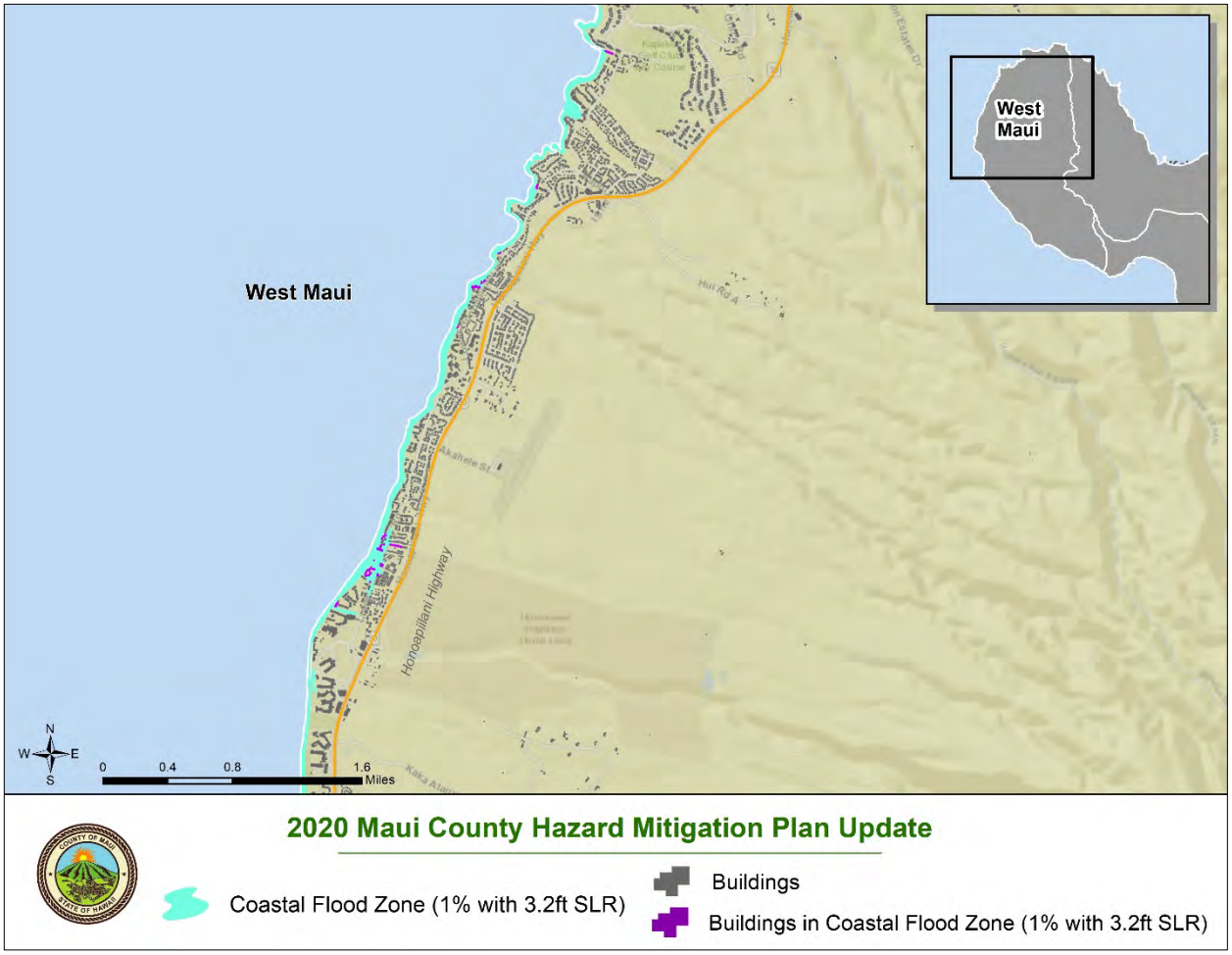

Figure 125. Buildings in 1% Coastal Flood Areas with 3.2ft Sea Level Rise in the Northern West Maui Community Planning Area.

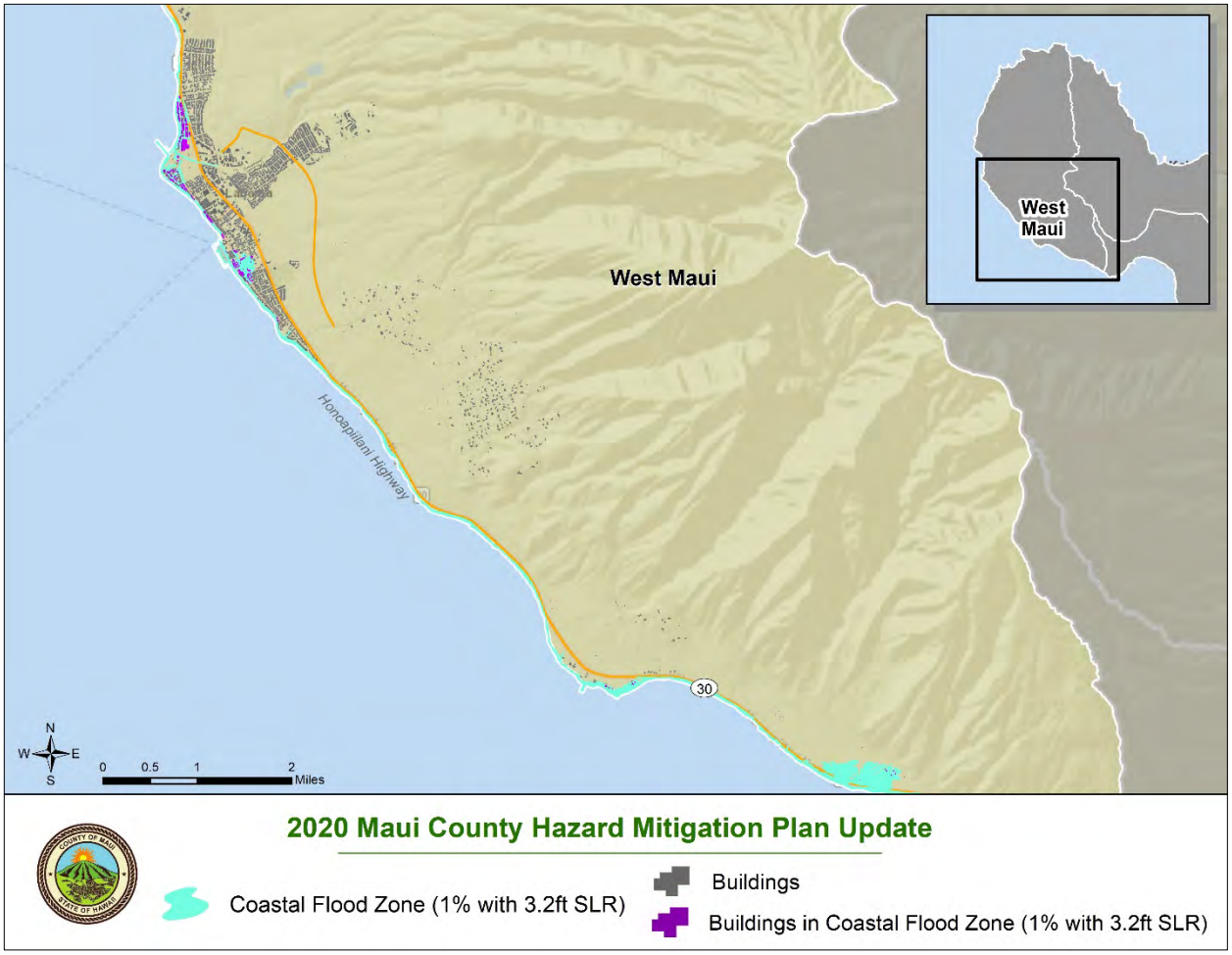

Figure 126. Buildings in 1% Coastal Flood Areas with 3.2ft Sea Level Rise in the Southern West Maui Community Planning Area.

GIS analysis was used to determine number of critical facilities within the 1% annual chance coastal flood hazard area with 3.2 feet of sea level rise. Overall, there are 38 critical facilities within these hazard areas in Maui County, including:

Table 50. Potentially At-Risk Critical Facilities in 1% Annual Chance Coastal Flood Zone with 3.2ft of Sea Level Rise.

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Commercial Facilities	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A	**0 (0%)**
Communications Facilities	0	0	0	0	1	N/A	0	N/A	**1 (13%)**
Emergency Services	0	1	0	0	3	0	1	0	**5 (14%)**

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Energy	0	N/A	N/A	N/A	0	N/A	0	N/A	**0 (0%)**
Food and Agriculture	0	0	N/A	N/A	N/A	N/A	0	N/A	**0 (0%)**
Government Facilities	N/A	N/A	N/A	N/A	1	N/A	1	N/A	**2 (14%)**
Healthcare and Public Health	0	1	0	0	2	0	1	0	**4 (8%)**
Mass care	0	1	0	0	2	0	0	0	**3 (4%)**
Transportation	0	N/A	0	N/A	0	N/A	8	0	**8 (30%)**
Water and Wastewater Systems	0	5	N/A	0	3	0	6	1	**15 (19%)**
TOTAL	**0 (0%)**	**8 (24%)**	**0 (0%)**	**0 (0%)**	**12 (38%)**	**0 (0%)**	**17 (16%)**	**1 (2%)**	**38 (13%)**

The figures below show critical facilities in Maui County 1% annual chance coastal flood hazard areas with 3.2 feet of sea level rise by community planning area.

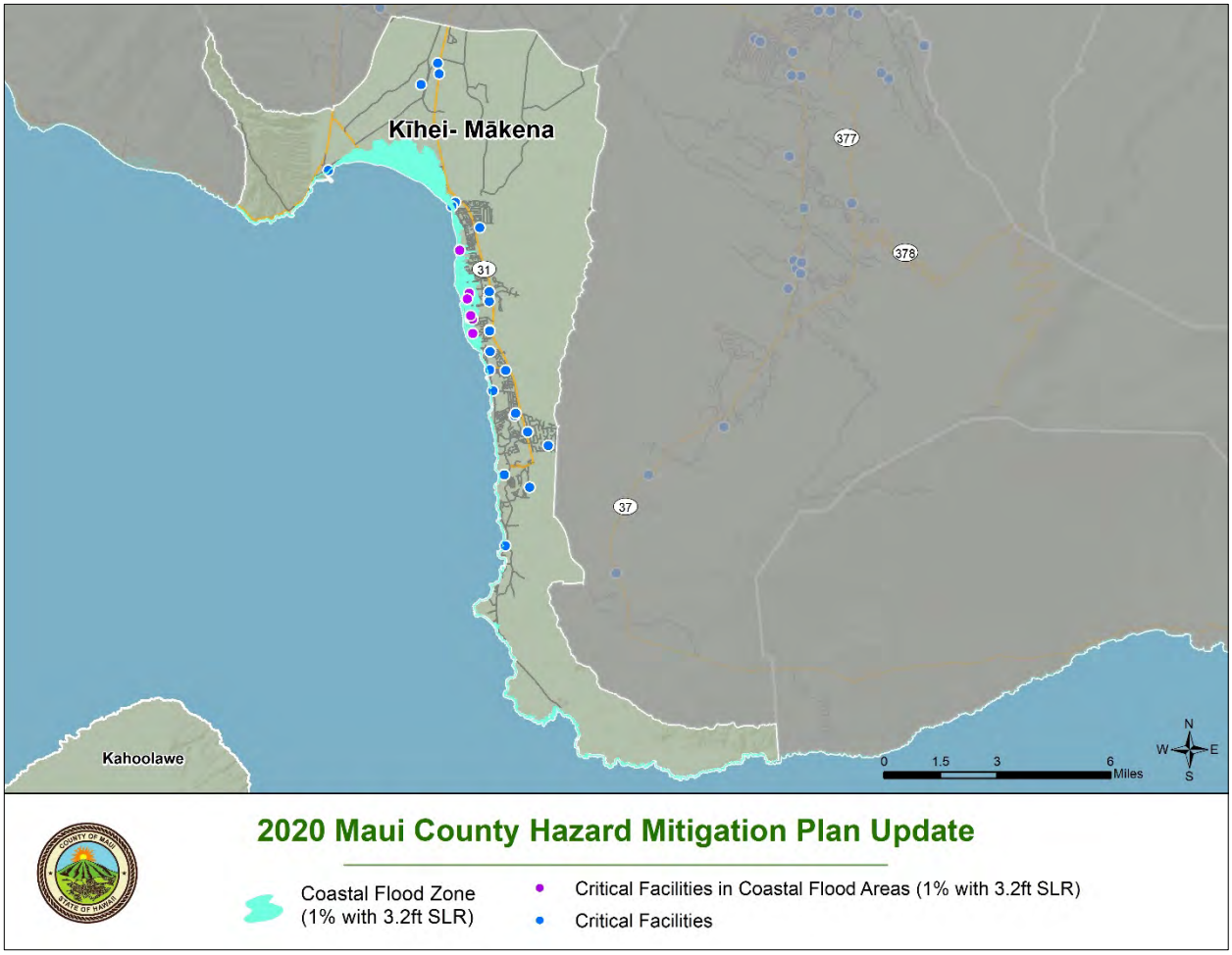

Figure 127. Critical Facilities in 1% Coastal Flood Areas with 3.2ft Sea Level Rise in the Kīhei-Mākena Community Planning Area.

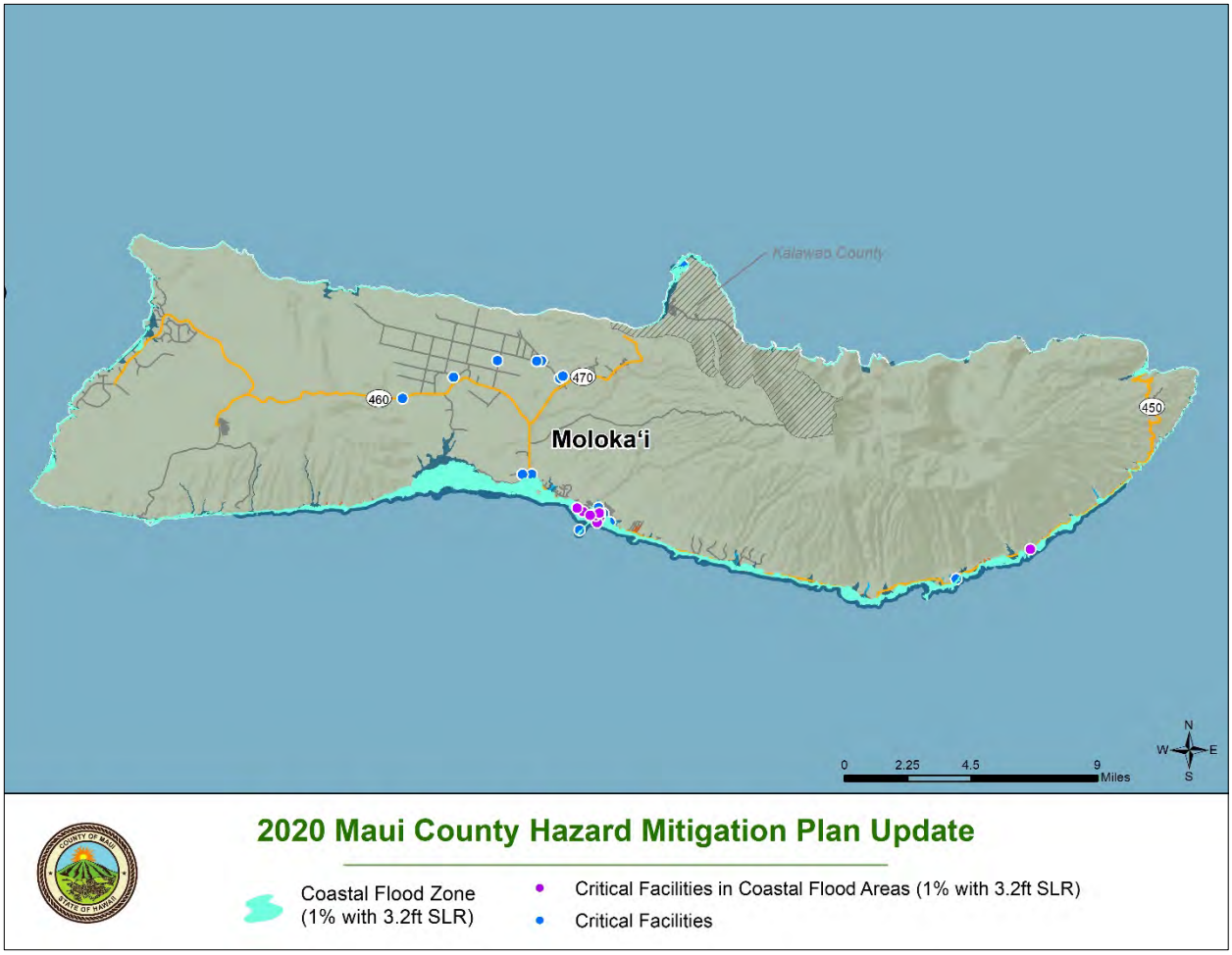

Figure 128. Critical Facilities in 1% Coastal Flood Areas with 3.2ft Sea Level Rise in the Moloka'i Community Planning Area.

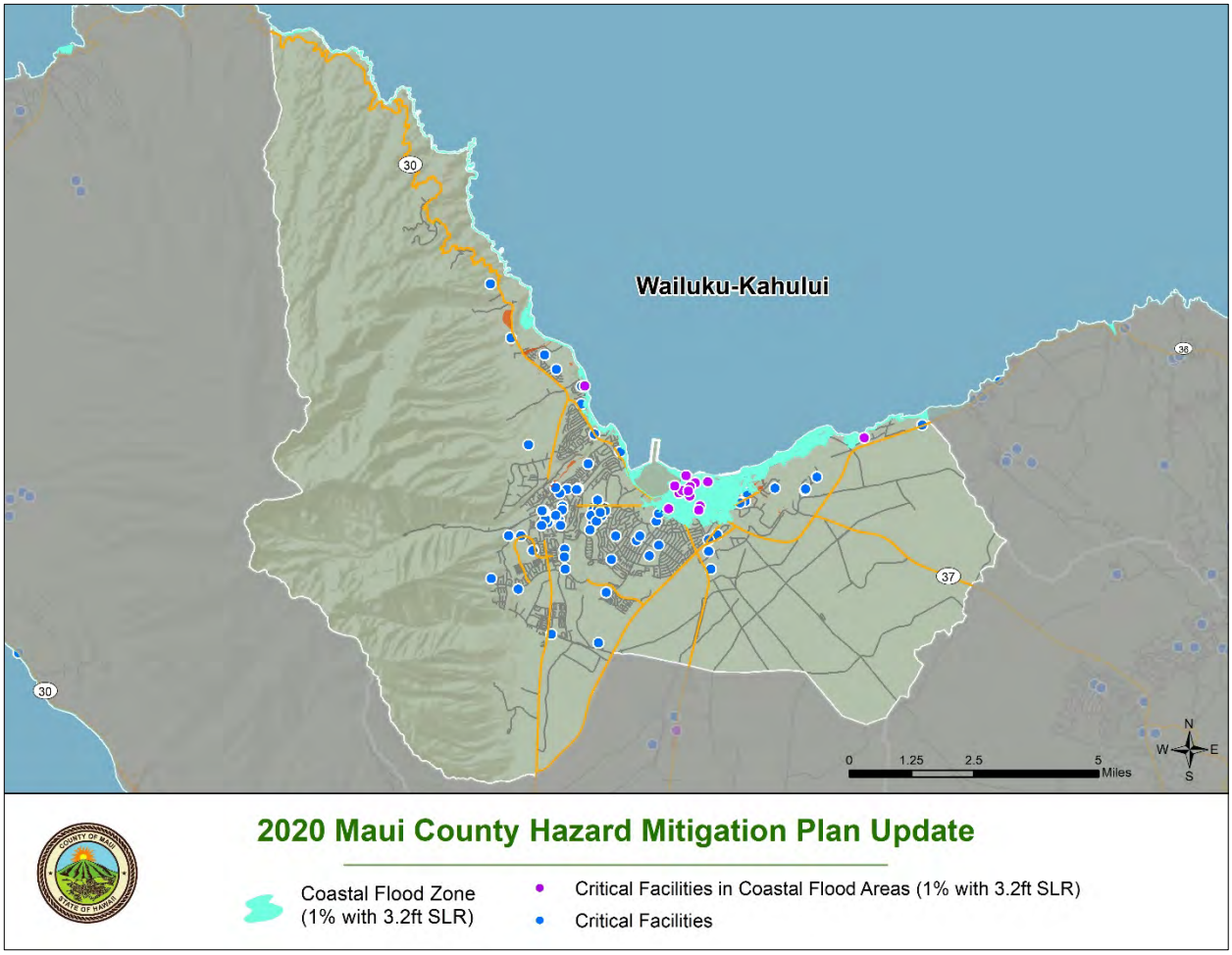

Figure 129. Critical Facilities in 1% Coastal Flood Areas with 3.2ft Sea Level Rise in the Wailuku-Kahului Community Planning Area.

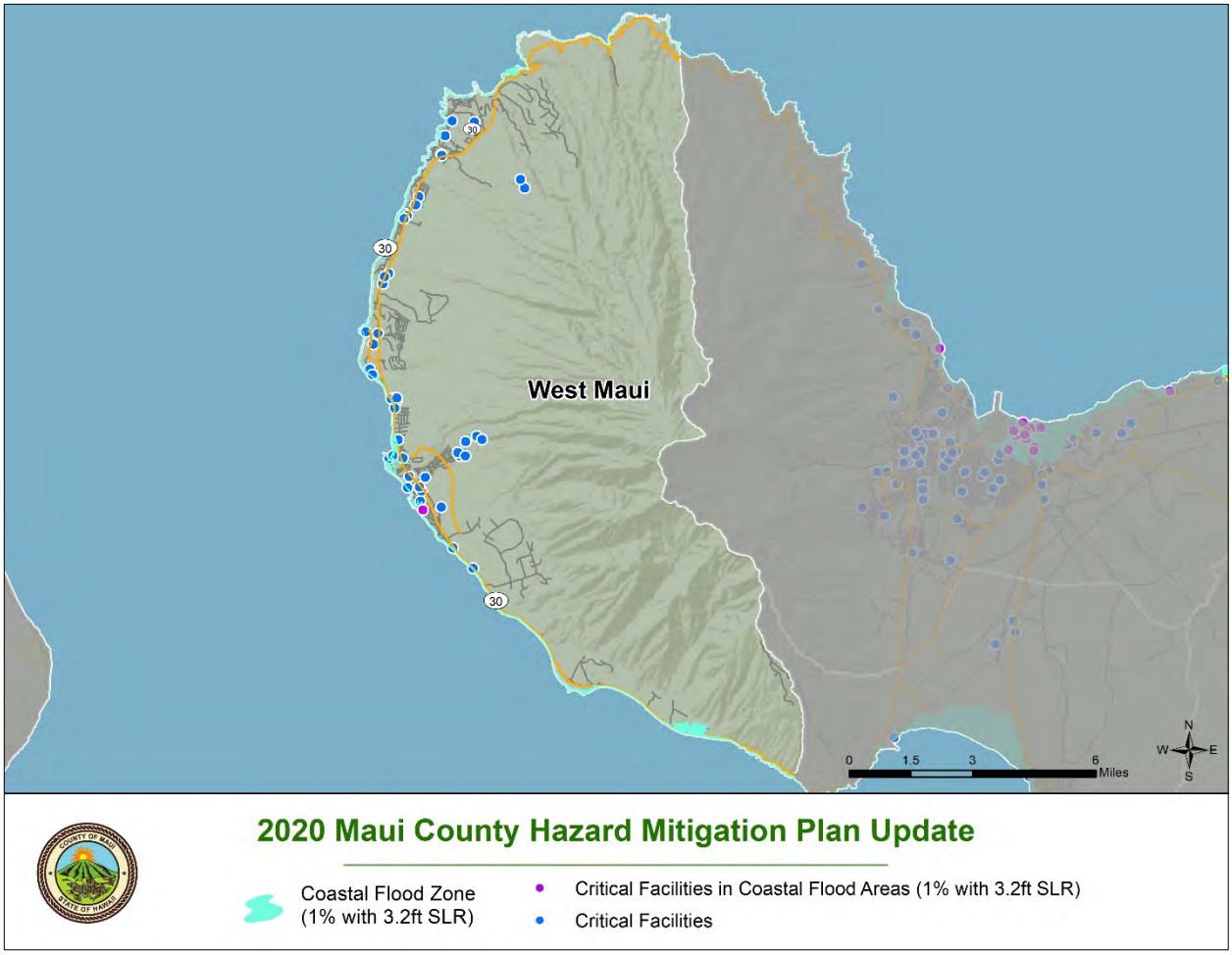

Figure 130. Critical Facilities in 1% Coastal Flood Areas with 3.2ft Sea Level Rise in the West Maui Community Planning Area.

As described in previous sections, utility lines, roads, and bridges are vulnerable to the impact of flood, including coastal flooding from sea level rise. Three bridges on Maui Island are within coastal flood hazard areas with 3.2 feet of sea level rise, two in West Maui and one in Kīhei-Makena. Nine bridges on Molokaʻi are within coastal flood hazard areas with 3.2 feet of sea level rise. There are no NBI bridges on the Island of Lānaʻi.

Further, many roads may have more or more segments within a potential future coastal flood hazard areas with 3.2 feet of sea level rise. These roadways are similar to those expected to be impacted by passive sea level rise, including Honoapiilani Highway in West Maui, North and South Kīhei Road in Kīhei-Mākena, Hāna Highway in Pāʻia-Haʻikū, and Kahului Beach Road in Wailuku-Kahului. On Molokaʻi, Maunaloa Highway near Kaunakakai is within future coastal flooding hazard areas, as is Kamehameha V Highway where it hugs the coast from Kaunakakai in central Molokaʻi to Hālawa Beach Park on Molokaʻi's eastern tip. Many county-owned local streets are also within future coastal flooding hazard areas within these planning areas.

Development Trends

In addition to current at-risk structures, future structures in current and future flood hazard areas (inland and coastal) are also at risk. According to Maui County officials, Kīhei is experiencing major development due to a limited housing supply and growing population. Noted development includes three to four story apartment buildings and the new Kīhei High School campus. Officials also noted that Wailuku is undergoing development aimed at middle-to high income households.

One way to assess potential future risk is to analyze future land uses designated for flood hazard areas. Maui County utilizes zoning as a tool for regulating future development within certain land use areas, called zones. The figure below shows zoning on this Island of Maui overlaid with flood hazard areas. Detailed zones have been categorized into general uses for clarity. Zoning data for the islands of Molokaʻi and Lānaʻi were not available. While much of the floodplain and floodway, especially inland stream reaches in less populated community planning areas, are designated as open space, certain areas within flood hazard areas are designated for growth, such as high density residential, commercial, and institutional uses, especially within coastal areas.

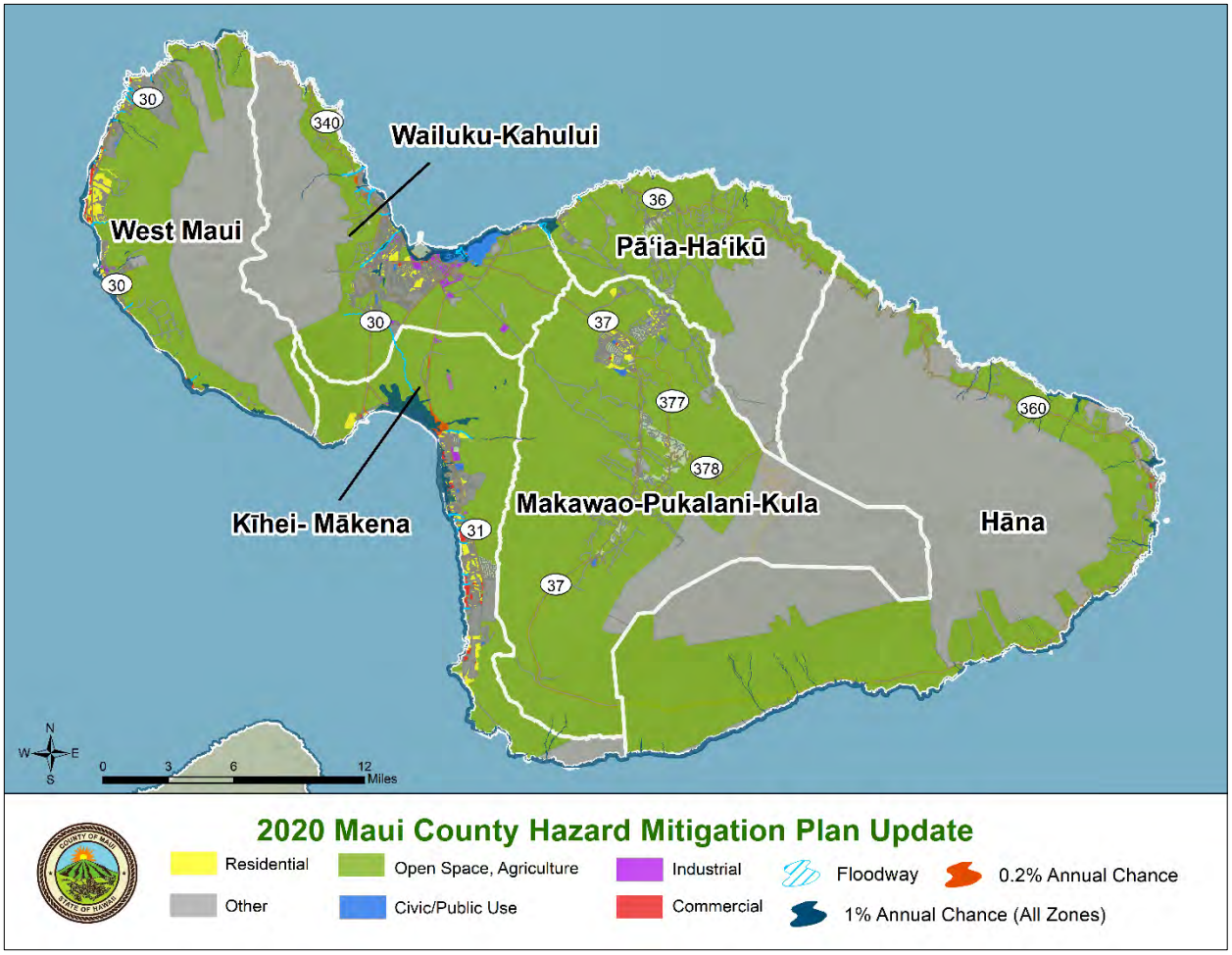

Figure 131. Zoning on this Island of Maui Overlaid with Flood Hazard Areas.

In addition to the use of zoning to direct future growth, Maui County regulates development within Special Management Areas, which require a special assessment during the development application process. The purpose of the Special Management Area Assessment is to provide a means to preserve, protect, and where possible, restore the natural resources of the Coastal Zone of Hawaiʻi by establishing special controls on development within the area along the shoreline. Figure 132 and Figure 133 show special management areas within Maui County overlaid with flood hazard areas.

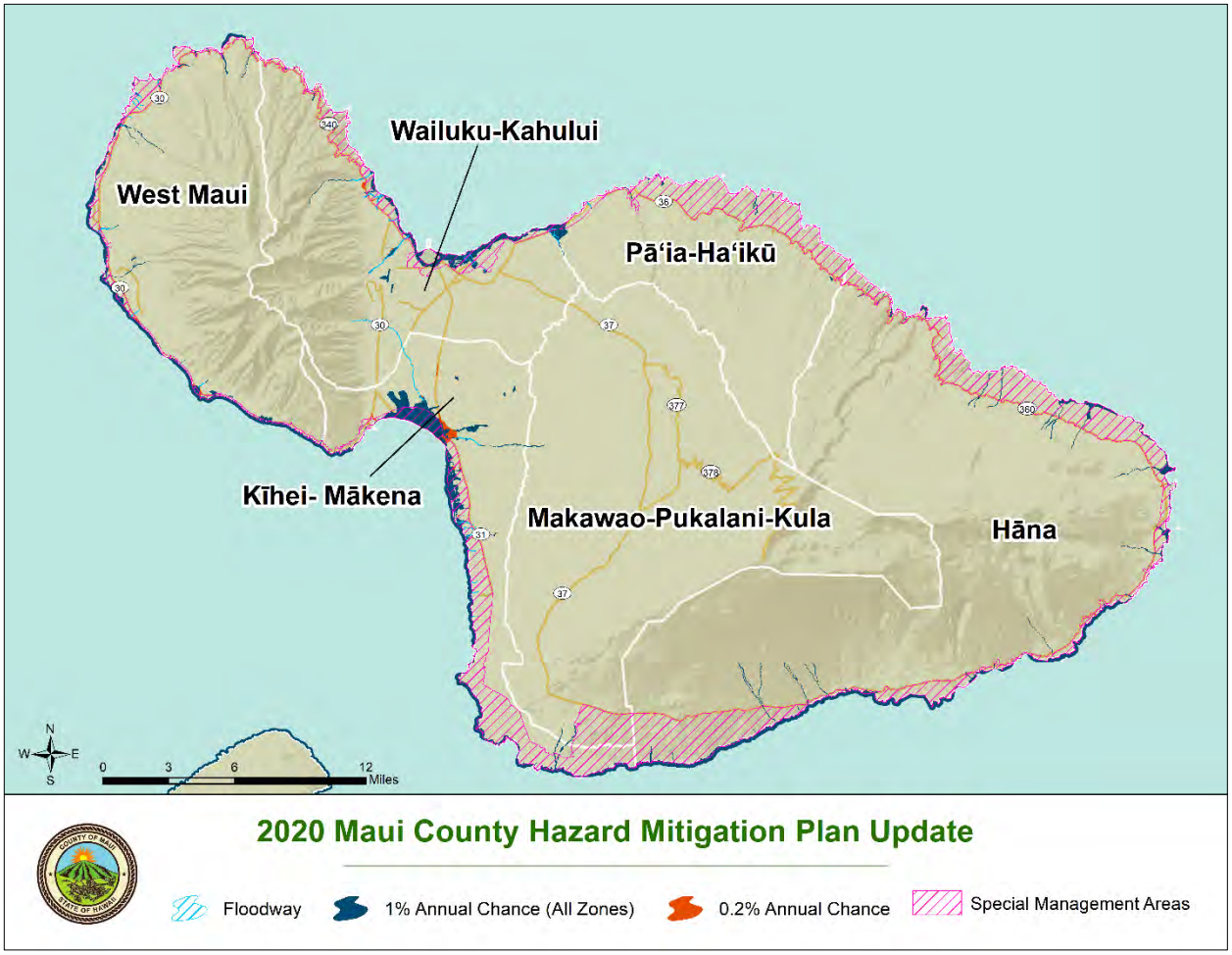

Figure 132. Special Management Areas on this Island of Maui Overlaid with Flood Hazard Areas.

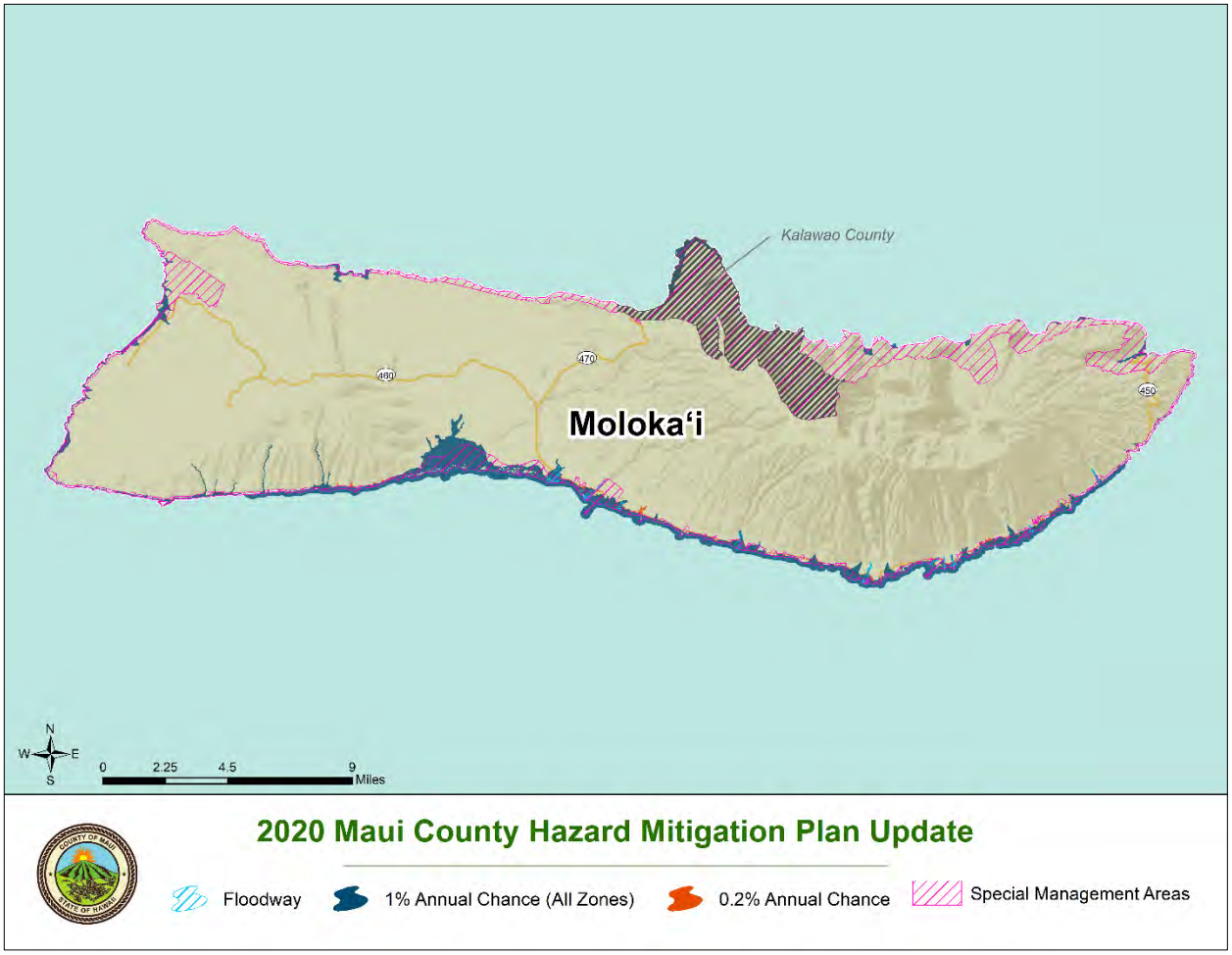

Figure 133. Special Management Areas on this Island of Moloka'i Overlaid with Flood Hazard Areas.

Life Safety, Health, Warning, and Evacuation Impacts

The public often underestimates the dangers presented by floodwaters. Flooding is often localized to certain parts of a community (e.g., certain roads, intersections, or neighborhoods), and floodwaters can prevent normal access to buildings and facilities. In Maui County, entire communities can be inaccessible due to floodwaters. This presents a danger when motorists and pedestrians attempt to traverse floodwaters. Motor vehicles and pedestrians can get swept up in flood currents, increasing the risk for drowning. Even in shallow waters, fast-moving currents can carry individuals or vehicles into deeper waters, where pressure from flowing water can prevent drivers from escaping submerged vehicles. As little as six inches of floodwater can move a vehicle, and as little as two inches can move a person. In addition, floodwaters often conceal conditions that are a danger to those on foot, including electrical wires, debris, nails, and open manholes hidden beneath the surface. In addition, roads and bridges can be weakened by flood impacts, making them unsafe for travel.

Maui County has experienced floods that have required small-scale evacuations and swift water rescues. Larger scale evacuation may be required for flooding associated with severe storms, such as hurricanes, tropical storms, or Kona storms. Maui also receives many visitors that may not be familiar with proper routes to lead them out of harm's way. Exercises and road markers are ways communities can become familiar with evacuation procedures.

Public Health Impacts

Floodwaters often contain contaminants such as bacteria and chemical hazards. Flooding often results in combined sewer overflows, resulting in sewage in floodwaters. Individuals traversing floodwaters or children playing in floodwaters contract diseases, injuries, and infections. Floodwaters may also contaminate drinking water sources and increase likelihood of waterborne diseases. Stagnant pools of water and saturated grounds can lead to an increase in the number of mosquito-borne diseases such as malaria and dengue and West Nile fevers. Rats and other rodents and wild animals also can carry viruses and diseases. The public should avoid such animals and should dispose of dead animals in accordance with guidelines issued by local animal control authorities. Leptospirosis—a bacterial disease associated predominantly with rats—often accompanies floods in developing countries, although the risk is low in industrialized regions unless cuts or wounds have direct contact with disease-contaminated floodwaters or animals.

Structures exposed to floodwaters can also present public health hazards. Damaged electrical systems and natural gas tanks present risk of fire and explosions. Potential for carbon monoxide poisoning increases after a flood, as power outages may lead to increased use of alternative fuel sources. Structures exposed to flooding may develop mold or wood rot. Mold growth can occur in flooded structures within 24 to 48 hours of inundation. People with asthma, allergies, or breathing conditions may be at a higher risk to mold.[151] The figure below provides tips for properly treating mold after a flood.

[151] Mold after a disaster. (2015). The Centers for Disease Control and Prevention. Retrieved August 18, 2017 from https://www.cdc.gov/disasters/mold/.

Figure 134. Tips for Treating Mold After a Flood Event.[152]

Floodwaters may make food unsafe for consumption. Floodwaters contain disease-causing bacteria, dirt, oil, human and animal waste, and farm and industrial chemicals. They carry away whatever lies on the ground and upstream. Their contact with food items, including food crops in agricultural lands, can make that food unsafe to eat and hazardous to human health. Power failures caused by floods damage stored food. Refrigerated and frozen foods are affected during the outage periods and must be carefully monitored and examined prior to consumption. Foods kept inside cardboard, plastic bags, jars, bottles,

[152] Hawai'i Department of Health. CDC. Retrieved from https://health.Hawai'i.gov/prepare/files/2019/04/infographic-mold-english.jpg.

and paper packaging are subject to disposal if contaminated by floodwaters. Even though the packages do not appear to be wet, they may be unhygienic with mold contamination and deteriorate rapidly.

Trains or trucks carrying hazardous materials during flood events have the potential spill or release hazardous materials due to crashes or derailments, which could negatively impact public health. Fixed sites, such as factories or industrial facilities, can also release hazardous materials when their buildings are flooded.

Lastly, flood events may have negative impacts on mental health. Experiencing a devastating flood and see loved ones lost or injured and homes damaged or destroyed, flood victims can experience long-term psychological impact. The expense and effort required to repair flood-damaged homes places severe financial and psychological burdens on the people affected, in particular the unprepared and uninsured. Prolonged post-flood recovery can cause mental disorders, anxiety, anger, depression, lethargy, hyperactivity, sleeplessness, and, in an extreme case, suicide. Existing issues around substance abuse or family violence may heighten after a flood event.

Impacts to Vulnerable Populations

All areas within Maui County are exposed to flood hazards, whether they occur in inland areas or in coastal areas. Based on available hazard information, populations living in low-lying areas, flood plains, along streams and gulches, or in areas along the shoreline are particularly susceptible to flood impacts.

Community Planning Areas with populations situated near the coast such as West Maui, Kīhei-Mākena, and Wailuku-Kahului are not only susceptible to flooding and property loss due to high waves, king tides and sea level rise, but as well the large volumes of water that flow downstream from upper elevations, at times with little to no warning. Roadways are often inundated or damaged by floodwaters which can hamper or prevent timely evacuation to higher ground and impede access to needed services such as medical care. In remote areas such as Hāna, flooding can further isolate populations, especially those living in locations where four-wheel drive vehicles are required.

Molokaʻi has the greatest proportion of total structures within FEMA SFHAs and has the highest overall Vulnerability Index score, while Kīhei-Mākena has the greatest total number of structures in flood zones, ranking sixth in overall vulnerability. Additionally, West Maui, ranking third in overall vulnerability, has the potential to experience the greatest losses based on building and content values. Populations in these Community Planning Areas could therefore experience significant losses due to flood hazards.

Populations exhibiting constraints related to all subcomponents of vulnerability: household composition, socioeconomic status, access to information, housing characteristics and access to lifelines may experience negative consequences as a result of flood hazards. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are described below.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty with mobilizing and evacuating or taking protective action in a timely fashion during a flood event. Further, the deaf or hard of hearing may not hear audible hazard alerts regarding imminent flood conditions. Once evacuated, these populations will require additional services and care considerations in the response aftermath and during recovery. Special accommodations for these populations must be considered in disaster planning processes.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a natural disaster. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate preparedness actions such as stocking extra food and supplies, support recovery actions such as repairing of homes after a flood, or fund mitigation actions that would protect their homes and property from future flood impacts.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon urgent

hazard warning information such as flash flood warnings. Additionally, those who do not speak English well, may not comprehend hazard warning information to the extent that enables them to make timely decisions and take life-saving actions.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living in housing built before 1950, and prior to the enactment of modern building codes, are more susceptible to damages and losses due to structural damage as a result of flood impacts. Older structures may be located in floodplains, near streams and closer to shorelines than modern setbacks dictate. In addition, higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences as a result of flood exposure, putting more people potentially in harm's way.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges during an evacuation, and have difficulty accessing needed supplies and services before, during and after a flood event. Those living in areas with limited road networks have reduced options for evacuation and could become completely isolated should roadways be damaged or washed away as a result from flooding. Additionally, those without health

insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Molokaʻi households also do not have access to a vehicle.

Economic Impacts

Flood events can have far-reaching impacts in Maui County. Flood losses occur directly due to damaged structures and infrastructure. Flood damage to businesses is difficult to estimate. Businesses that are disrupted by floods often have to be closed. They lose their inventories, customers cannot reach them, and employees are often focused on protecting or cleaning up their flooded homes. Business can be disrupted regardless of the business being located in the floodplain when customers and clients cannot reach their location. Business interruption is also forgone sales and tourism taxes for the county. As with flooded roads, public expenditures on flood fighting, sandbags, fire department calls, clean-up and repairs to damaged public property affect all residents of the city, not just those in the floodplain.

Climate Change Impacts

Climate change is expected to exacerbate inland and coastal flooding. Climate change is associated with more frequent ENSO extremes, which will lead to more frequent and severe storms in Maui County.

In coastal areas, high wave flooding will combine with sea level rise for a more severe impact that reaches further inland. King Tides will have a similar impact when combined with projected future sea level rise. Other potential impacts of sea level rise in Maui County include increased rates of coastal erosion and saltwater intrusion into surface water and groundwater systems.

Coral reefs provide substantial protection against coastal flooding and erosion by dissipating wave energy. A USGS study that examined the role coral reefs play in reducing coastal flooding found that for the 100-year storm event, coral reefs protected approximately 7.6 square kilometers of land on Maui Island, 0.9 square kilometers on Lānaʻi Island, and 1.8 square kilometers on Molokaʻi from flooding. Overall, the study found that the value of economic activity protected by coral reefs in Maui County is approximately $312 million.[153] These flood areas for the 100-year event, modeled with and without

[153] Storlazzi, C.D., et al (2019). *Rigorously valuing the role of U.S. coral reefs in coastal hazard risk reduction: U.S. Geological Survey Open-File Report 2019–1027*, 42 p., https://doi.org/10.3133/ofr20191027.

coral reefs, are shown in the figures below.[154] Climate change, as well as acute human impacts, degrade coral reefs through warming ocean waters and degrading water quality, which stress corals and lead to coral loss and bleaching episodes. On Maui, a study by the Hawai'i Division of Aquatic Resources found that coral cover declined from 35% in 1999 to 27% in 2006 across Maui's nine coral reefs. Of these, the Maalaea reef was one of the worst impacted, declining from 51% cover in 1995 to just 8% in 2006.[155] There are several coral reef restoration plans and projects underway in Maui County.

[154] Gibbs, A.E et al (2019). *Projected flooding extents and depths based on 10-, 50-, 100-, and 500-year wave-energy return periods, with and without coral reefs, for the States of Hawaii and Florida, the Territories of Guam, American Samoa, Puerto Rico, and the U.S. Virgin Islands, and the Commonwealth of the Northern Mariana Islands*. U.S. Geological Survey data release. Retrieved from https://doi.org/10.5066/P9KMH2VX.

[155] Hawai'i Division of Aquatic Resources (n.d.). *Status of Maui's Coral Reefs*. Retrieved from https://dlnr.hawaii.gov/coralreefs/files/2019/09/MauiReefDeclines.pdf.

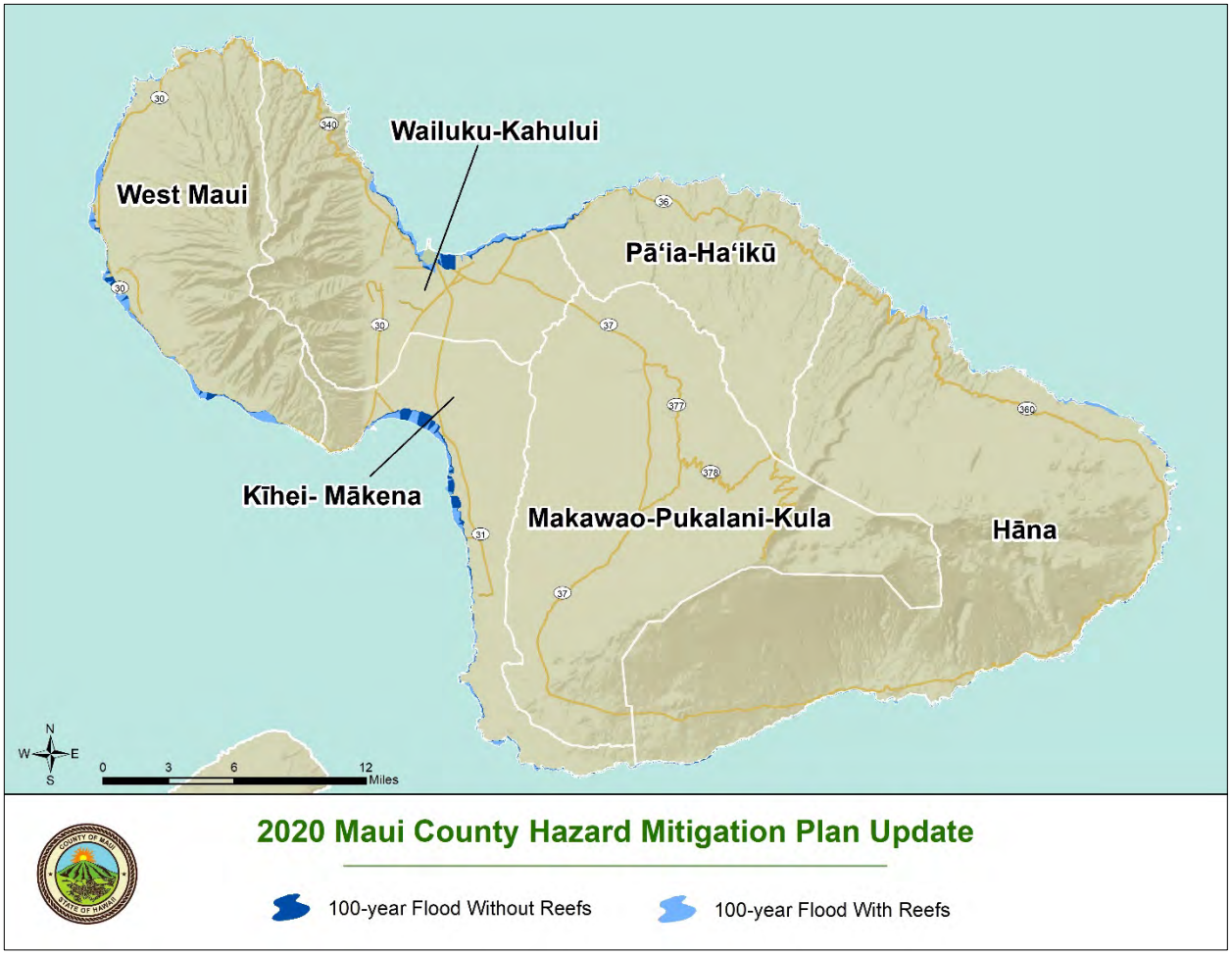

Figure 135. Extent of the 100-year Flood with and without Coral Reefs on the Island of Maui.

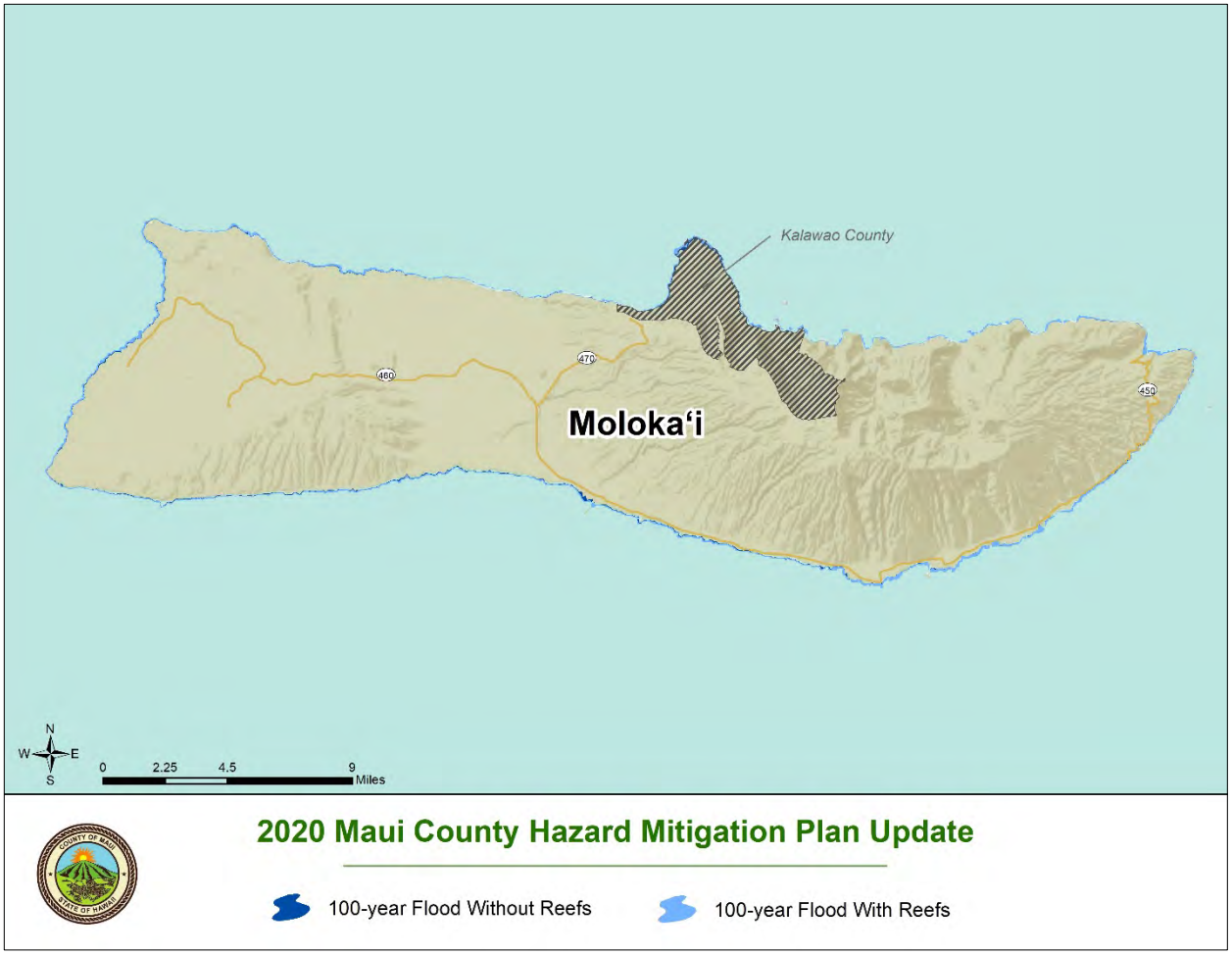

Figure 136. Extent of the 100-year Flood with and without Coral Reefs on the Island of Moloka'i.

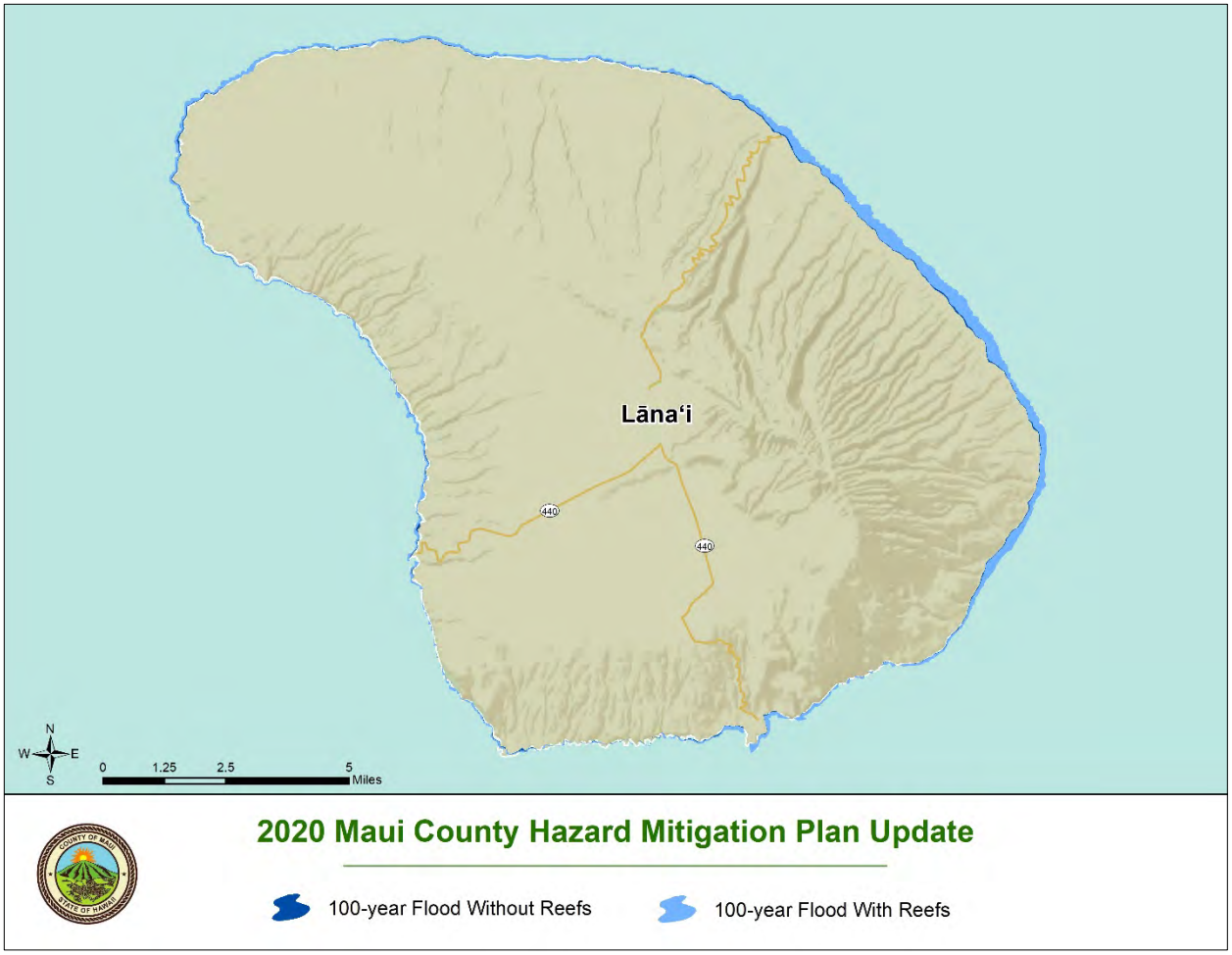

Figure 137. Extent of the 100-year Flood with and without Coral Reefs on the Island of Lānaʻi.

High Windstorms

Description

There are several types of wind hazards that affect Maui County. These include trade winds and thunderstorm wind events. Hurricanes tropical storms, and Kona Storms are also wind events that have the potential to impact Maui County, but due to special hazards associated with these types of events, they are listed as a separate hazard.

High wind definitions can vary by region. In general, high wind events are those events greater than normal averages and have damage potential. Wind events are common throughout the United States, including the Hawaiian Islands. However, the severity of high wind events varies depending on location. Figure 138 below shows wind zones in the U.S. based on ASCE 7-98 criteria. Based on assigned wind zones, Maui County is located in Wind Zone II, which experiences winds up to 160 miles per hour.

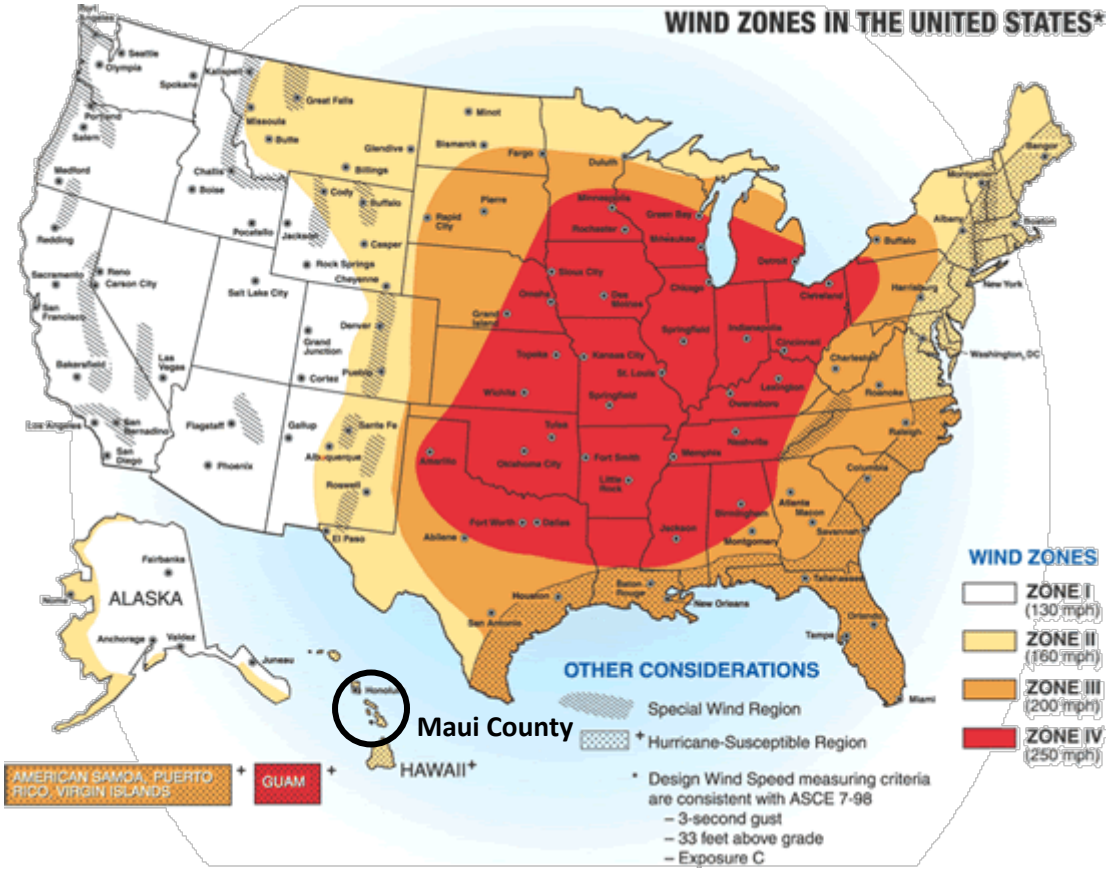

Figure 138. ASCE 7-98 U.S. Wind Zone.[156]

Local National Weather Service Centers can issue a high wind advisory, watch, or warning. At the Honolulu Weather Forecast Office, a wind advisory is issued when sustained winds of 30 to 39mph and/or frequent gusts up to 50mph or greater are occurring or imminent. For summit areas the sustained wind range is 45 to 55mph and/or frequent gusts of 55 to 65mph. Wind advisories may be in effect for 6 to 12 hours.

A High Wind Watch is issued when sustained winds exceeding 40mph and/or frequent gusts over 60mph are likely to develop in the next 24 to 48 hours. For summit areas, high wind watches are issued when sustained winds are expected to exceed 56mph and/or frequently gust over 66mph. A High Wind Warning is issued when these same wind speeds are occurring or imminent. Wind warnings may be issued up to 24 hours ahead of the onset of high winds.[157]

A Beaufort Wind Scale may also be used to describe wind severity as shown in Table 51 below.

[156] University of Missouri Extension. Weather-related Resources. http://extension.missouri.edu/webster/weather.aspx
[157] National Weather Service Honolulu, HI Forecast Office. *Questions about products*. Retrieved from https://www.weather.gov/hfo/prod_questions.

Table 51. Beaufort Wind Scale.[158]

Beaufort Number	Wind (Knots)	Description	On the Water	On Land
0	Less than 1	Calm	Sea surface smooth and mirror-like	Calm, smoke rises vertically
1	1-3	Light Air	Scaly ripples, no foam crests	Smoke drift indicates wind direction, still wind vanes
2	4-6	Light Breeze	Small wavelets, crests glassy, no breaking	Wind felt on face, leaves rustle, vanes begin to move
3	7-10	Gentle Breeze	Large wavelets, crests begin to break, scattered whitecaps	Leaves and small twigs constantly moving, light flags extended
4	11-16	Moderate Breeze	Small waves 1-4 ft. becoming longer, numerous whitecaps	Dust, leaves, and loose paper lifted, small tree branches move
5	17-21	Fresh Breeze	Moderate waves 4-8 ft. taking longer form, many whitecaps, some spray	Small trees in leaf begin to sway
6	22-27	Strong Breeze	Larger waves 8-13 ft., whitecaps common, more spray	Larger tree branches moving, whistling in wires
7	28-33	Near Gale	Sea heaps up, waves 13-19 ft., white foam streaks off breakers	Whole trees moving, resistance felt walking against wind
8	34-40	Gale	Moderately high (18-25 ft.) waves of greater length, edges of crests begin to break into spindrift, foam blown in streaks	Twigs breaking off trees, generally impedes progress
9	41-47	Strong Gale	High waves (23-32 ft.), sea begins to roll, dense streaks of foam, spray may reduce visibility	Slight structural damage occurs, slate blows off roofs
10	48-55	Storm	Very high waves (29-41 ft.) with overhanging crests, sea white with densely blown foam, heavy rolling, lowered visibility	Seldom experienced on land, trees broken or uprooted, "considerable structural damage"
11	56-63	Violent Storm	Exceptionally high (37-52 ft.) waves, foam patches cover sea, visibility more reduced	N/A
12	64+	Hurricane	Air filled with foam, waves over 45 ft., sea completely white with driving spray, visibility greatly reduced	N/A

Trade winds are the most common winds over Hawaiian waters. These persistent winds blow 70% of the time from a northeast to east-northeast direction and generally range from 10 to 25mph. Occasional extreme events reach 40 to 50mph when the sub-tropical high-pressure cell north of the islands intensifies. Trade winds occur up to 90% of the time in summer (June through August) and 50% of the time in winter (December through January).

On the Island of Maui, trade winds appear to be stronger when passing through the isthmus between the West Maui Mountains and Haleakalā. Wind speeds may be higher at locations such as Mā‘alaea and north Kīhei than along the island’s north shore. This increase in wind speed is the result of wind

[158] Beaufort Wind Scale. http://www.spc.noaa.gov/faq/tornado/beaufort.html

funneling, which occurs when wind passes between two mountains or into a valley. North Pacific high-pressure systems can cause gusty trade wind episodes over Hawaiian waters, which can last for days.[159]

Thunderstorms are associated with high wind because wind is typically one component of thunderstorms. Thunderstorms are very dangerous because of their ability to generate tornadoes, hailstorms, strong winds, flash flooding, and damaging lightning. While thunderstorms can occur in all regions of the United States, they are most common in the central and southern states because atmospheric conditions in those regions are ideal for generating these powerful storms.

Three conditions need to occur for a thunderstorm to form. First, there needs to be moisture present to form clouds and rain. Second, it needs unstable air, such as warm air that can rise rapidly (this often referred to as the "engine" of the storm). Third, thunderstorms need lift, which comes in the form of cold or warm fronts, sea breezes, mountains, or the sun's heat. When these conditions occur simultaneously, air masses of varying temperatures meet, and a thunderstorm is formed. These storm events can occur singularly, in lines, or in clusters. Further, they can move through an area very quickly or linger for several hours.

Straight-line winds, which in extreme cases have the potential to cause wind gusts that exceed 100 miles per hour, are responsible for most thunderstorm wind damage. One type of straight-line wind, the downburst, can cause damage equivalent to a strong tornado and can be extremely dangerous to aviation.

According to the National Weather Service, more than 100,000 thunderstorms occur each year, though only about 10 percent of these storms are classified as "severe." A severe thunderstorm occurs when the storm produces one of three elements: 1) Hail of three-quarters of an inch; 2) Tornado; 3) Winds of at least 58 miles per hour.

Figure 139 illustrates thunderstorm hazard severity based on the annual average number of days with a thunderstorm event. According to the map, Maui County is in a location that experiences approximately 6 thunderstorm days per year.

[159] Maui County Hazard Mitigation Plan Update (2015). *Chapter 13: High Wind Storm.*

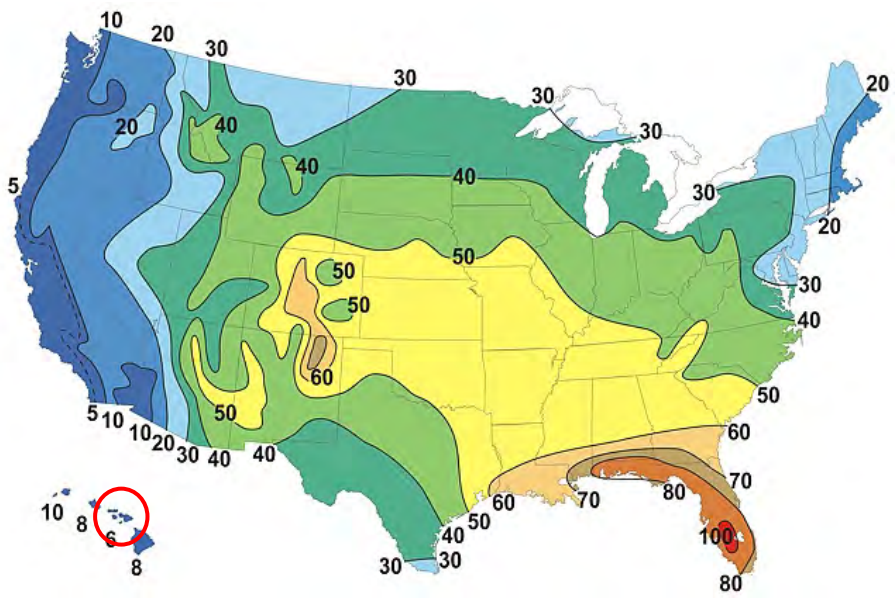

Figure 139. Average Number of Days with Thunderstorms (NOAA).

Location

High winds, including thunderstorm wind, can impact the entire county. Maui County is classified as a Zone II wind zone, capable of experiencing winds up to 160 miles per hour as shown in Figure 138**.** However, south-facing shorelines are at greatest risk to wind events, along with the north shore as winds accelerate down the north slopes of Haleakalā.[160]

Previous Occurrences

Previous wind events were gleaned from the 2015 Maui County Hazard Mitigation Plan, as well as from NOAA's NCEI Storm Events Database, which was investigated for past high wind and thunderstorm wind events reported in Maui County. From 1970 to 2004, the 2015 Maui County Hazard Mitigation Plan reported 67 high wind events, totaling almost $2.5 million in damages, and resulting in five injuries and 3 fatalities. Details for these events are presented in the table below. Location within community planning areas was not available for these events.

Table 52. Previous Wind Events in Maui County (1970-2004).

Date	Description	Property Damage	Injuries	Fatalities
12/25/1970	High winds	$0	0	0
01/05/1971	Wind	$5,752	0	0
04/19/1972	Large swell and gusty winds	$0	0	2
02/08/1973	Dust devil	$262	4	0

[160] Maui County Hazard Mitigation Plan Update (2015). *Chapter 13: High Wind Storm.*

Date	Description	Property Damage	Injuries	Fatalities
12/30/1973	High winds and rough seas	$26,233	0	0
11/23/1975	High seas/ high winds/ heavy rain	$5,412	0	0
02/05/1976	High wind/ high surf/ flood	$51,176	0	0
03/16/1978	High winds and sea	$17,864	0	1
07/02/1979	High winds	$160	0	0
01/08/1980	High winds	$0	0	0
02/11/1981	Wind	$25,627	0	0
12/25/1981	Heavy rain and wind	$256,278	0	0
08/03/1981	Heavy rain and wind	$2,563	0	0
02/11/1982	Rain/hail/wind	$402,345	0	0
07/21/1982	Rain and wind	$603,516	0	0
08/01/1982	Rain/surf/wind	$60,352	0	0
08/14/1982	Rain/surf/wind	$24,141	0	0
12/18/1982	Wind	$24,141	0	0
12/23/1982	Wind	$24,141	0	0
12/24/1983	Wind and heavy rain	$23,389	0	0
03/10/1983	Dust devil	$1,169	0	0
10/15/1983	Wind and surf	$2,339	0	0
12/24/1983	Strong winds with 50 mph gusts	$0	0	0
12/24/1984	Wind and flood	$22,421	0	0
01/13/1985	Wind and surf	$216,503	0	0
03/01/1985	Wind and surf	$21,650	0	0
11/30/1985	Wind	$21,650	0	0
12/30/1988	Wind and surf	$1,969	0	0
11/04/1988	Wind/flood/ lightning	$196,921	0	0
12/05/1988	Flash flooding/wind/lightning	$32,820	0	0
03/01/1989	Wind/flash flooding/surf	$187,869	0	0
12/09/1989	Flash flooding and wind	$18,787	0	0
01/27/1991	Wind and flooding	$171,040	0	0
12/04/1993	Strong trade winds	$0	0	0
03/14/1994	Winds	$15,719	0	0
12/23/1996	Southwest winds	$0	0	0
01/25/1997	Southwest winds	$0	0	0
02/25/1997	High winds	$0	0	0
01/05/1998	Westerly winds of 40 to 60 mph	$0	0	0
01/29/1998	High winds of 50 to 60 mph	$0	0	0
04/03/1998	High winds of 50 to 60 mph	$0	0	0
04/09/1998	High winds up to 50 mph	$0	0	0

Date	Description	Property Damage	Injuries	Fatalities
04/13/1998	High winds up to 40 to 60 mph	$0	0	0
11/30/1998	High winds of 50 to 60 mph	$0	0	0
01/15/1999	High winds	$0	0	0
02/03/1999	High winds	$0	0	0
03/20/1999	Wind gusts up to 55 mph	$0	0	0
07/26/1999	Winds with gusts over 70 mph	$0	0	0
08/31/1999	Winds with gusts between 35 and 55 mph	$0	0	0
11/28/1999	Trade winds of 30 to 45 mph	$0	0	0
03/22/2000	Winds with gusts up to 45 mph	$0	0	0
04/01/2000	Winds gusts up to 60 mph	$0	0	0
11/17/2000	Wind of 30 to 40 mph with gusts up to 50 mph	$0	0	0
01/14/2001	Wind of 35 to 40 mph with gusts up to 50 mph	$0	0	0
04/12/2001	Wind up to 30 mph with gusts up to 43 mph	$0	0	0
08/31/2001	Wind up to 35 mph with gusts up to 51 mph	$0	0	0
12/02/2001	Wind up to 40 mph with gusts up to 50 mph	$0	0	0
12/11/2001	Wind up to 40 mph with gusts up to 55 mph	$0	0	0
01/17/2002	Wind up to 40 mph with gusts up to 50 mph	$0	0	0
01/29/2002	Wind up to 40 mph with gusts up to 45 mph	$0	0	0
02/26/2002	Wind up to 40 mph with gusts up to 44 mph	$0	0	0
03/17/2002	Wind up to 40 mph with gusts up to 50 mph	$0	0	0
04/01/2002	Wind	$0	1	0
01/04/2003	High winds	$0	0	0
01/14/2003	High winds with gusts up to 70 mph	$0	0	0
01/19/2003	Wind up to 60 mph with gusts up to 70 mph	$0	0	0
12/21/2003	Wind up to 45 mph with gusts up to 50 mph	$0	0	0

Since 2004, a total of 27 wind events and approximately $4.1 million in damages (2019 dollars) were reported for Maui County, although damage estimates were not available for several events in which known damages occurred. No injuries or deaths were reported in Maui County due to these events. The table below presents details for these events.

Table 53. NCEI-Reported Previous Wind Events in Maui County.

Location	Date	Wind Speed (knots)	Damages (2019 dollars)	Description
Lahaina, Kahului	2/27/2004	50	$0	Wind gusts from thunderstorms damaged several boats along coastal sections of West Maui and northern portions of the Central Valley. However, damage estimates are not available. There were no reports of serious injuries.
Haleakalā Summit	12/2/2004	61	$0	N/A
Haleakalā Summit	12/6/2004	52	$0	N/A
Haleakalā Summit	1/10/2005	40	$0	Sustained west to southwest winds in excess of 45 mph impacted the summit of Haleakalā in East Maui. No serious property damage or injuries were reported.
Haleakalā Summit	3/12/2005	55	$0	High winds and icy conditions caused power outages on the summit of Haleakalā, which interrupted broadcast transmissions from public and commercial radio and television stations. There were no reports of serious property damage or injuries.
Haleakalā Summit	12/18/2005	51	$0	N/A
Wailea, Kahului	3/27/2006	50	$0	A thunderstorm toppled trees in Wailea and Kula, and downed power lines in Kahului. An emergency manager estimated wind gusts to at least 50 knots with the storm. There were no serious injuries, and damage estimates are not available.
Haleakalā Summit	2/18/2007	50	$0	N/A
Maui Island, Molokaʻi, Kahoʻolawe, Lānaʻi (Makai), Lānaʻi (Mauka)	12/4 to 12/5/2007	72	$0	Several utility poles and transmission lines were blown down by wind gusts in Central Maui. A roof was blown off a home on Mahinahina Street in Lahaina. A roof was blown off a home in Kaunakakai by wind gusts. High winds downed a large tree in Lānaʻi City. High winds caused 8 utility poles to fall in Kīhei. Flash flooding damaged homes, and the inclement weather snarled traffic. A Haleakalā National Park Ranger recorded a wind gust of 75 knots with a hand held weather sensor. The state estimates total damages to be about $5 million.
Haleakalā Summit	1/16/2009	58	$0	West winds gusted above 65 mph at the summit of Haleakalā on the Valley Isle of Maui.
Kahana	12/20/2009	50	$0	A thunderstorm at the Kahului Airport on Maui generated a wind gust of over 50 knots. There were no reports of significant property damage or injuries.

Location	Date	Wind Speed (knots)	Damages (2019 dollars)	Description
Hāna	3/9/2012	43	$3,935,596	Strong winds destroyed a portion of the roof on the Hāna Hotel on Maui. Damages in Maui were estimated at $3.2 million (2012 dollars).
Haleakalā Summit	5/23/2012	59	$0	N/A
Haleakalā Summit	6/4/2012	57	$0	N/A
Haleakalā Summit	6/17/2012	61	$0	N/A
Kahoʻolawe	1/5 - 1/6/2013	60	$0	High winds caused property damage in isolated locales, though the costs were not available.
Lānaʻi (Mauka)	2/18/2013	58	$0	N/A
West Maui	2/18/2013	43	$5,970	Strong winds knocked down a power line and two 30-foot trees on Ala Moana Street in Lahaina.
Central Maui	7/31/2013	39	$5,970	Gusty trade winds helped topple two power poles on Maui along Māʻalaea Harbor Road. There were no reports of serious injuries.
Lānaʻi (Mauka)	8/8/2014	54	$115,927	Wind gusted over 50 knots and damaged four roll-up doors at the recently built state airport fire station. There was also damage to a maintenance facility.
Hāna, Pāʻia-Haʻikū	2/9/2015	49	$11,255	Hosmer Grove Campground closed in windward East Maui because of strong winds and downed trees.
Hāna, Pāʻia-Haʻikū	2/14/2015	47	$11,255	Maui Police reported road closures due to downed trees and utility lines in several areas in and around Haʻikū in windward East Maui, including West Kuiaha Road and Ulumalu Road.
Lānaʻi (Mauka), West Maui	1/21/2017	57	$0	Lānaʻi Airport AWOS recorded a 66-mph wind gust. A wind gust of 59 mph was measured in Lahaina, Maui. Power outages were reported in many areas, in addition to downed trees and power lines, and roof damage to many residences.
West Maui	2/5/2017	43	$10,609	In Maui County, a ferry between Lānaʻi and Lahaina on Maui was halted because of rough seas from the winds, and two sailboats ran aground.
Kanaha	10/24/2017	52	$0	Multiple power lines knocked down on Hāna Highway at Hookele Street. Hāna Highway was then closed at Airport Access Road. Entire island of Maui lost power for a time as more wind damage occurred in the short time after the initial problems occurred near the airport.
Hāna, Pāʻia-Haʻikū	9/12/2018	43	$6,180	As Tropical Storm Olivia approached the islands from the east-northeast and then made a double landfall in Maui County, it brought gusty winds and heavy precipitation. Most effects were concentrated over Maui and Molokaʻi. The system downed trees,

Location	Date	Wind Speed (knots)	Damages (2019 dollars)	Description
				caused power outages and debris flows, and generated flash flooding. Downed trees downed blocked Hāna Highway at mile markers 21 and 26. Downed trees were reported at the intersection of Kawai Ola Place and Hāna Highway near Hāna, and two miles southeast of Nahiku along Hāna Highway.
Hāna, Pāʻia-Haʻikū, Kīhei-Mākena, Makawao-Pukalani-Kula	2/10/2019	45	$12,000	A tree was reported down on Hāna Highway in windward East Maui near mile marker 14 or 15, south of Nahiku. Another tree was downed on Kula Highway by the Kula post office in Upcountry Maui. A power outage occurred with downed lines in the Makawao (windward Haleakalā section of the Maui), Pukalani, and Kula.

Extent

Wind extent can be measured in terms of speed, reported in knots. Within Maui County, the strongest wind speed reported during a windstorm event was 72 knots (83mph). It should be noted that stronger wind events are possible in the county.

Probability of Future Events

Extreme wind is recognized as a regular occurrence in Maui County. With 94 wind events reported in Maui County in 50 years, the county experienced approximately two reported wind events each year, although it is likely that wind events have gone unreported, especially if they did not result is damage, injuries, or deaths. Further, the county is in a location that experiences approximately six thunderstorm days per year, as shown previously in Figure 139. However, climate change impacts may decrease the frequency of some future wind events, as climate change is associated with a documented decrease in trade winds in Maui County. Based on the above factors and available information regarding the location of past wind events, an annual probability of Highly Likely (greater than 90% annual chance) was assigned for high windstorm events in all community planning areas in Maui County.

Vulnerability

All of Maui County is vulnerable to high windstorms due to the topography and movement of weather fronts through the area. During a time of extreme heat and high winds, the wildfire threat would significantly increase. Specific impacts to buildings, infrastructure, life safety, public heath, and the economy from lightning are described below. All current and future buildings, infrastructure, and populations are considered at-risk to severe wind. Climate-related impacts to the lightning events are also described.

Building and Infrastructure Impacts (including Critical Facilities)
All current and future buildings in Maui County (including critical facilities) are considered at-risk to high wind events. High wind has the potential to blow shingles, siding, awnings, and other features off buildings. Falling trees and tree limbs can damage structures and block roadways, demonstrated by the 2019 windstorm that caused downed trees to block Hāna Highway and Kula Highway. Objects picked up by wind can be hurled through the air, damaging structures and breaking windows when contact is made. In some cases, structures can be blown off foundations. In addition, mobile homes are considered at a higher risk to severe wind. Proper anchoring can make mobile homes more resilient to severe wind.

Severe winds can cause damage to critical infrastructure, including communications infrastructure, utility poles, and above ground power lines can be blown down.

Life Safety, Health, Warning, and Evacuation Impacts
Severe winds can result in serious life safety impacts. People outside during severe wind events may be struck by falling trees and limbs, or by objects falling off buildings or being hurled through the air. While high windstorms are unlikely to result in an evacuation, wind advisories, watches and warnings may be issued for sustained winds and gusts of certain speeds (see *Description* subsection for warning thresholds specific to Maui County). Watches and warnings may be issued several days to several hours ahead of an event. Certain areas, such as Haleakalā National Park, may close to visitors during high wind events.

Public Health Impacts
No special public health issues are attributable to high windstorms.

Impacts to Vulnerable Populations
High windstorms have the potential to affect the entire county of Maui. Based on the hazard information above, areas at greatest risk to wind events are south-facing shorelines and communities along the northern slopes of Haleakalā. Therefore, populations in the Kīhei-Mākena, Pāʻia-Haʻikū, Hāna, Wailuku-Kahului and Molokaʻi Community Planning Areas, and especially those living in poorly built structures may be most affected. While all vulnerability subcomponents are summarized below, vulnerable populations exhibiting constraints related to household composition, socioeconomic status, housing characteristics and access to lifelines may be most susceptible to negative consequences resulting from high windstorms. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are also described.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty with mobilizing or taking protective action (e.g., securing outdoor furniture or other items that could become airborne) in a timely fashion during a high wind event. If evacuated due to damages as a result of high winds, these populations will require additional services and care

considerations in the response aftermath and during recovery. Special accommodations for these populations must be considered in disaster planning processes.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a natural disaster. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate preparedness actions such as stocking extra food and supplies, support recovery actions such as repairing of homes after a high windstorm, or fund mitigation actions that would protect their homes and property from future hazard impacts.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon information pertaining to preparing for high wind events. Additionally, those who do not speak English well, may not comprehend hazard warning information to the extent that enables them to make timely decisions and take appropriate actions.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than

well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living in housing built before 1950, and prior to the enactment of modern building codes, are more susceptible to damages and losses due to structural damage as a result of high windstorms. In addition, higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences as a result of hazard exposure.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges and have difficulty accessing needed supplies and services before and after a high wind event. Those living in areas with limited road networks could become completely isolated should roadways be blocked by fallen trees and other debris as a result from high windstorms. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului

has the highest percentage of households without a vehicle (7%). Over 6% of Moloka‘i households also do not have access to a vehicle.

Economic Impacts
Communication lines, antennas, and towers can suffer damage from wind and downed branches/trees. Damages to buildings, roads, and vehicles can be costly. Businesses interruptions can occur due to power outages. Flights may be delayed or canceled due to severe wind events.

Climate Change Impacts
Climate change is projected to have various impacts of wind events in Maui County. While trade winds have decreased as temperatures have warmed over the last several decades, how future climate change conditions will impact trade winds and monsoon winds in Maui County is unclear.[161] Increases in severe storm events may increase the severity and/or frequency of high wind events in Maui County.

Hurricane (including Tropical Storm and Kona Storms)

Description
A hurricane is a large, rotating storm with high speed winds. Hurricanes form over warm, tropical waters when warm, moist air rises, creating an area of low pressure. Surrounding areas of high pressure push toward the low pressure, then also warm and rise. As warmed air continues to rise, surrounding air swirls around the low-pressure area to take its place. As the warm air rises it cools and forms clouds. The storm system spins and grows as it continues to be fed by warm ocean water. As the storm spins faster, a low-pressure eye forms in the center of the storm.[162] The eye is clear and calm, but is surrounded by the eyewall, which contain the storm’s strongest winds and heaviest rains. As a hurricane makes landfall, it weakens as its supply of warm ocean water is cut off. The figure below shows a cross-section of a hurricane.

[161] US Global Change Research Program (2018). Fourth National Climate Assessment, Chapter 27: Hawai’i and Pacific Islands. Retrieved from https://nca2018.globalchange.gov/chapter/27/.
[162] NASA. *How do hurricanes form?*. Retrieved from https://spaceplace.nasa.gov/hurricanes/en/.

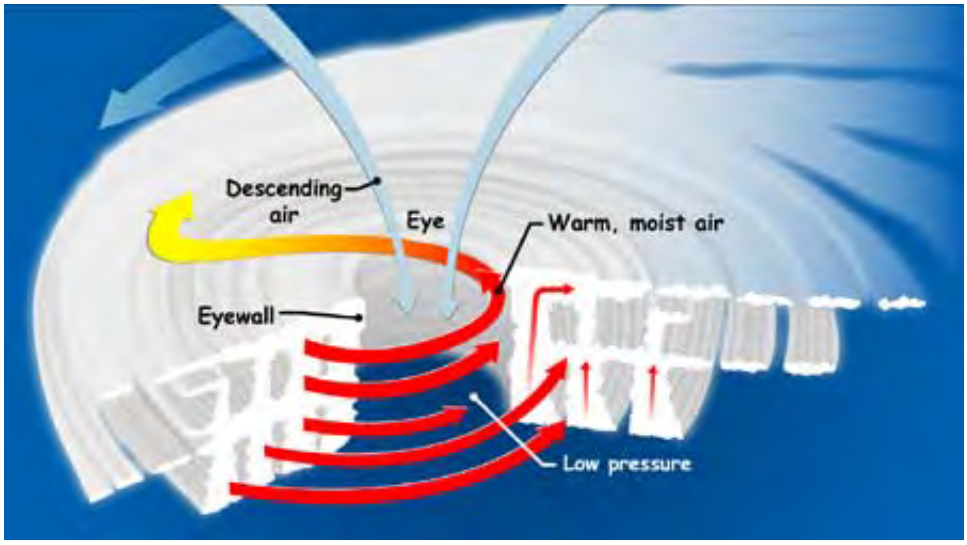

Figure 140. Hurricane Cross-Section.[163]

Hurricanes and tropical storms (also referred to as tropical cyclones or typhoons), can be damaging and potentially deadly in the Hawaiian Islands. These storms can bring excessive amounts of rain, strong and damaging winds, storm surge, high waves, erosion along shorelines, and tidal and coastal flooding. In the Northern Hemisphere, hurricanes typically form in three regions of the world: the tropical Atlantic, the eastern tropical Pacific, and the western tropical Pacific. In the Southern Hemisphere, hurricanes form in the western tropical Pacific and Indian Ocean. Hawaiʻi lies in the Central Pacific, which, on average, experiences four to five hurricanes every year.

In the United States, forecast centers classify hurricanes and similar, but weaker storms in the following categories according to their maximum sustained winds:

Tropical Depression—A weak tropical cyclone with a surface circulation including one or more closed isobars (lines or curves of constant pressure) and highest sustained winds (measured over one minute or more) of less than 38 mph. Tropical depressions are assigned a number denoting their chronological order of formation in a given year.

Tropical Storm—A tropical cyclone with highest sustained winds between 39 and 73 mph.

Hurricane (or Typhoon west of 180º longitude) —A tropical cyclone with highest sustained winds greater than 74 mph. Intensity is quantified by category, as shown in Table 54.

[163] NASA. *How do hurricanes form?*. Retrieved from https://spaceplace.nasa.gov/hurricanes/en/.

Table 54. Hurricane Damage Classification on the Saffir Simpson Scale.

Storm Category (Sustained Winds - MPH)	Damage Level	Description of Damages	Photo Example
1 (74-95)	**MINIMAL** *Very dangerous winds will produce some damage*	No real damage to building structures. Damage primarily to unanchored mobile homes, shrubbery, and trees. Also, some coastal flooding and minor pier damage. An example of a Category 1 hurricane is Hurricane Dolly (2008).	
2 (96-110)	**MODERATE** *Extremely dangerous winds will cause extensive damage*	Some roofing material, door, and window damage. Considerable damage to vegetation, mobile homes, etc. Flooding damages piers and small craft in unprotected moorings may break their moorings. An example of a Category 2 hurricane is Hurricane Francis in 2004.	
3 (111-129)	**EXTENSIVE** *Devastating damage will occur*	Some structural damage to small residences and utility buildings, with a minor amount of curtain wall failures. Mobile homes are destroyed. Flooding near the coast destroys smaller structures, with larger structures damaged by floating debris. Terrain may be flooded well inland. An example of a Category 3 hurricane is Hurricane Ivan (2004).	
4 (130-156)	**EXTREME** *Catastrophic damage will occur*	More extensive curtain wall failures with some complete roof structure failure on small residences. Major erosion of beach areas. Terrain may be flooded well inland. An example of a Category 4 hurricane is Hurricane Charley (2004).	
5 (157+)	**CATASTROPHIC**	Complete roof failure on many residences and industrial buildings. Some complete building failures with small utility buildings blown over or away. Flooding causes major damage to lower floors of all structures near the shoreline. Massive evacuation of residential areas may be required. An example of a Category 5 hurricane is Hurricane Andrew (1992).	

Tropical storms and hurricanes can occur in the Central Pacific any time of year, but most form between June 1st and November 30th. This period is known as hurricane season. August to October are peak

months for hurricane development. In Hawai'i, the Central Pacific Hurricane Center monitors hurricanes.[164]

The three major threats caused by hurricanes include storm surge, high winds, and flooding associated with heavy rainfall. These threats are described below:

Storm Surge – Storm surge is an abnormal rise is water due to a storm, above predicted astronomical tides. Storm surge occurs when water is pushed toward the shore by the force of the winds swirling around the storm. This rise in water level can cause extreme flooding in coastal areas, especially when storm surge coincides with normal high tide, resulting in storm tides reaching up to 20 feet or more. The water level rise due to the combination of storm surge and the astronomical tide is referred to as a storm tide.[165] Storm surge pushes breaking waves further inland, which can batter buildings, roads, and other infrastructure. Storm surge is often the greatest threat to life and property from hurricane and is responsible for nearly 90% of all hurricane-related deaths and injuries.

High Winds— Hurricane winds can reach speeds up to 155 miles per hour in the eye-wall of the hurricane, with gusts exceeding 224 miles per hour. The force of wind during a hurricane can uproot large trees, down power lines and utility poles, knock over signs, and damage/destroy homes and buildings. Flying debris can also cause damage to both structures and the general population. When hurricanes first make landfall, it is common for tornadoes to form, which can cause severe localized wind damage.

Rainfall and Flooding—The torrential rains that normally accompany a hurricane can cause serious flooding over a wide area. The speed of a hurricane impacts rain – slow-moving storms with lots of moisture may saturate an area for a longer period, whereas fast moving systems may not cause substantial flooding. Whereas the storm surge and high winds are concentrated around the eye of a hurricane, the rain may extend for hundreds of miles and may last for several days, affecting areas well after the hurricane has diminished. Intense rainfall can cause different types of destruction. Seepage of water into buildings can cause structural damage and if the rain is steady and persistent, the structures may simply collapse from the weight of the absorbed water. Inland flooding means that building structures and critical transportation facilities, such as roads and bridges in valleys and low-lying areas, are at risk. In addition, heavy rain often triggers landslides, typical in areas with medium to steep slopes that have become over-saturated.

Kona Storms

Kona storms, also referred to as Kona lows, are subtropical cyclones that occur in the north central Pacific during the cool season. The Hawaiian word "kona" means leeward and refers to the

[164] Hawai'i Department of Health. Hurricane Season. Retrieved from https://health.Hawai'i.gov/prepare/advisories/hurricane-season/.

[165] NOAA. Storm surge overview. Retrieved from https://www.nhc.noaa.gov/surge/.

southwesterly winds associated with the storm that replace the usually dominant trade winds in Hawai‘i that blow from the northeast. Unlike hurricanes, Kona storms form over cool waters, and typically occur from October through April in Hawai‘i.[166] Kona storms originate from a southward dip in the jet stream (a band of strong winds high in the atmosphere that drive weather systems) that sinks and breaks off, leaving behind a low-pressure circulation that is cut off from the main core of the jet. These lows can linger for several days. Swirling winds and clouds form around this low-pressure system in a manner similar to that of a hurricane.[167]

The impacts of Kona storms are similar to those of a hurricane or tropical storm, including heavy rains, hailstorms, high winds, large surf, waterspouts, and severe thunderstorms. Heavy rains associated with Kona storms can cause flooding and landslides. Kona storms can also bring blizzard conditions to high elevations.

Location

Hurricanes and tropical storms have the potential to impact all islands in Maui County. Therefore, it is assumed that all of Maui County is susceptible to hurricanes and tropical storms. However, areas impacted by specific storms will depend on hurricane storm track and location. Maui County can be impacted by hurricanes that do not make a direct hit (e.g. the eye does not make landfall in the county), as damaging winds and bands of rain can impact locations one hundred miles or more from the eye of the storm, depending on storm size.

Further, coastal areas are often the hardest hit during a hurricane. They are often the recipient of a hurricane’s strongest winds and rainfall before it weakens upon tracking inland. In addition, coastal areas have the potential to be impacted by storm surge, one of the most deadly and damaging impacts on hurricanes. NOAA’s Sea, Lake, and Overland Surges from Hurricanes (SLOSH) models estimate storm surge heights resulting from historical, hypothetical, and predicted hurricanes with consideration to atmospheric pressure, size, forward speed, and track data. These variables are used to create a model of the wind field that drives storm surge.[168] Areas with the potential to be impacted by estimated storm surge for hurricane categories 1 - 4 are presented in the figures below for each island. On the Island of Maui, Kahului (one of the county’s most urbanized cities), coastal areas of Wailuku (the county seat), and the tourist destination of Kīhei are some of the most populated areas within potential storm surge locations. On the Island of Moloka‘i, Kaunakakai, the island’s most populous town, is largely within estimated storm surge areas.

Estimated storm surge depths by hurricane category for each community planning area are shown in this profile’s *Vulnerability Assessment* section.

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[166] Morrison, I., and S. Businger (n.d.). *Synoptic structure and evolution of a Kona low.* University of Hawai’i. Retrieved from https://www.soest.Hawai’i.edu/MET/Faculty/businger/poster/KonaLow/.
[167] NASA Earth Observatory (2007). *Kona low over Hawai’i*. Retrieved from https://earthobservatory.nasa.gov/images/19423/kona-low-over-Hawai’i.
[168] NOAA National Hurricane Center and Central Pacific Hurricane Center (n.d.). *Sea, lake, and Overland Surges from Hurricane (SLOSH).* Retrieved from https://www.nhc.noaa.gov/surge/slosh.php.

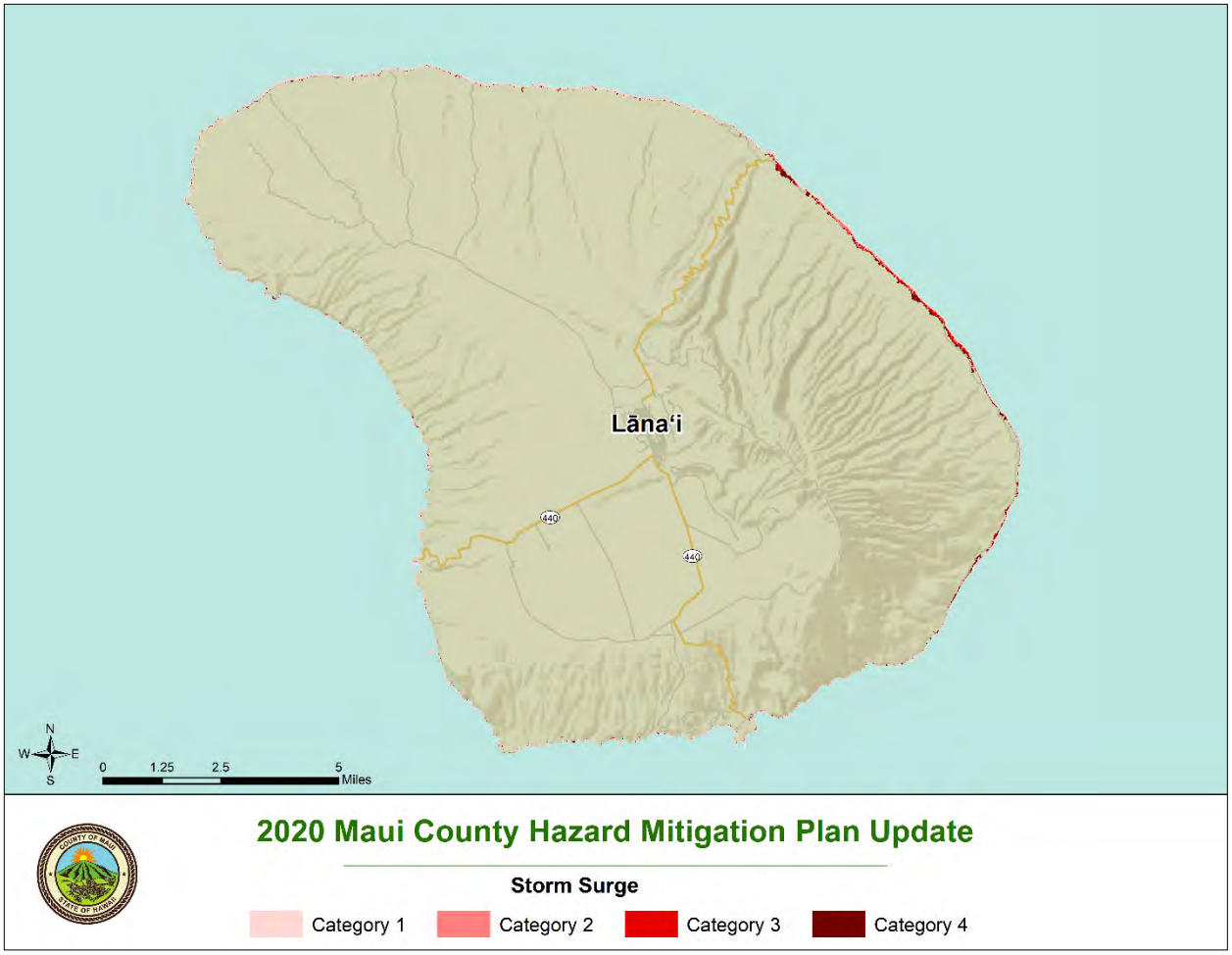

Figure 141. Estimated Storm Surge Inundation for the Island of Lānaʻi.

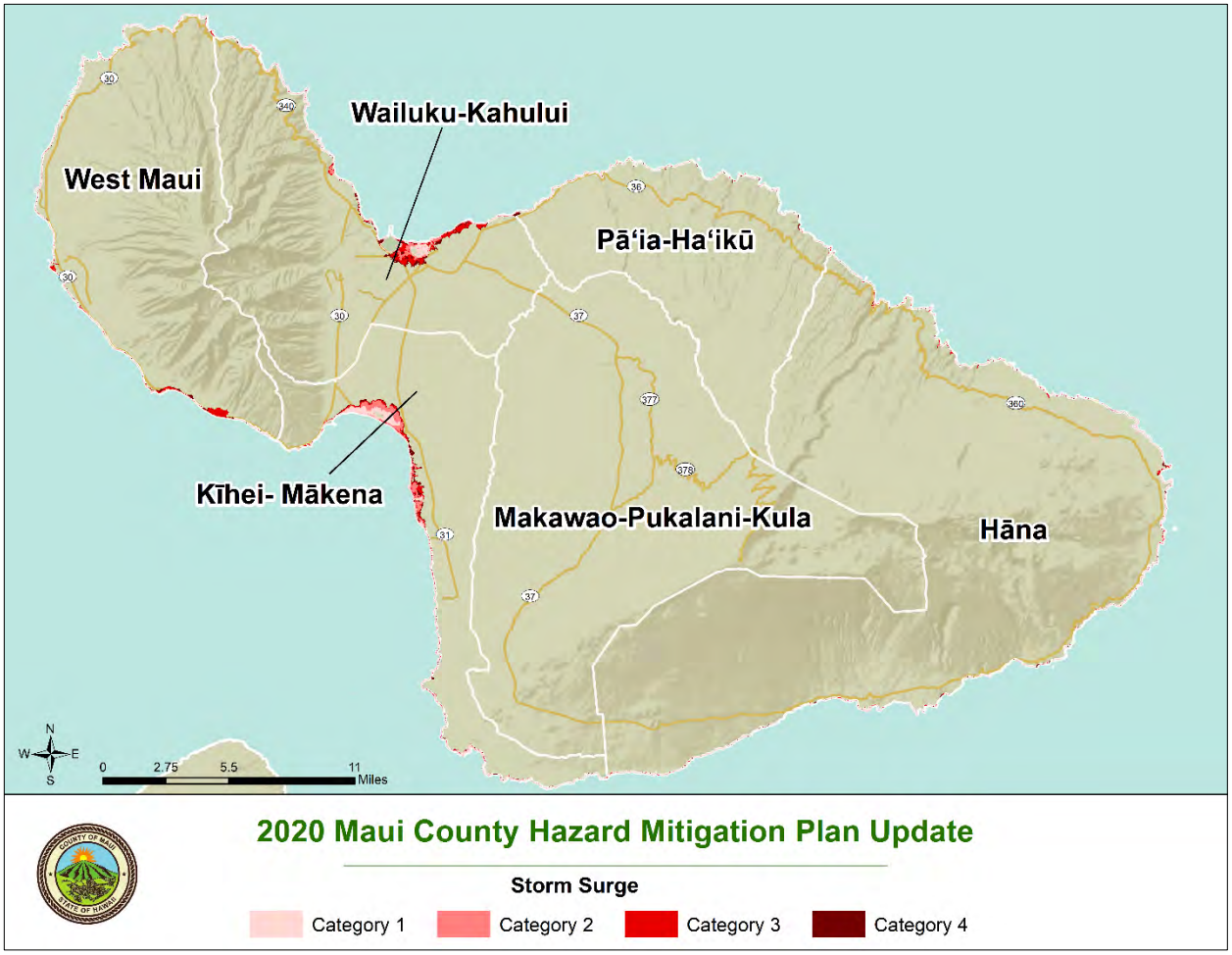

Figure 142. Estimated Storm Surge Inundation for the Island of Maui.

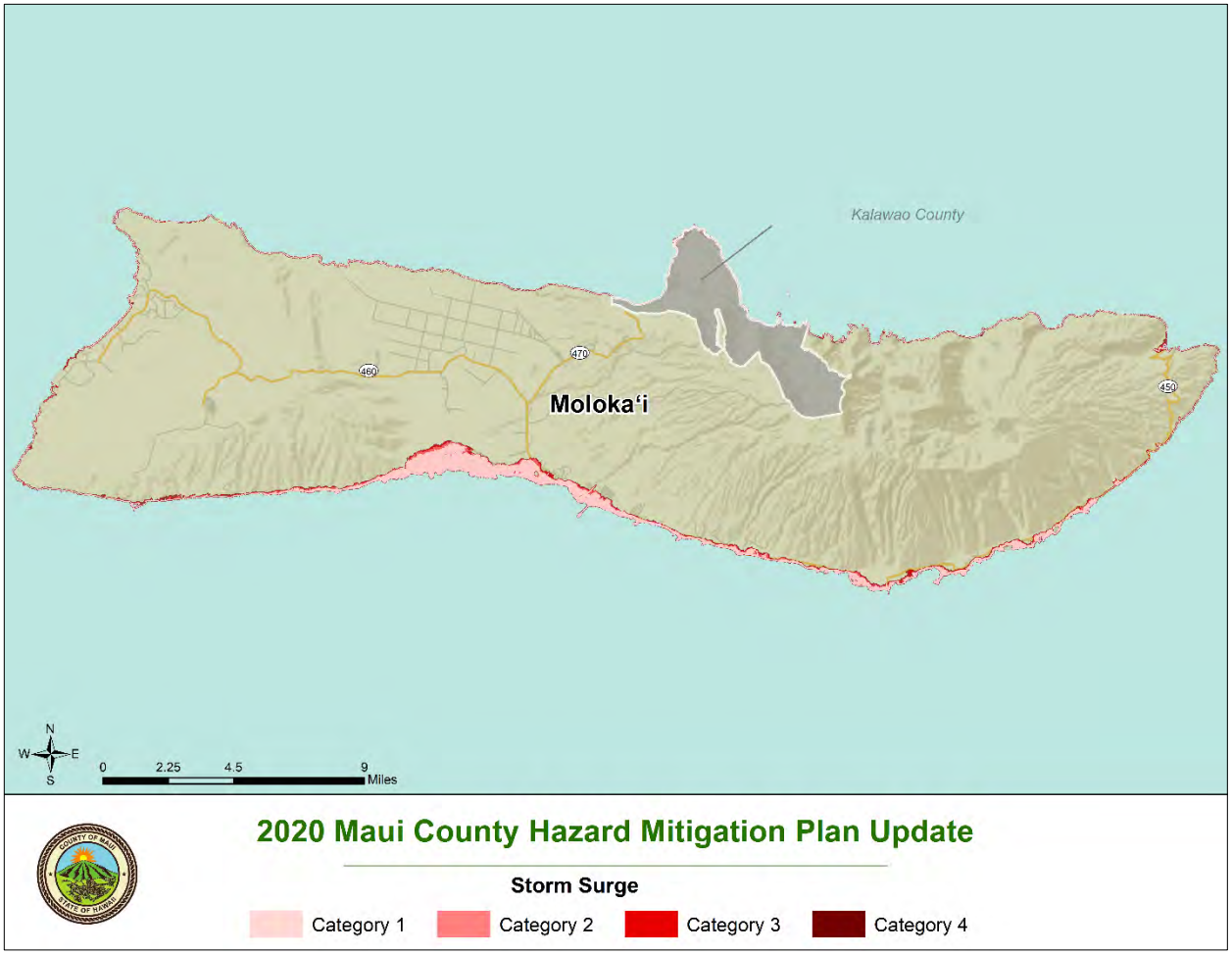

Figure 143. Estimated Storm Surge Inundation for the Island of Moloka'i.

Kona Storms

Kona storms also have the potential to impact the entire county. Cloudy and wet conditions are likely to impact the typically dry and sunny western and southwestern sides of the islands. Volcano peaks and high elevations may experience blizzard-like conditions.

Previous Occurrences

While Maui County has only received one direct hit from a hurricane or tropical storm in recent history (Tropical Storm Olivia), many historic hurricanes have tracked close enough to the county to impact one or more of its islands. Official hurricane tracking began in 1950. However, one notable hurricane before this reporting period began has been described as impacting Maui County; in 1874, storm Die Deutsche Seewarte III destroyed 23 homes Moloka'i and several others on Lāna'i. Since 1950, 18 hurricanes and tropical storms have had a significant impact on one or islands in Maui County, as detailed below:[169]

1. **Hurricane Nina** (November 1957) – Brought gusts greater than 90 mph to the Island of Maui.

[169] Unless otherwise indicated, all historic events were sourced from the 2015 Maui County hazard Mitigation Plan Update or the 2018 State of Hawai'i Hazard Mitigation Plan Update.

2. **Hurricane Dot (1959) –** Resulted in a disaster declaration for Maui County. Estimated damages were approximately $150,000 (non-inflated).
3. **Tropical Storm Sarah** (1971) – Five houses were damaged on Molokaʻi and the Lānaʻi airport closed.[170]
4. **Hurricane Estelle** (1986) – Produced high surf in Maui County.
5. **Hurricane Iniki** (September 1992) – One of the costliest hurricanes to impact the State of Hawaiʻi. Kauai was the hardest hit, with $1.8 billion in damages and 13,000 homes destroyed. This event was much less devasting for Maui County, but did result in a disaster declaration.
6. **Tropical Storm Dora** (July 1993) – Flooding closed Honoapiilani Highway, clogged drainage channels, deposited silt in water supplies, and caused one family to be evacuated.[171]
7. **Tropical Storm Flossie** (July 2013) – Brought high surf, thunderstorms, heavy rain, flash flooding and strong wind to Maui and Hawaiʻi Counties. Strong winds downed trees and power lines, which closed roads and caused power outages on the islands of Maui and Molokaʻi in Maui County. The state EOC was activated for this hurricane, and several injuries were reported due to lightning strikes.
8. **Tropical Storm Iselle** – (August 2014) – Made landfall on the Big Island, and caused power outages, washed out roads, and widespread flooding throughout Maui County. This event resulted in a disaster declaration for Maui County, and caused approximately $4.9 million in damages.
9. **Tropical Storm Ana** (October 2014) – Maui County experienced gusty winds, high surf, and heavy rain. No significant damages were reported in the county.
10. **Tropical Storm Guillermo** (August 2015) – In Maui County, Tropical Storm Guillermo brought surf of 10 to 20 feet along the eastern shores of Maui and Molokaʻi. Beaches were closed in Maui County, and high water brought debris onto coastal roads. No significant property damages were reported.
11. **Hurricane Kilo** (August 2015) – Produced flash flooding and road closures in Maui County.
12. **Hurricane Ignacio** (August – September 2015) – Swell from Hurricane Ignacio generated 10 to 20-foot surf along east-facing shores, and six to eight-foot surf along south-facing shores on all islands, except for Lānaʻi. No significant damages to property in Maui County were reported, but the high surf deposited sand and debris on coastal roads.
13. **Hurricane Jimena** (September 2015) **–** Remnants of Hurricane Jimena brought heavy rains and flooding to parts of the state, including Maui County.
14. **Tropical Storm Niala** (September 2015) **–** All state and county EOCs monitored the event.
15. **Tropical Storm Oho** (October 2015) **–** All state and county EOCs monitored the event.
16. **Hurricane Olaf** (October 2015) – Swell produced eight to 12-foot surf on east-facing shores on Maui Island, and 6 to 9-foot surf along southern-facing shores. Several roadways were

[170] Fletcher et al (2002). *Atlas of natural Hazards in the Hawaiian Coastal Zone*. USGS. Retrieved from https://pubs.usgs.gov/imap/i2761/i2761.pdf.
[171] Fletcher et al (2002). *Atlas of natural Hazards in the Hawaiian Coastal Zone*. USGS. Retrieved from https://pubs.usgs.gov/imap/i2761/i2761.pdf.

inundated by several inches of water. There were no significant injuries or property damage reported. All EOCs in the state were monitoring the event.

17. **Hurricane Lester** (September 2016) – Hurricane Lester weakened and cleared the Hawaiian Islands without significant impacts. However, this event caused closures throughout Maui County and emergency shelters opened.[172]
18. **Hurricane Lane** (August 2018)[173] – Hurricane Lane reached a Category 5 as it moved across the eastern and central Pacific (only the 5th on record in the Central Pacific basin) toward the Hawaiian Islands. Lane rapidly weakened as it approached the State of Hawaiʻi and veered away from the state rather than making landfall. However, Hurricane Lane was a slow-moving storm that still caused record-breaking rainfall around the state. It dropped 58 inches of rain on the Island of Hawaiʻi, which is the second highest recorded rainfall from a hurricane in the United States (the record was 60.6 inches, set by Hurricane Harvey in 2017).

    In Maui County, rain bands soaked the eastern slopes of Maui Island, causing numerous landslides, especially on Hāna Highway. Parts of eastern Maui (the Pāʻia-Haʻikū and Hāna community planning areas) received upwards of 25 inches of rainfall. Severe road wash-out occurred on the western slopes of Maui. Flooding damages to infrastructure in Maui County were estimated at approximately $2 million. The figure below shows rainfall totals over the State of Hawaiʻi from Hurricane Lane.

[172] Pignataro, A. (2016). *Maui County prepares for Hurricane Lester with lots of closures.* Maui Time. Retrieved from https://mauitime.com/news/science-and-environment/maui-county-prepares-for-hurricane-lester-with-lots-of-closures/.

[173] Beven, J.L. II, and Wroe, D. (2019). *Hurricane Lane Tropical Cyclone Report (EP142018)*. NOAA NWS National Hurricane Center and Central Pacific Hurricane Center. Retrieved from https://www.nhc.noaa.gov/data/tcr/EP142018_Lane.pdf.

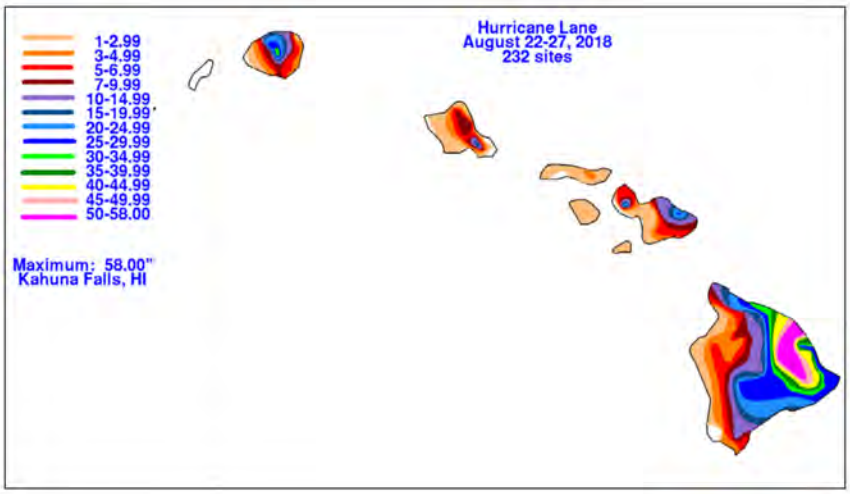

Figure 144. Hurricane Lane Rainfall Analysis Over the State of Hawai'i.[174]

Further, gusty winds brought by Hurricane Lane fanned a series of wildfires in western Maui, which had been experiencing moderate drought conditions. Sustained winds of 30 mph and gusts of 50 mph produced by Hurricane Lane drove three wildfires that rapidly burned 2,000 acres and destroyed 21 residential structures, causing over $4 million in damages.

This event resulted in a disaster declaration for Maui County, with damages estimated at $6.5 million. Figure 145 and Figure 146 show damages in Maui County from Hurricane Lane.

[174]Beven, J.L. II, and Wroe, D. (2019). *Hurricane Lane Tropical Cyclone Report (EP142018) – Figure 4*. NOAA NWS National Hurricane Center and Central Pacific Hurricane Center. Retrieved from https://www.nhc.noaa.gov/data/tcr/EP142018_Lane.pdf.

Figure 145. Hurricane Lane damage to Puu Way.

Figure 146. Hurricane Lane damage in Maui County.

19. **Tropical Storm Olivia** (September 2018) – Tropical Storm Olivia made history as the first hurricane or tropical storm to make landfall of the Island of Maui since recording or such storms began. Olivia brought heavy rain and sustained wind over 40 mph. Flooding and landslides caused road closures and several homes had to be evacuated due to rising rivers. Power outages impacted about 8,000 customers. Olivia also made landfall on the Island of Lānaʻi. No deaths or injuries were reported as a result of this tropical storm.[175] [176]

    The figure below shows hurricane and tropical storms tracks near the Hawaiian Islands from 1950 to 2014.

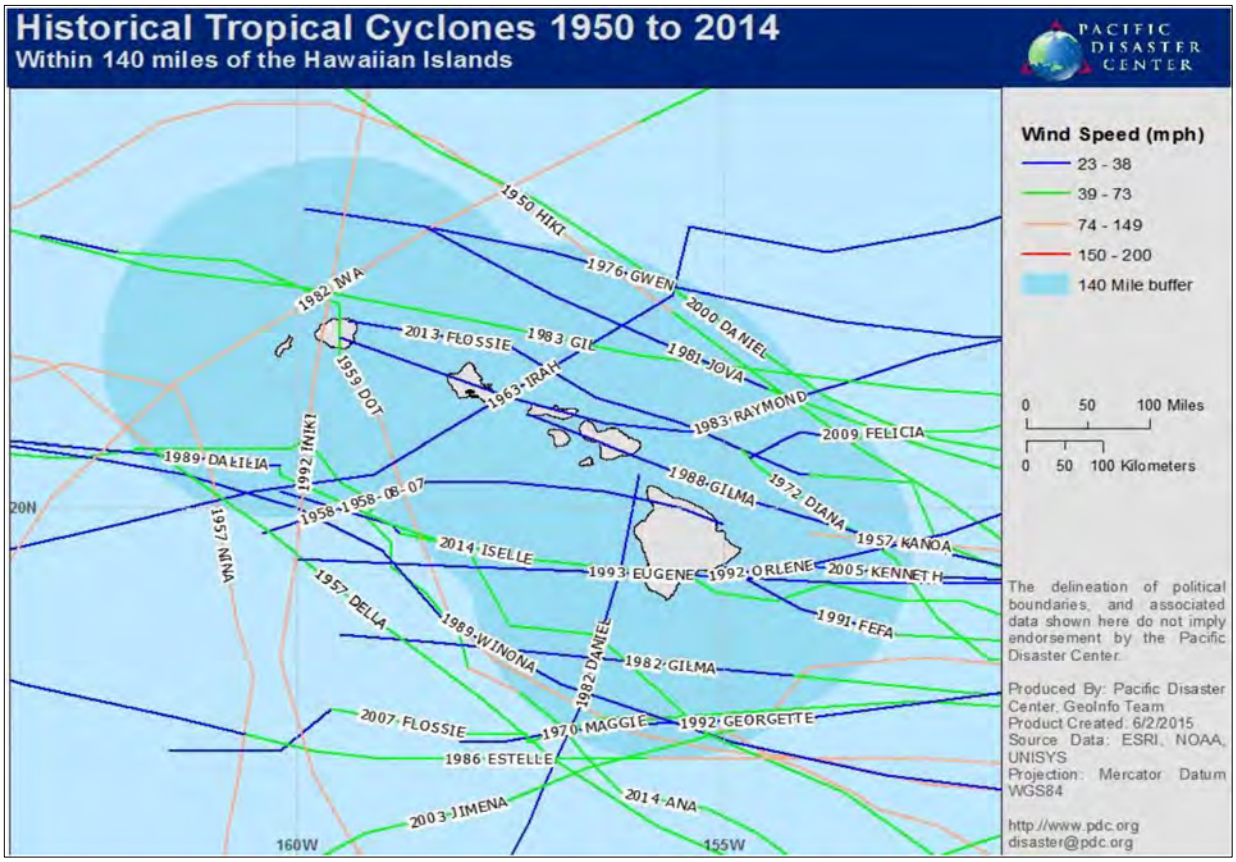

Figure 147. Hurricane and Tropical Storm Tracks within 140 miles of Hawaiʻi.

Kona Storms

Maui County has been impacted by numerous Kona storms throughout its history. Six Kona storms were noted as having a significant impact on Maui County, which are detailed in the table below. However, it

[175] Gomes, A. (2018). *Olivia makes brief but historic landfall on Maui. Star Advertiser*. Retrieved from https://www.staradvertiser.com/2018/09/13/Hawai'i-news/olivia-makes-brief-but-historic-landfall-on-maui/.
[176] Cullinane, S. (2018). *Tropical Storm Oliva makes landfall in Hawai'i.* CNN. Retrieved from https://www.cnn.com/2018/09/12/us/olivia-Hawai'i-wxc/index.html.

is likely that many Kona storm events that have impacted the county have gone unreported, especially those that did not result in significant damages, deaths or injuries.

Table 55. Kona Storms that had Significant Impact on Maui County.

Year	Description
1960	A Kona storm impacting the islands of Maui and Oahu caused $250,000 in damages.[177]
1980	Keawakapu, Mokapu, Palauea, and Poolenalena in the Kīhei-Mākena community planning area suffered severe episodic erosion during a Kona storm event.[178]
1982	Keawakapu, Mokapu, Palauea, and Poolenalena in the Kīhei-Mākena community planning area suffered severe episodic erosion during a Kona storm event.[179]
1999	A Kona storm caused roadway flooding, minor rock and landslides, and occasional power outages in Maui County. The entire state was impacted by this event.[180]
2007	A strong Kona storm that hit the Island of Maui caused wind gusts up to 70 mph, along with heavy rainfall. The storm resulted in debris flows in Kīhei, Napili (impacting Honoapiilani Highway), and on Lower Kula Road and Polipoli Road in the Makawao-Pukalani-Kula community planning area. The debris flowing across Polipoli Road contained the remnants on a private residence, and the road was closed for several days.[181] At least five homes in Kula were damaged by wind and rain. One home in Keokea washed into a gulch, and its residents had to be rescued by fire crews from the rooftop. Figure 148 shows impacts from this event in Kula. In Kīhei-Mākena, ponding occurred along South Kīhei Road. High surf and flooding affected coastal parks. In Molokaʻi, Maunaloa Highway experienced ponding, although not enough to close the road. Ponding also occurred in the Kaunakakai area of Molokaʻi.
2019	A powerful Kona storm brought gusts on up to 60 miles an hour and swells to Maui County. Winds toppled trees and power lines. One man died in Napili Bay of the coast of northwest Maui after getting stuck in rough seas.[182]

[177] Fletcher et al (2002). *Atlas of natural Hazards in the Hawaiian Coastal Zone*. USGS. Retrieved from https://pubs.usgs.gov/imap/i2761/i2761.pdf.
[178] 2015 Maui County Hazard Mitigation Plan Update
[179] 2015 Maui County Hazard Mitigation Plan Update
[180] NOAA. NCEI Storm Events Database -Flood Events in Maui County.
[181] 2015 Maui County Hazard Mitigation Plan Update
[182] Eherts, F., and R. Duff (2019). *1 dead s powerful Kona low slams Hawai'i with high winds, rain, and life-threatening surf*. AccuWeather. Retrieved from https://www.accuweather.com/en/weather-news/1-dead-as-powerful-kona-low-slams-Hawai'i-with-high-winds-rain-and-life-threatening-surf/336813.

Figure 148. Damage from the Kona Storm in Kula.[183]

Extent

As demonstrated by previous occurrences, powerful hurricanes, tropical storms, and Kona storms occur in Maui County. Category 5 hurricanes as assigned via the Saffir Simpson scale are the most severe hurricanes. However, the severity of hurricanes and tropical storms can also be determined by damage amounts. In Maui County, the most damaging hurricane to impact the county was Hurricane Lane in 2018, which caused approximately $6.5 million in damages and resulted in a presidential disaster declaration. Hurricane Lane was initially forecasted to strike Maui with Category 5 hurricane force winds. While the storm still brought tremendous damage, it is an example that stronger events are possible.

However, more intense hurricane events have also been experienced on neighboring islands. For instance, Kaua‘i County received the brunt of Hurricane Iwa in 1982, which produced an estimated $234 million in damage. Similarly, Hurricane Iniki was a Category 4 hurricane that hit the County of Kaua‘i in September 1992, causing almost $2 billion in damages. Events such as these are possible in Maui County. In addition, hurricane and tropical storm frequency and intensity are projected to increase in the central Pacific region under climate warming scenarios. Similarly, projected sea level rise combined with storm surges could have impacts from which coastal communities are unable to fully recover.[184]

Probability

Previous occurrences have indicted 24 events (18 hurricane/tropical storms and six Kona storms) in 70 years. This indicates an event impacts Maui County approximately every four years. However, it is likely that many Kona storm events occurring within Maui County have gone unreported. Further, as

[183] Maui County General Plan 2030 Maui Island Plan. *Chapter 3: Natural Hazards.*
[184] U.S. Global Change Research Program (2018). *Fourth National Climate Assessment. Chapter 27: Hawai’i and U.S.-Affiliated Pacific Islands*. Retrieved from https://nca2018.globalchange.gov/chapter/27/.

mentioned above, hurricane and tropical storm frequency in Maui County is projected to increase along with warming trends. It should be noted that hurricane and tropical storm frequency in Maui County is highly variable based on ENSO patterns. Hurricanes are much more likely to impact Hawaiʻi during El Niño years. For instance, in 2015, which was an El Niño year, the central Pacific region experienced 15 named storms (eight hurricanes and five major hurricanes), making 2015 the most active season since 1970.[185] While it is unknown exactly how the timing and intensity of ENSO patterns will change in the future, climate model results indicate a doubling of El Niño and La Niña extremes in the 21st century when compared to the 20th century.[186]

Kona storms

The frequency of Kona storms is variable. Typically, the Hawaiʻian Islands experience one or two Kona storms every year, but some years may pass with no Kona storms, or have as many as four or five.[187]

Based on historic events, all community planning areas can experience impacts from hurricane, tropical storm and Kona storm events. Lānaʻi and West Maui may be less likely than other communities to experience impacts from hurricane events based on past descriptions, as they are somewhat sheltered from approaching hurricanes, which often impact east- and south-facing shorelines first. The table below presents hurricane (including tropical storm and Kona storm) probabilities for each community planning area.

Table 56. Hurricane (including Tropical Storm and Kona Storm) Event Probabilities for Maui County Community Planning Areas.

Community Planning Area	Hurricane (including Tropical Storm and Kona Storm) Probability
Hāna	Likely (10% to 90% annual chance)
Kīhei-Mākena	Likely (10% to 90% annual chance)
Lānaʻi	Possible (1% to 10% annual chance)
Makawao-Pukalani-Kula	Likely (10% to 90% annual chance)
Molokaʻi	Likely (10% to 90% annual chance)
Pāʻia-Haʻikū	Likely (10% to 90% annual chance)
Wailuku-Kahului	Likely (10% to 90% annual chance)
West Maui	Possible (1% to 10% annual chance)

Vulnerability

All current and future buildings, infrastructure, and populations in Maui County are considered at risk to hurricanes, tropical storms, and Kona storms. These storms result in damaging winds, heavy rains and floods, and storm surges. Further, these storms can cause cascading impacts; for instance, storm surges

[185] 2018 State of Hawai'i Hazard Mitigation Plan Update.
[186] U.S. Global Change Research Program (2018). *Fourth National Climate Assessment. Chapter 27: Hawai'i and U.S.-Affiliated Pacific Islands*. Retrieved from https://nca2018.globalchange.gov/chapter/27/.
[187] Western Regional Climate Center. *Climate of Hawai'i*. Retrieved from https://wrcc.dri.edu/narratives/HAWAI'I.htm.

may cause severe coastal erosion, heavy rains may prompt landslides, or, in the case of Hurricane Lane, gusty winds may fan wildfires in unsaturated parts of the county. Specific impacts to buildings, infrastructure, socially vulnerable populations, life safety, public heath, and the economy from these hazards are described below. Climate-related impacts to the tsunami events are also described.

Building and Infrastructure Impacts (including Critical Facilities)
All current and future buildings and infrastructure, including critical facilities are considered at risk to hurricanes, tropical storms, and Kona storms. Damaging winds and heavy rains can impact coastal and inland areas of Maui County, and storm surges can impact coastal areas. Strong sustained winds and even stronger wind gusts associated with these storms can blow shingles, siding, awnings, and even roofs off buildings. Falling trees and tree limbs can damage structures. Objects picked up by wind can be hurled through the air, damaging structures and breaking windows when contact is made. In some cases, structures can be blown off foundations.

Further, heavy rains can cause riverine and flash flooding, which can inundate structures. Heavy rains can also seep through roofs and walls, especially ones that have been damaged by winds, causing water damage. Water damage can lead to structural damage, wood rot, and mold growth (described further under the Flood profile *Vulnerability Assessment*).

Storm surges can inundate buildings. As storm surges push breaking waves inland, the force of large, high velocity waves can damage and destroy structures. This process can also cause severe erosion, which can undermine building foundations. NOAA has mapped storm surge depth and location using SLOSH models for category 1 through 4 hurricanes. GIS analysis was used to determine buildings and infrastructure within storm surge areas, using SLOSH model data, building footprints, critical facilities data, and parcel data from county tax assessor records.

For buildings, the determination of assessed value at-risk was calculated by summing the total assessed building values for building footprints that were confirmed to be located within or partially within storm surge area. The number of parcels, building footprints, and their associated value are presented by community planning district in Table 57. This is an approximate analysis for planning purposes. This analysis does not account for building elevations or other protections.

Table 57. Potentially At-Risk Parcels, Buildings, and Improvement Value in NOAA Storm Surge Areas.

High Wave SLR Hazard Area	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Hāna								
Category 1	282	14%	7	0%	$1,179,021	$589,510	$1,768,531	1%
Category 2	298	14%	10	1%	$1,389,502	$694,751	$2,084,253	1%
Category 3	342	16%	17	1%	$2,782,119	$1,391,060	$4,173,179	1%

High Wave SLR Hazard Area	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Category 4	362	17%	24	1%	$3,744,523	$1,872,262	$5,616,785	2%
Kīhei-Mākena								
Category 1	756	4%	33	0%	$153,506,766	$76,753,382	$230,260,148	1%
Category 2	3089	17%	366	4%	$682,236,132	$341,118,066	$1,023,354,198	6%
Category 3	3499	19%	580	7%	$1,114,293,673	$557,146,836	$1,671,440,510	10%
Category 4	4153	23%	805	9%	$1,343,170,049	671,585,024	$2,014,755,074	12%
Lānaʻi								
Category 1	25	2%	0	0%	$0	$0	$0	0%
Category 2	26	2%	0	0%	$0	$0	$0	0%
Category 3	33	2%	6	0%	$63,331	$31,665	$94,996	0%
Category 4	37	3%	12	0%	$497,098	$248,549	$745,647	0%
Makawao-Pukalani-Kula								
Category 1	2	0%	0	0%	$0	$0	$0	0%
Category 2	2	0%	0	0%	$0	$0	$0	0%
Category 3	2	0%	0	0%	$0	$0	$0	0%
Category 4	2	0%	0	0%	$0	$0	$0	0%
Molokaʻi								
Category 1	1476	24%	375	15%	132,180,800	$66,090,400	$198,271,200	16%
Category 2	1627	27%	462	18%	160,477,900	$80,238,950	$240,716,850	19%
Category 3	1734	28%	508	20%	173,317,400	$86,658,700	$259,976,100	21%
Category 4	1781	29%	524	21%	177,285,600	$88,642,800	$265,928,400	22%
Pāʻia-Haʻikū								
Category 1	71	1%	2	0%	154,348	$77,174	$231,522	0%
Category 2	89	2%	2	0%	154,348	$77,174	$231,522	0%
Category 3	90	2%	3	0%	168,616	$84,308	$252,924	0%
Category 4	102	2%	10	0%	4,315,784	$2,157,892	$6,473,676	0%
Wailuku-Kahului								
Category 1	141	1%	32	0%	13,269,653	$6,634,827	$19,904,480	0%
Category 2	209	1%	102	1%	83,972,449	$41,986,225	$125,958,674	1%
Category 3	474	1%	323	2%	274,723,199	$137,361,600	$412,084,799	5%
Category 4	668	1%	526	3%	$449,640,973	$224,820,487	$674,461,460	8%
West Maui								
Category 1	1700	9%	11	0%	$24,284,302	$12,142,151	$36,426,453	0%
Category 2	1843	10%	17	0%	$25,539,568	$12,769,784	$38,309,352	0%
Category 3	2179	12%	103	2%	$81,383,559	$40,691,780	$122,075,339	1%
Category 4	2243	12%	125	2%	$100,513,327	$50,256,664	$150,769,991	1%
MAUI COUNTY TOTAL								
Category 1	**4,453**	**0%**	**460**	**1%**	**$324,574,890**	**$162,287,444**	**$486,862,334**	**1%**
Category 2	**7,183**	**0%**	**959**	**1%**	**$953,769,899**	**$476,884,950**	**$1,430,654,849**	**3%**

High Wave SLR Hazard Area	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Category 3	**8,355**	**0%**	**1,540**	**2%**	**$1,646,731,897**	**$823,365,949**	**$2,470,097,846**	**5%**
Category 4	**9,348**	**0%**	**2,026**	**3%**	**$2,079,167,354**	**$1,039,583,677**	**$3,118,751,031**	**6%**

All community planning areas have some exposure to storm surge hazards, with the exception of Makawao-Pukalani-Kula, which is located inland. The data in the table above indicates that several community planning areas have greater vulnerability to storm surge than others in terms of building exposure. Kīhei-Mākena has the greatest amount of exposure, with up to 805 buildings (valued at $2 billion) in storm surge areas, whereas Molokaʻi has the greatest proportion of structures potentially at-risk, with 21% of its buildings (and 22% of total building value) in the Category 4 storm surge area. The figures below show building exposure within storm surge areas by community planning area. Storm surge depth is presented by hurricane category.

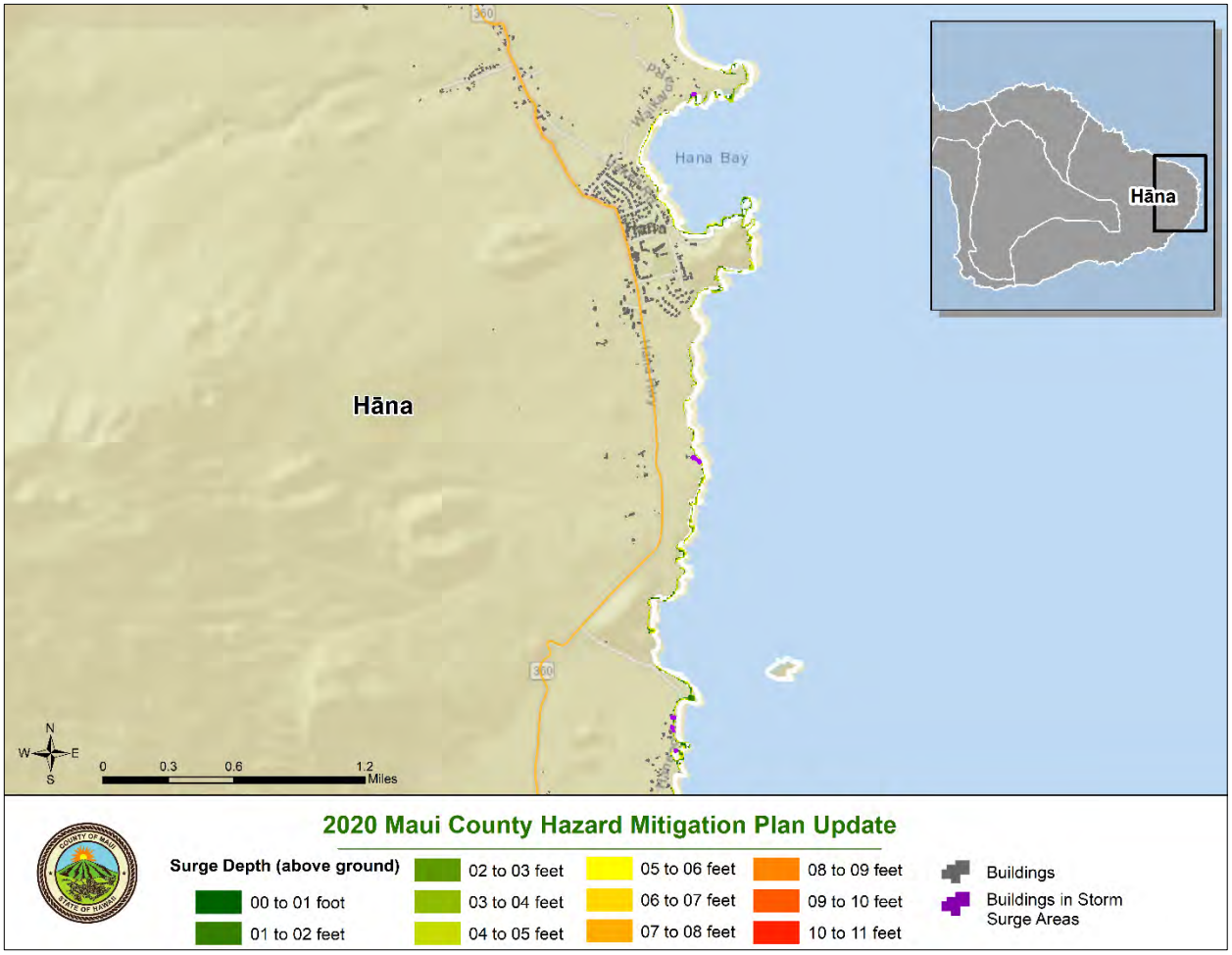

Figure 149. Buildings in Category 1 Storm Surge Areas in the Hāna Community Planning Area.

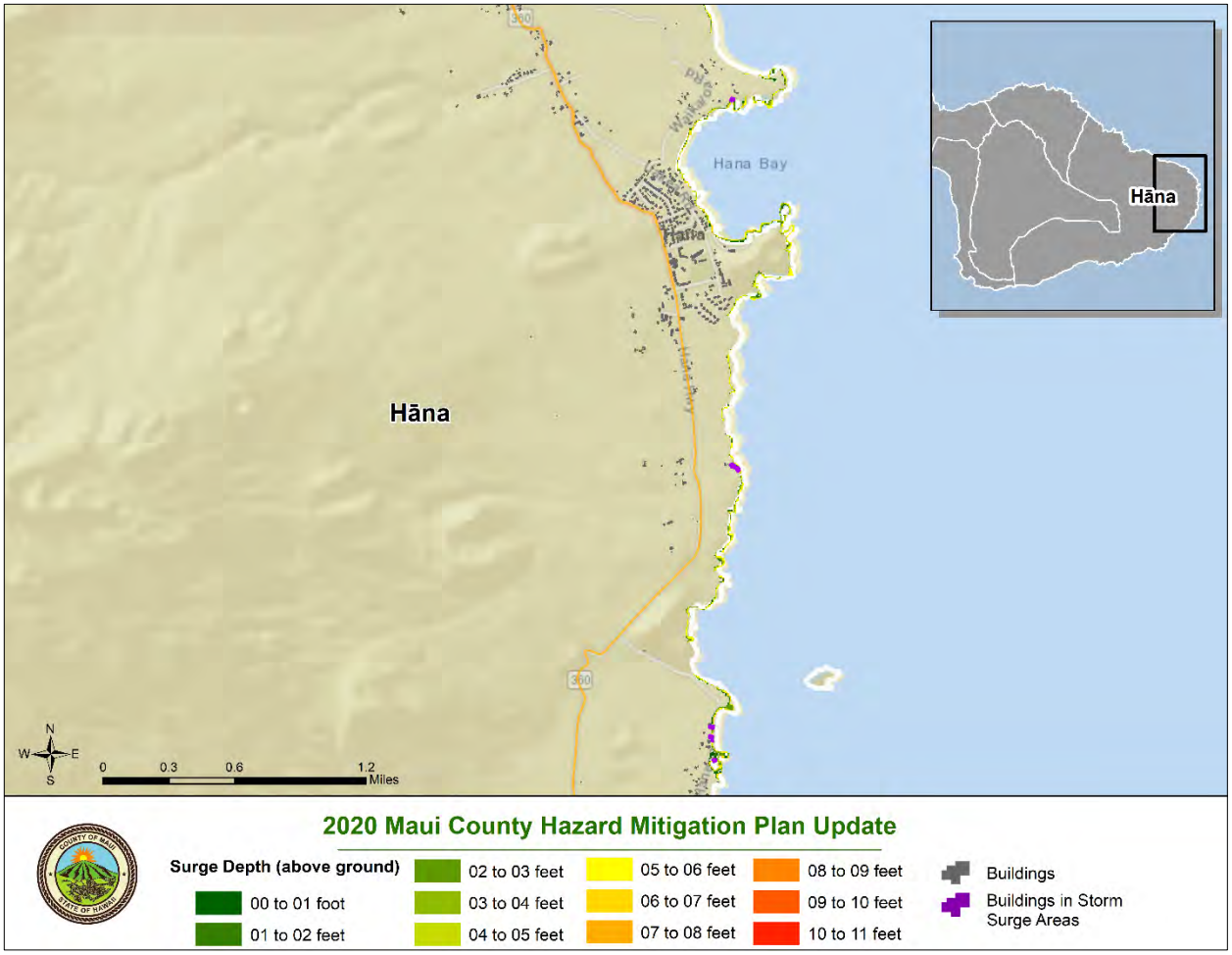

Figure 150. Buildings in Category 2 Storm Surge Areas in the Hāna Community Planning Area.

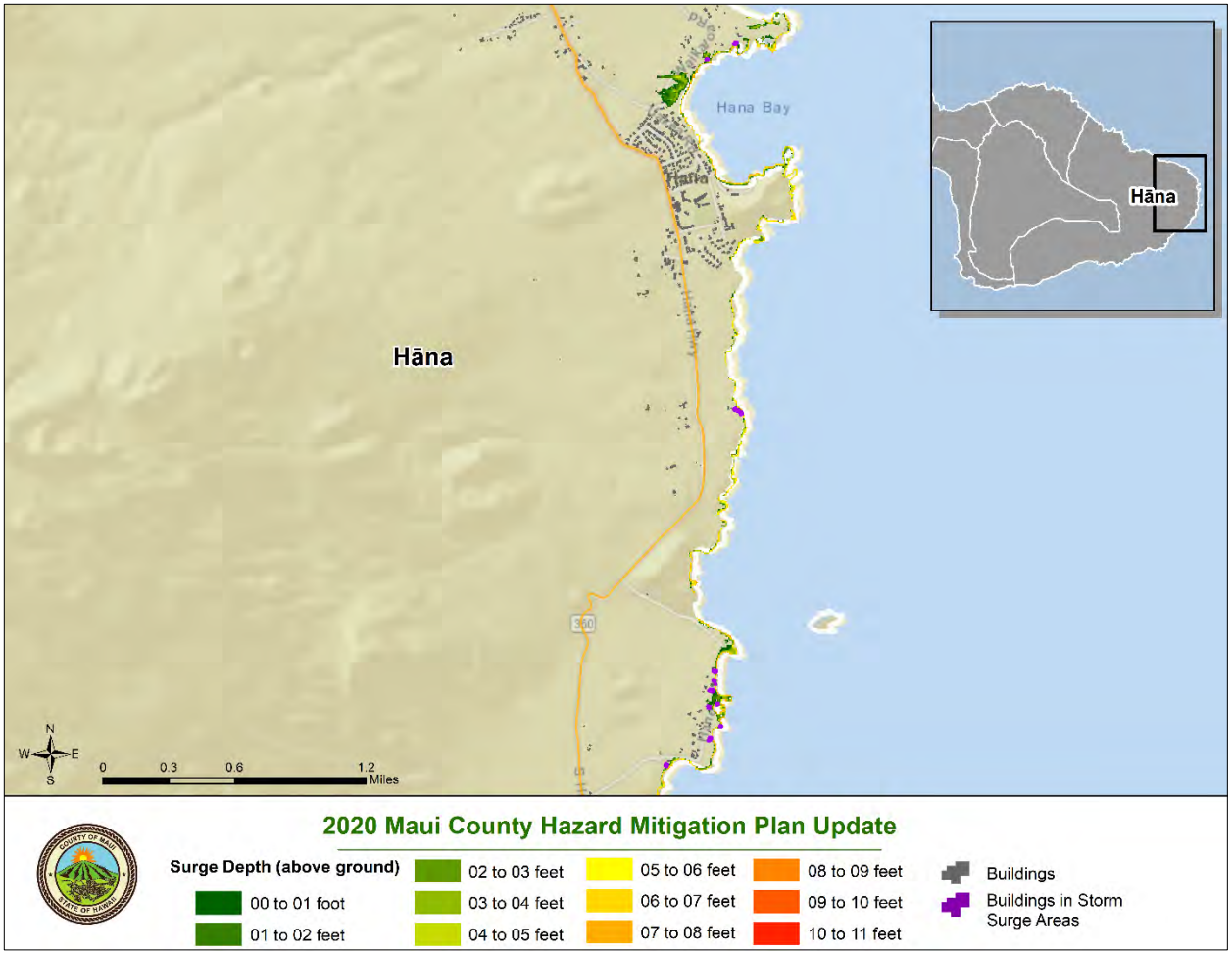

Figure 151. Buildings in Category 3 Storm Surge Areas in the Hāna Community Planning Area.

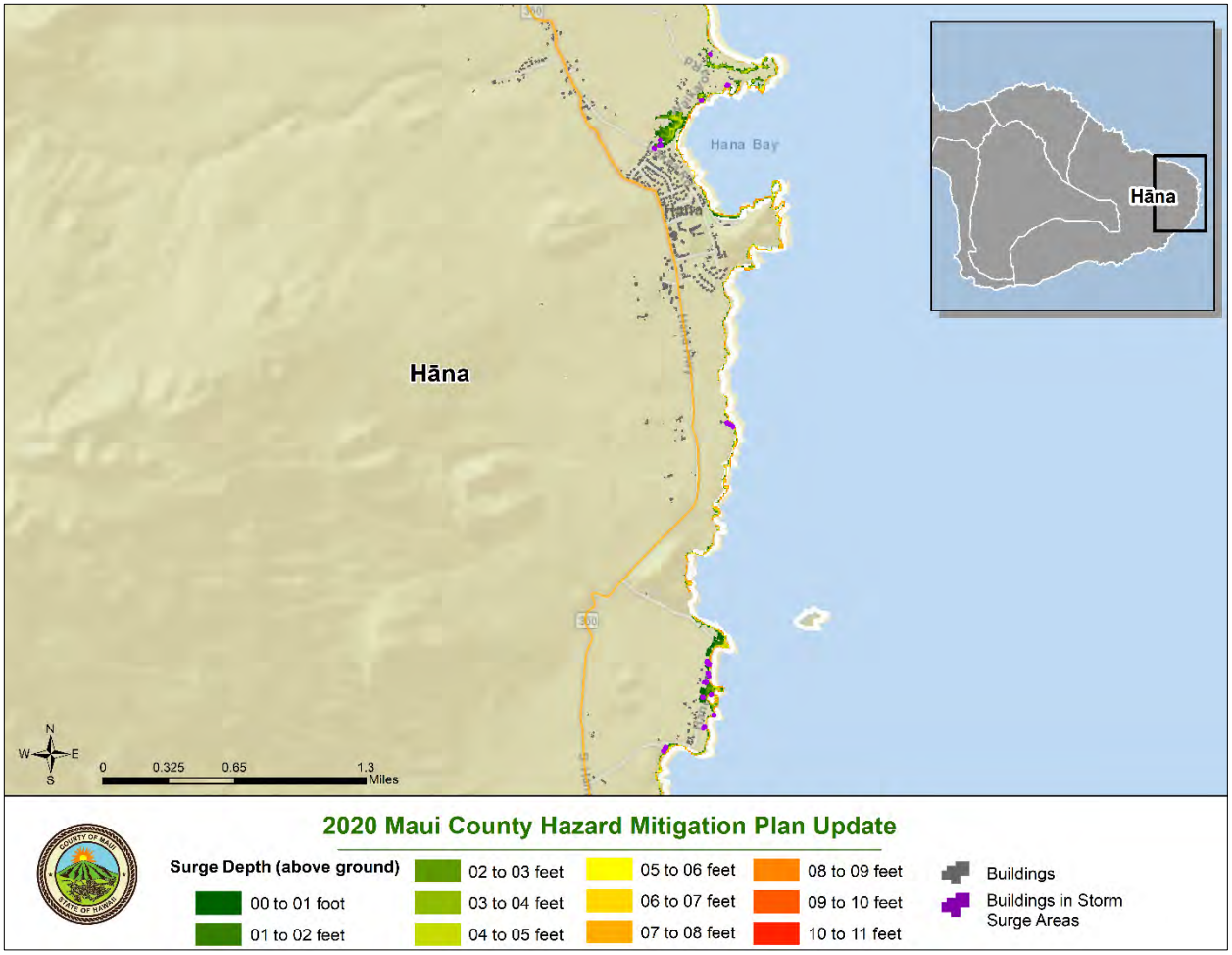

Figure 152. Buildings in Category 4 Storm Surge Areas in the Hāna Community Planning Area.

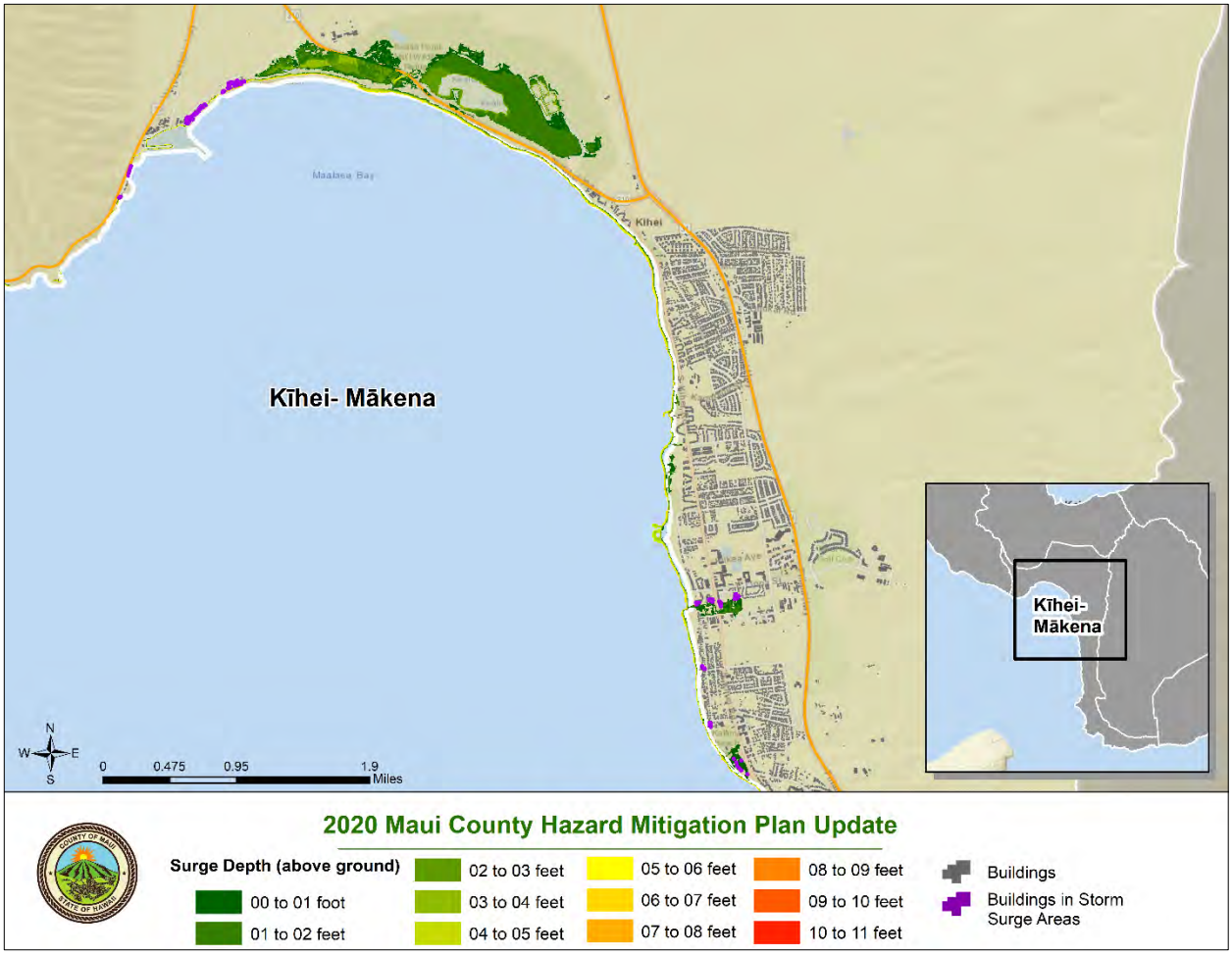

Figure 153. Buildings in Category 1 Storm Surge Areas in the Kīhei-Mākena Community Planning Area.

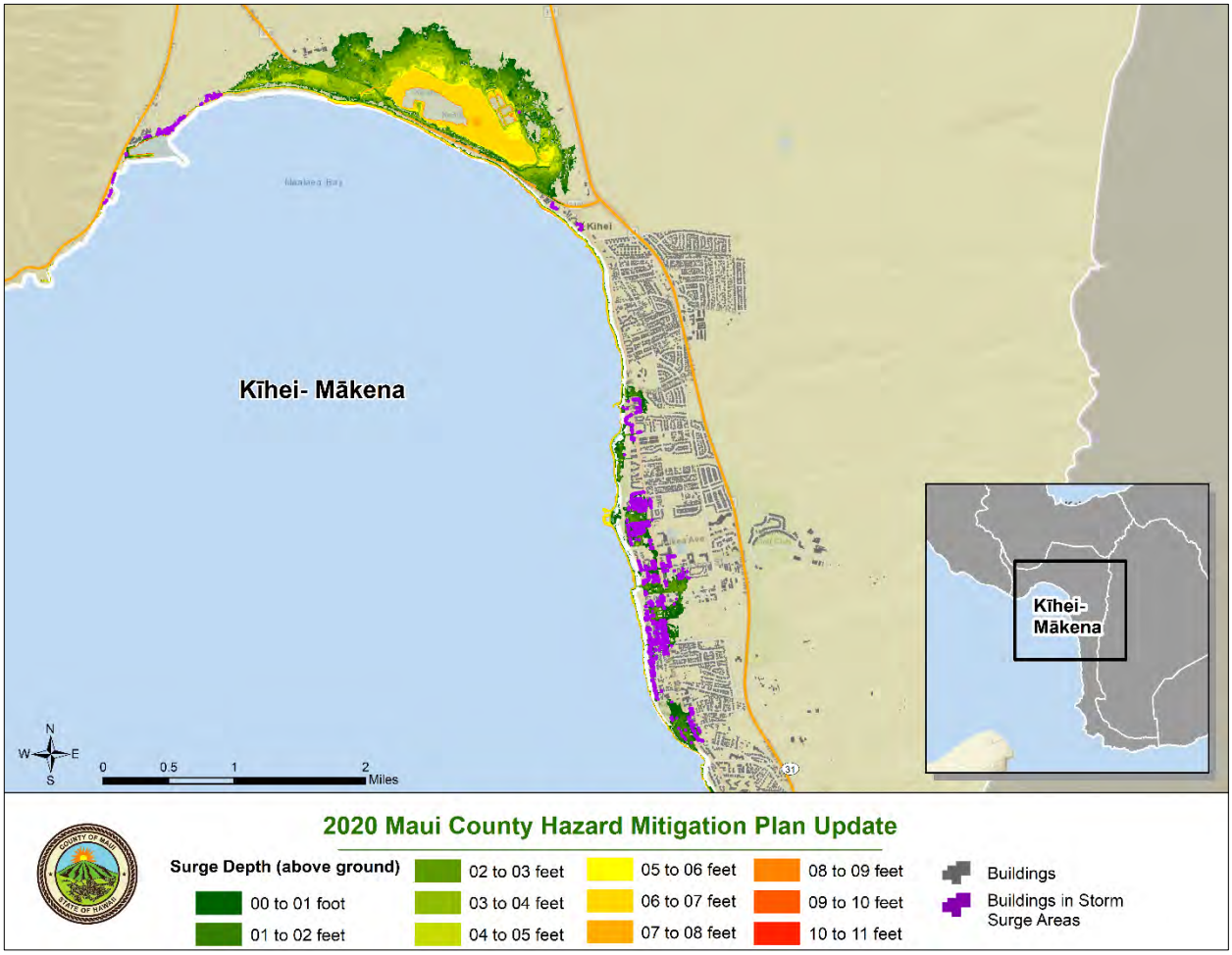

Figure 154. Buildings in Category 2 Storm Surge Areas in the Kīhei-Mākena Community Planning Area.

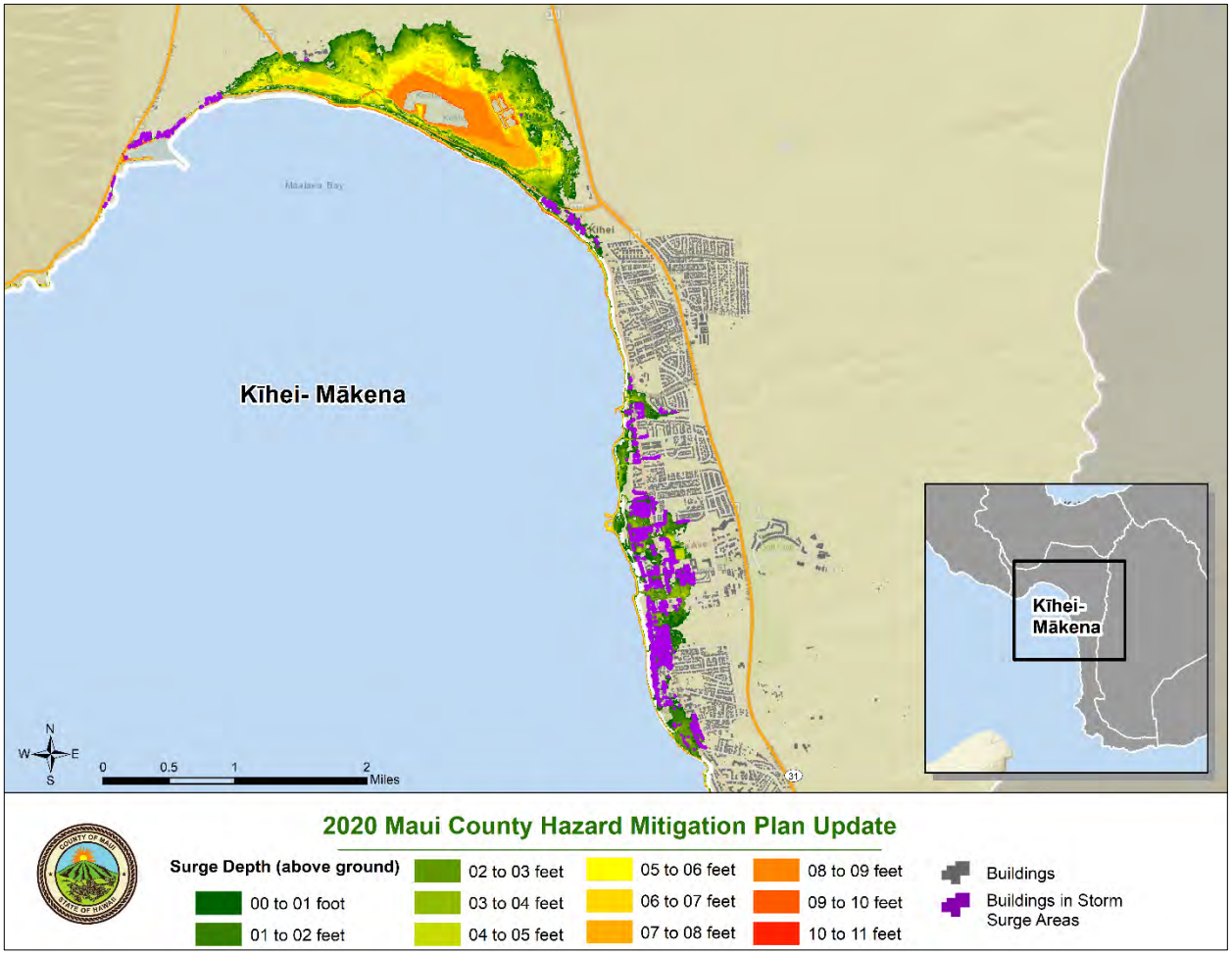

Figure 155. Buildings in Category 3 Storm Surge Areas in the Kīhei-Mākena Community Planning Area.

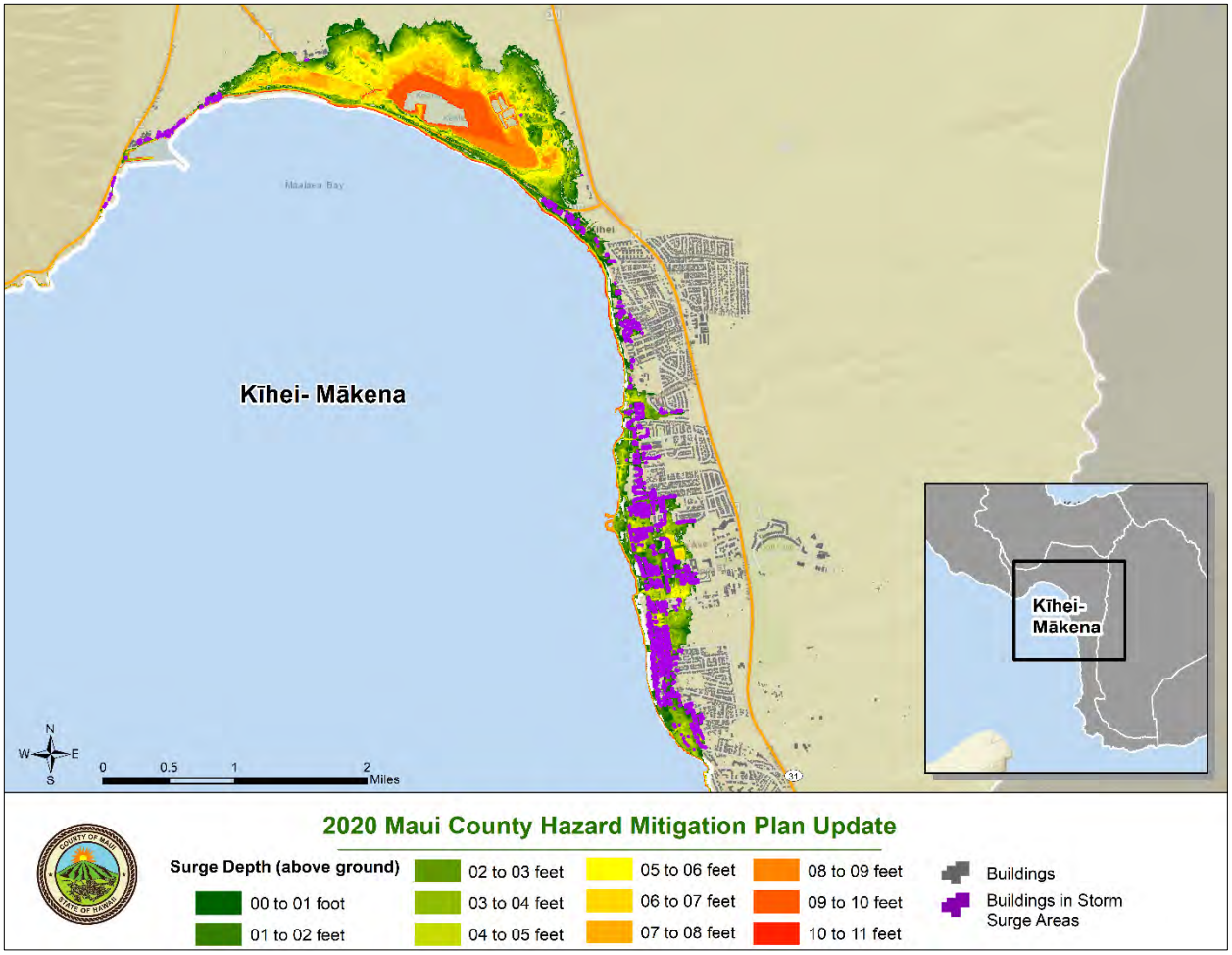

Figure 156. Buildings in Category 4 Storm Surge Areas in the Kīhei-Mākena Community Planning Area.

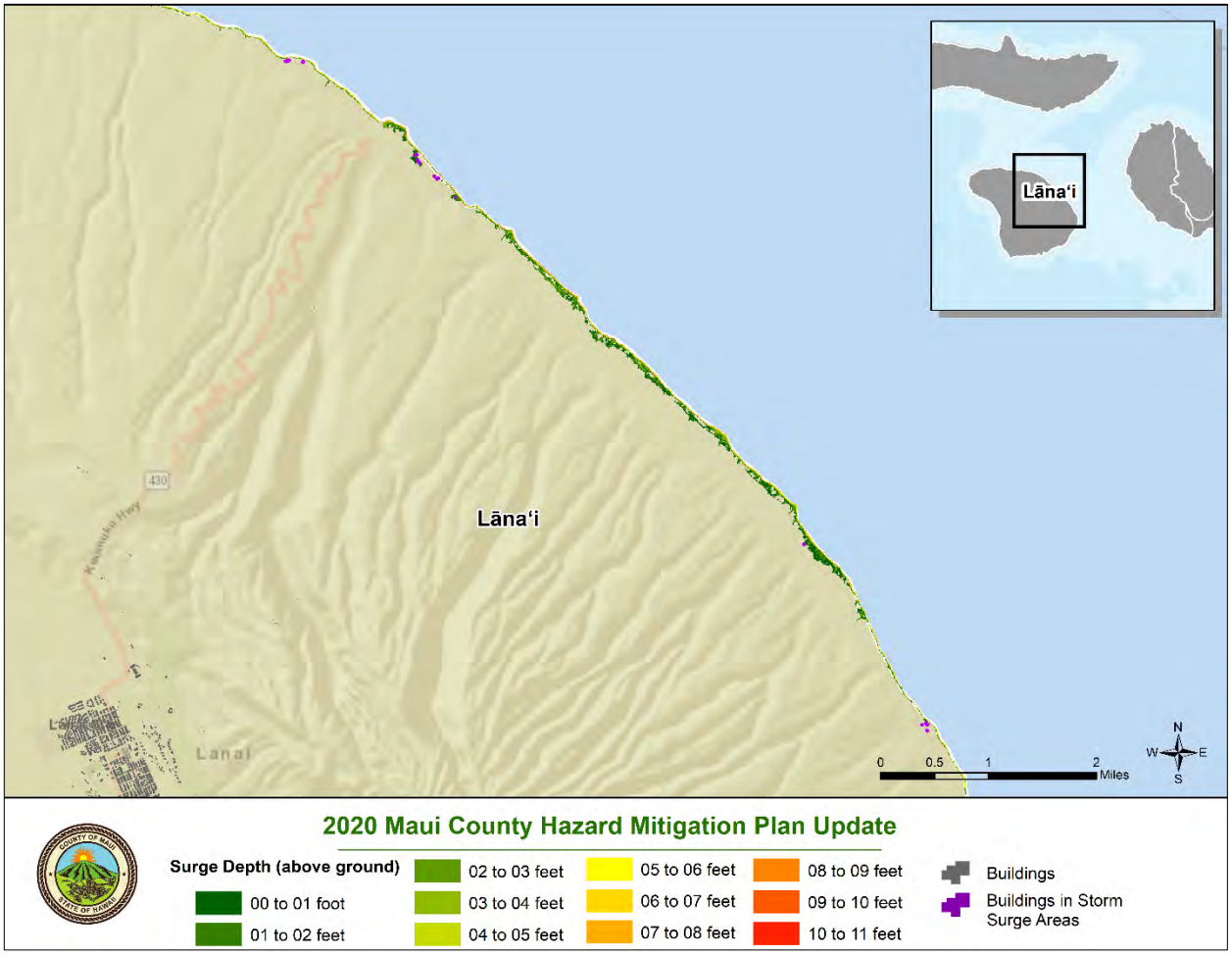

Figure 157. Buildings in Category 3 Storm Surge Areas in the Lānaʻi Community Planning Area.

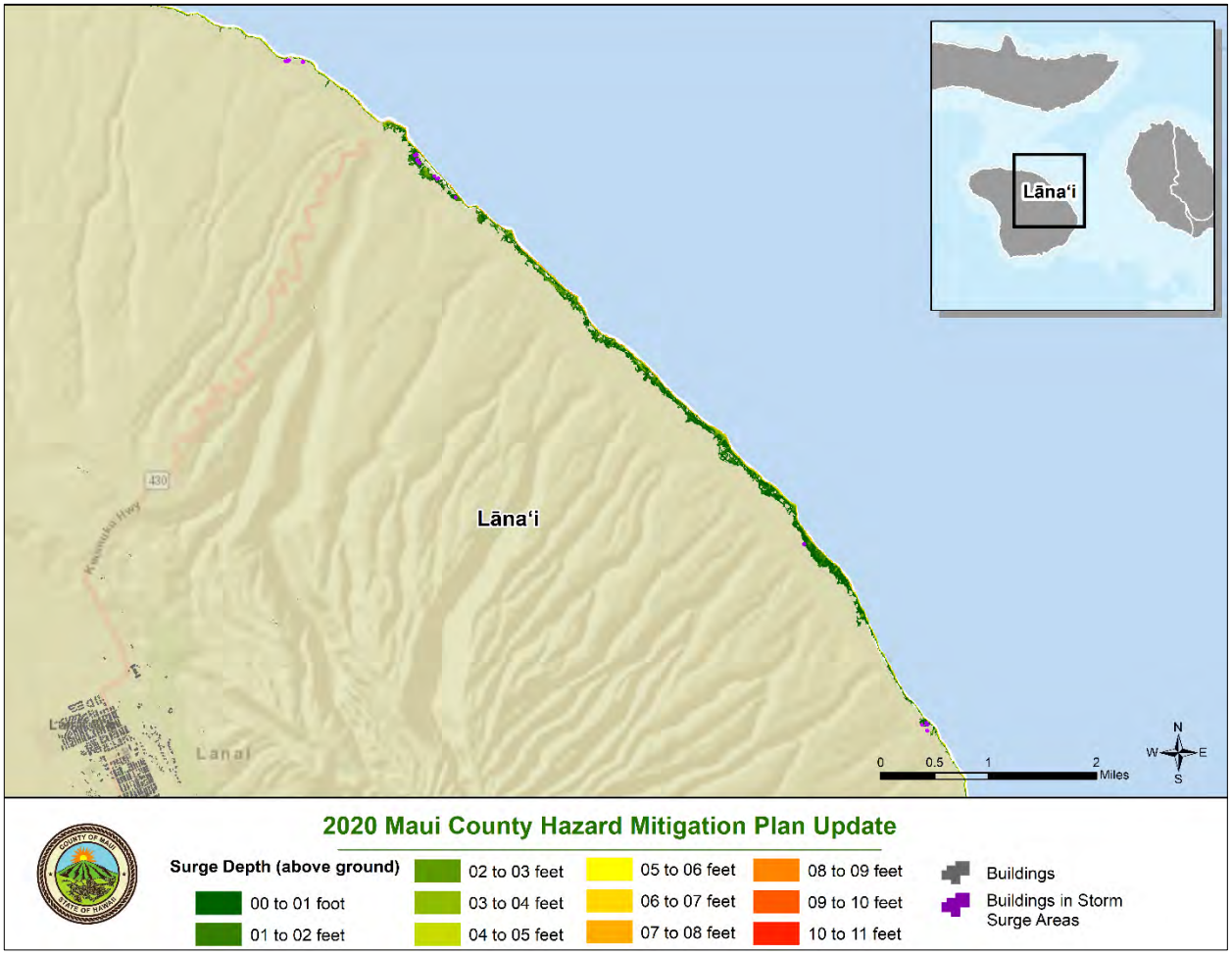

Figure 158. Buildings in Category 4 Storm Surge Areas in the Lānaʻi Community Planning Area.

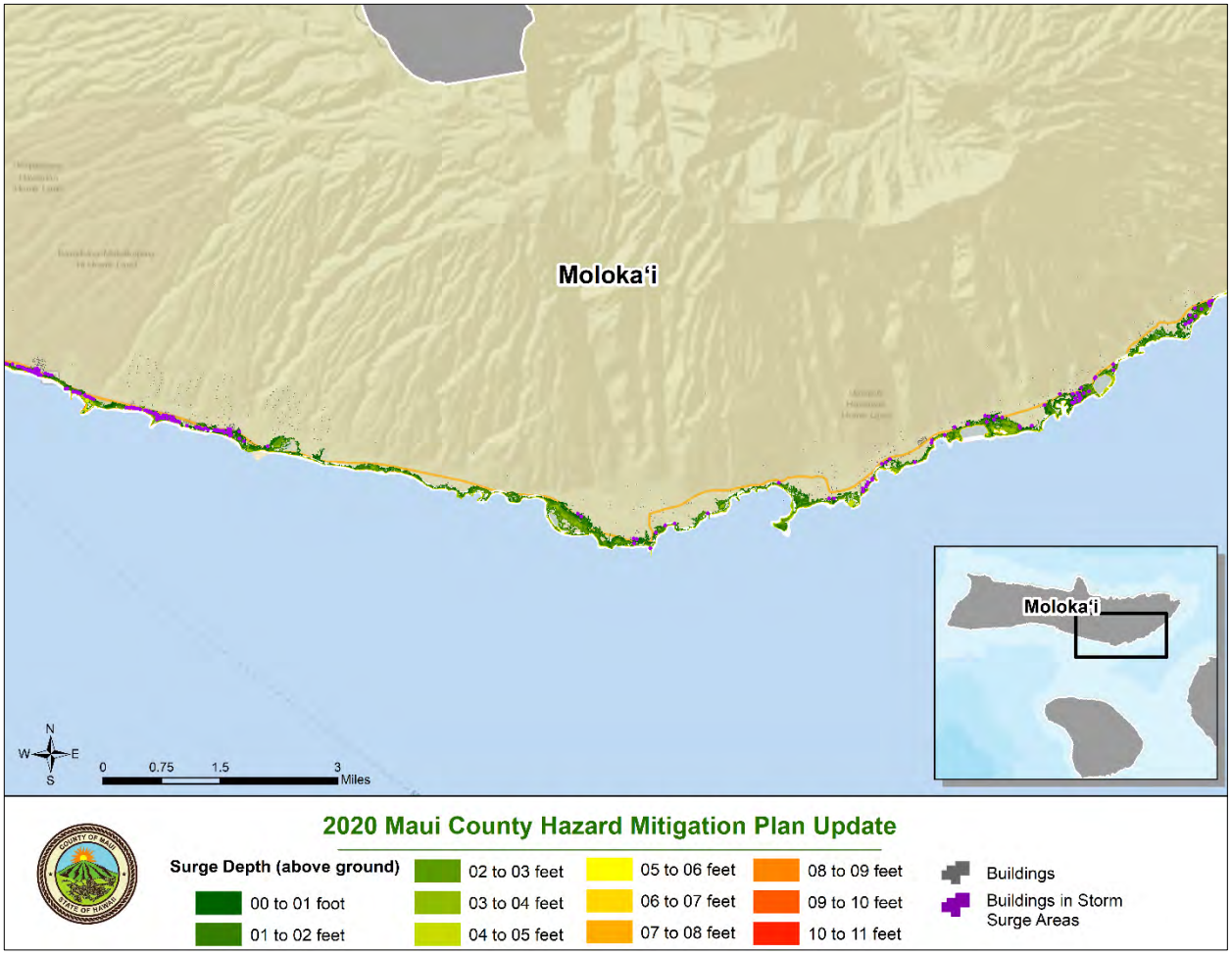

Figure 159. Buildings in Category 1 Storm Surge Areas in the Eastern Moloka‘i Community Planning Area.

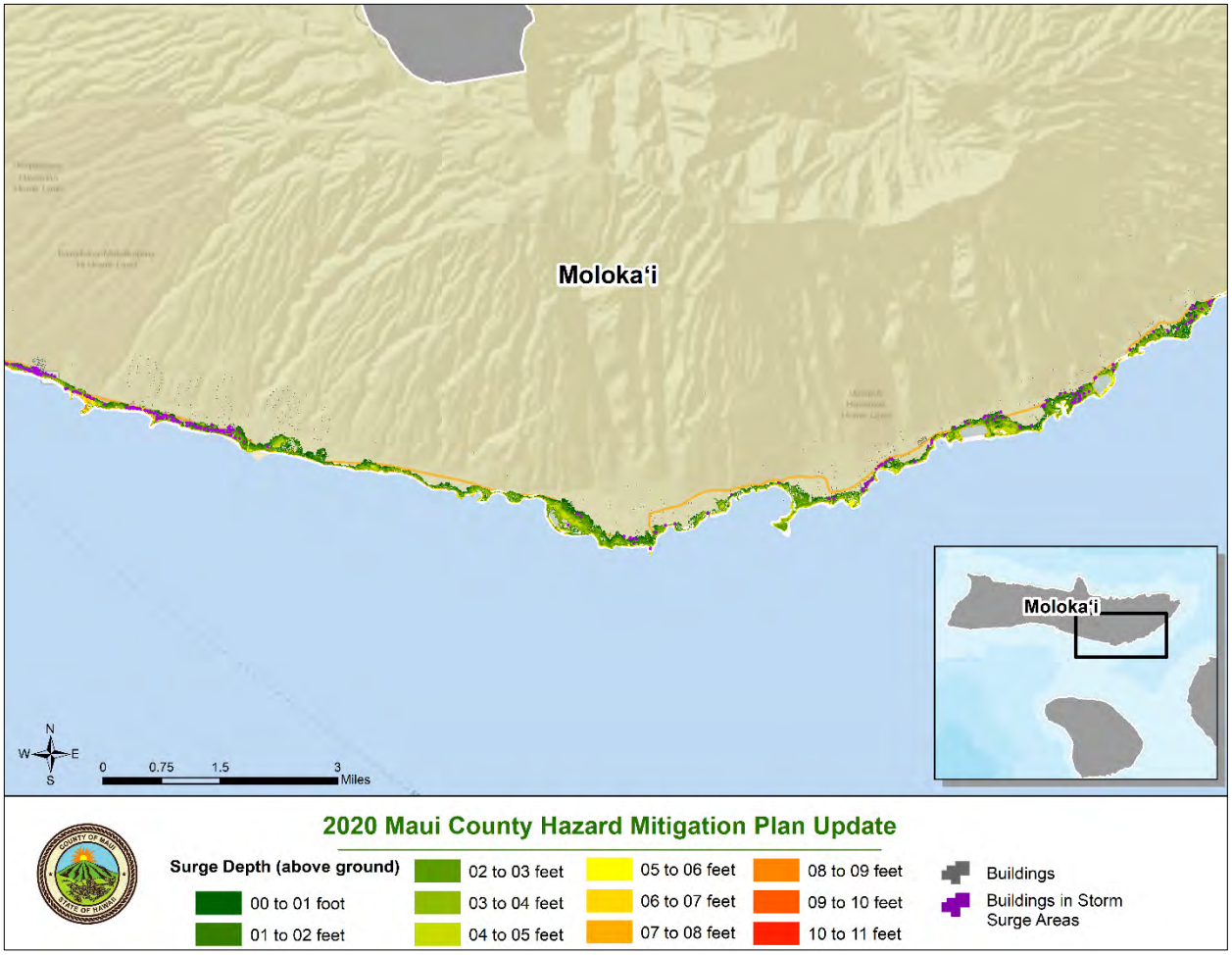

Figure 160. Buildings in Category 2 Storm Surge Areas in the Eastern Moloka‘i Community Planning Area.

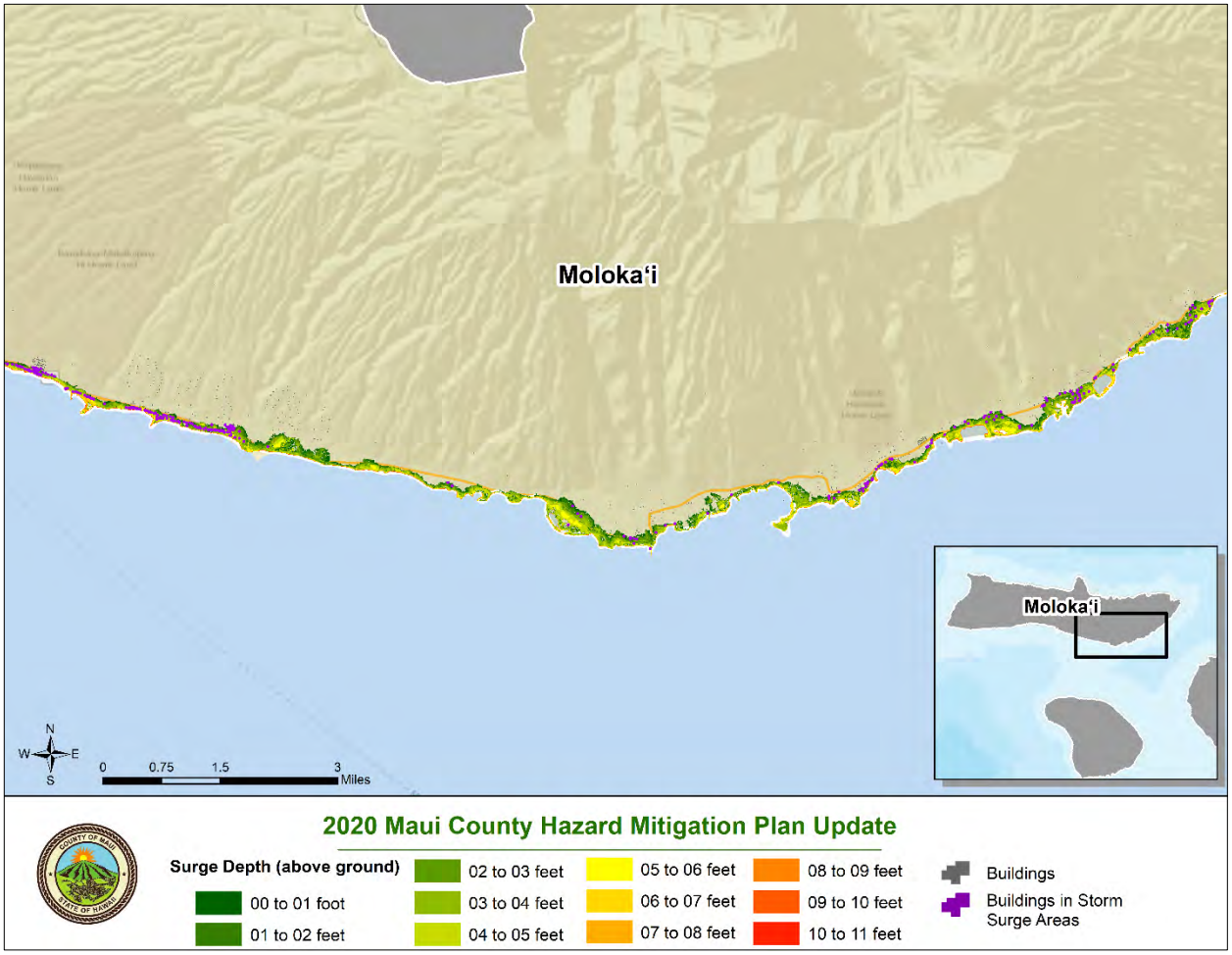

Figure 161. Buildings in Category 3 Storm Surge Areas in the Eastern Moloka‘i Community Planning Area.

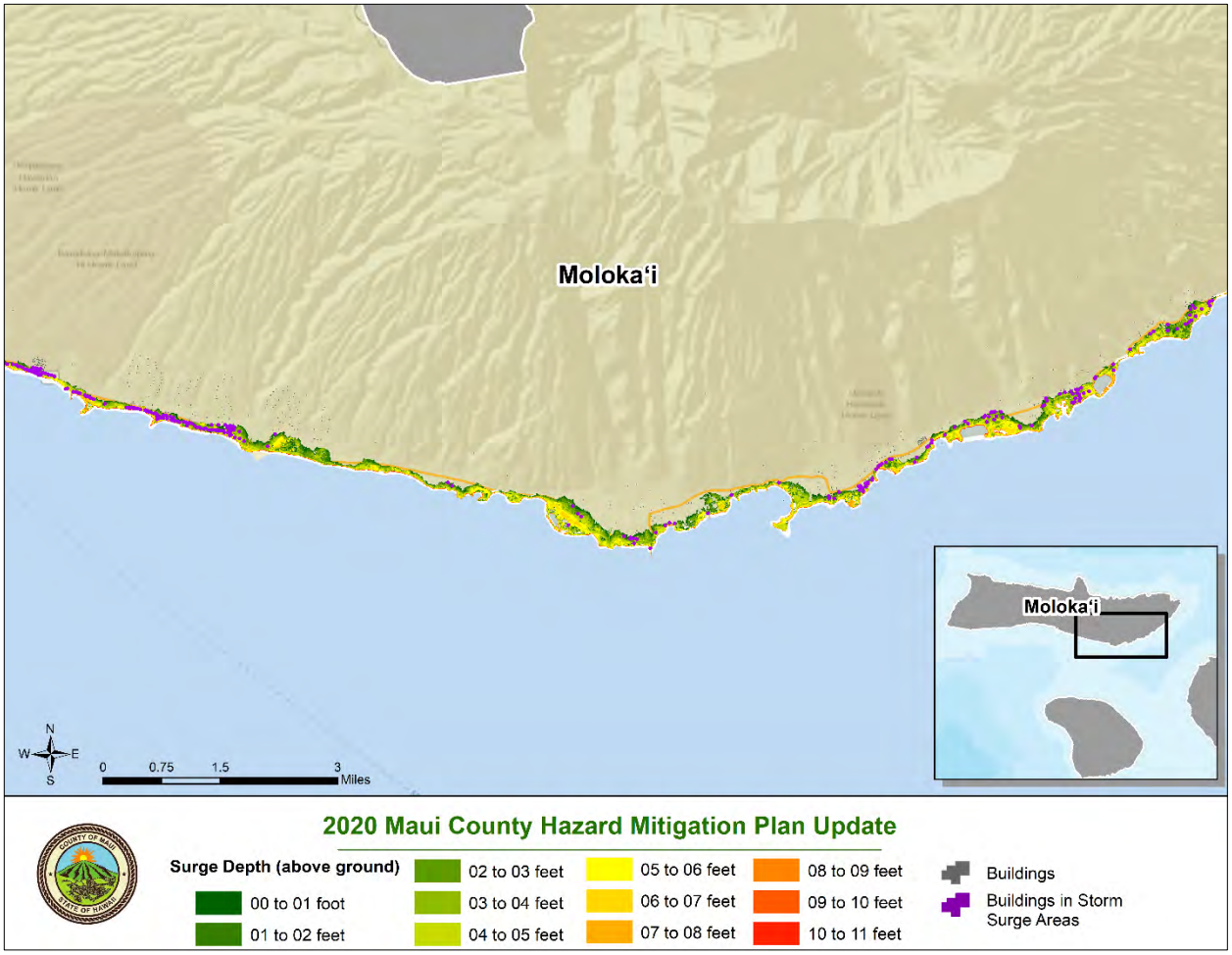

Figure 162. Buildings in Category 4 Storm Surge Areas in the Eastern Moloka‘i Community Planning Area.

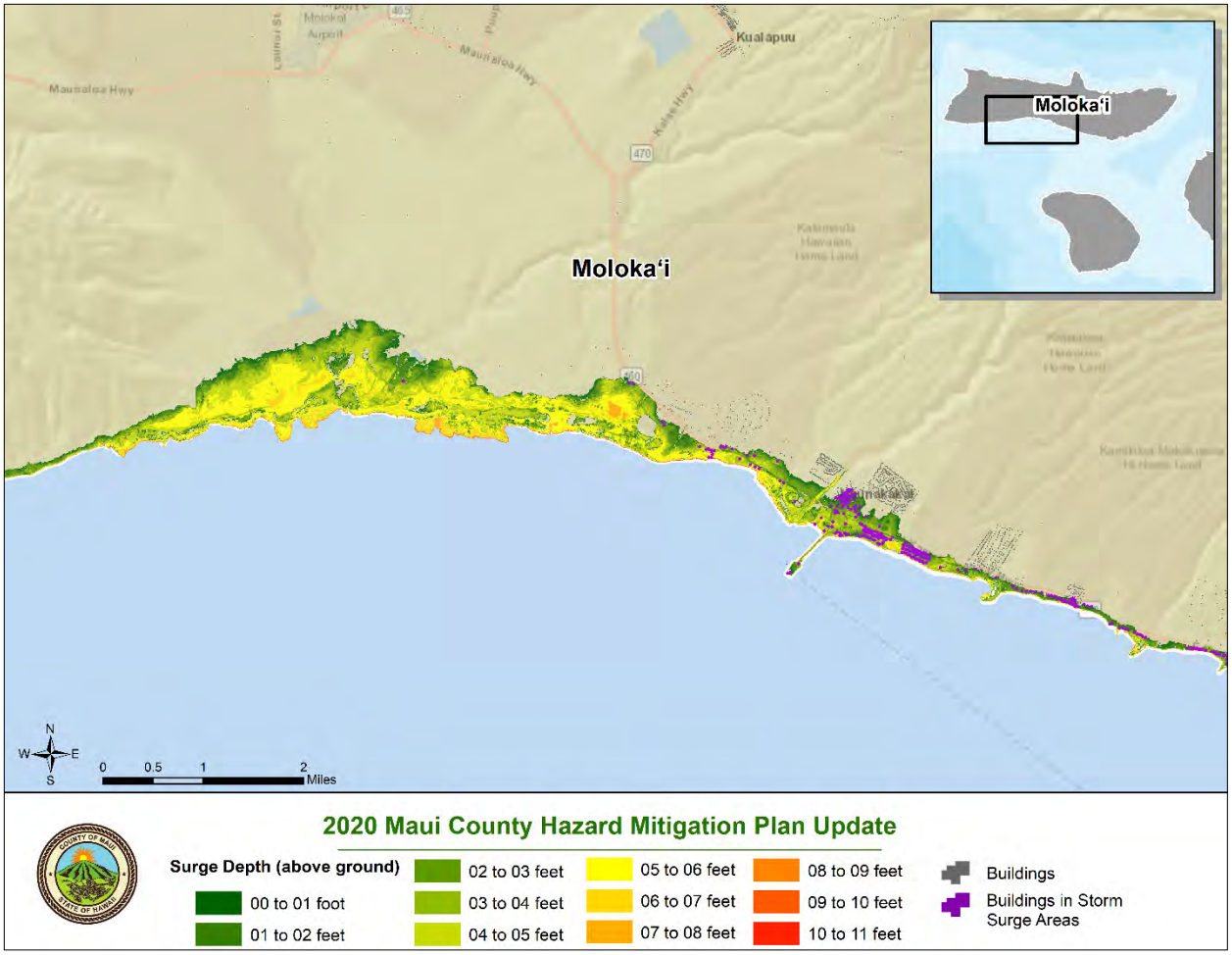

Figure 163. Buildings in Category 1 Storm Surge Areas in the Western Molokaʻi Community Planning Area.

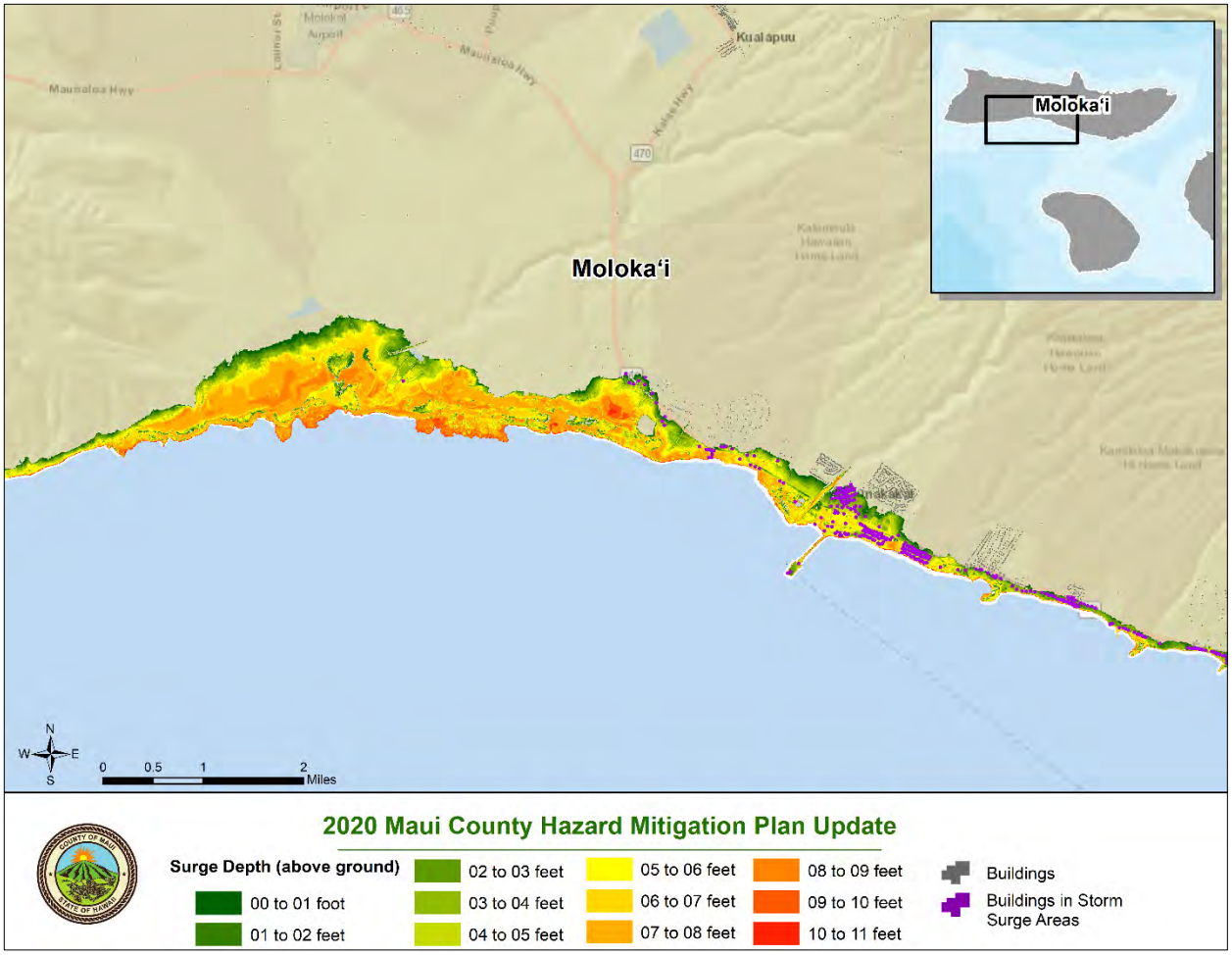

Figure 164. Buildings in Category 2 Storm Surge Areas in the Western Moloka'i Community Planning Area.

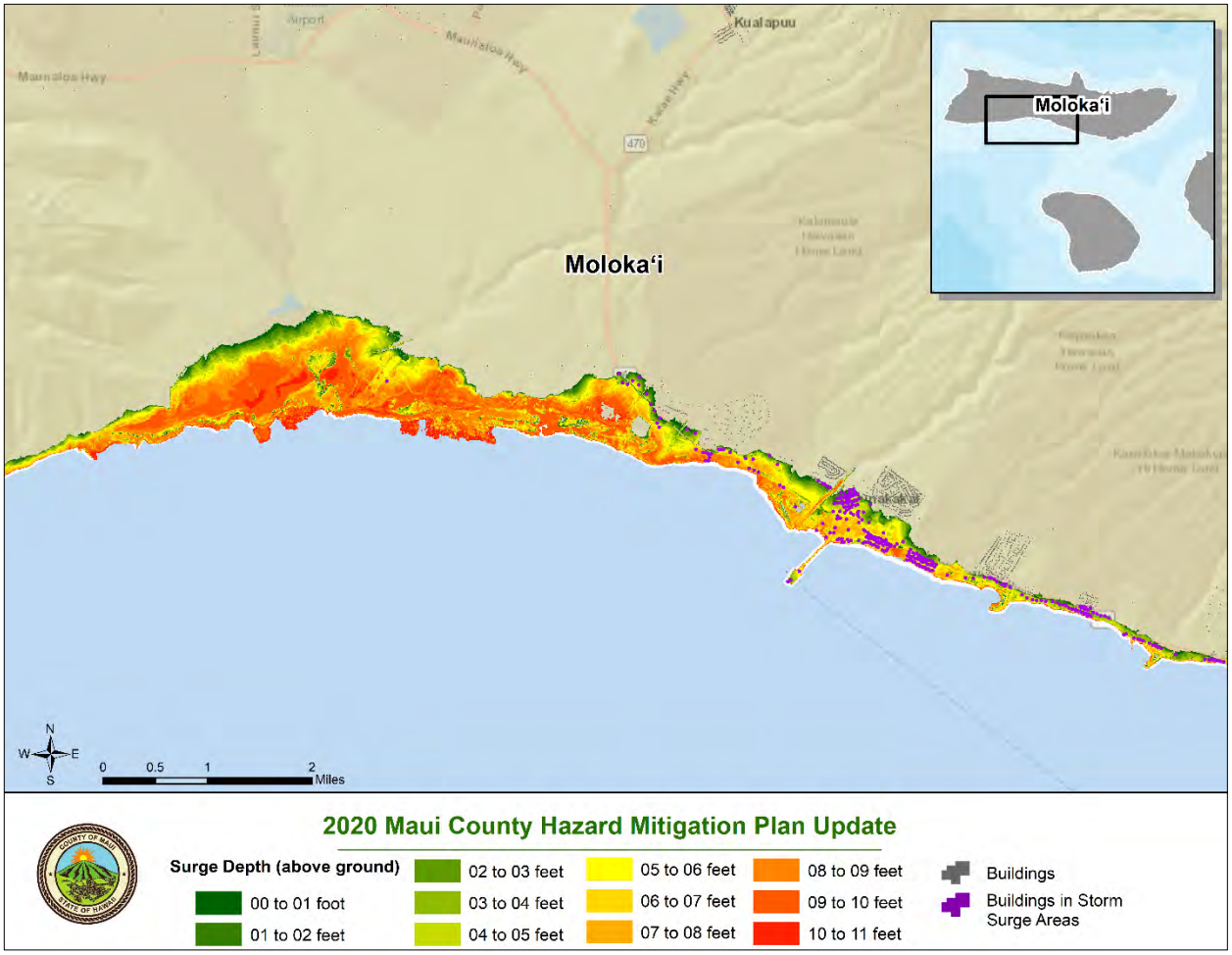

Figure 165. Buildings in Category 3 Storm Surge Areas in the Western Molokaʻi Community Planning Area.

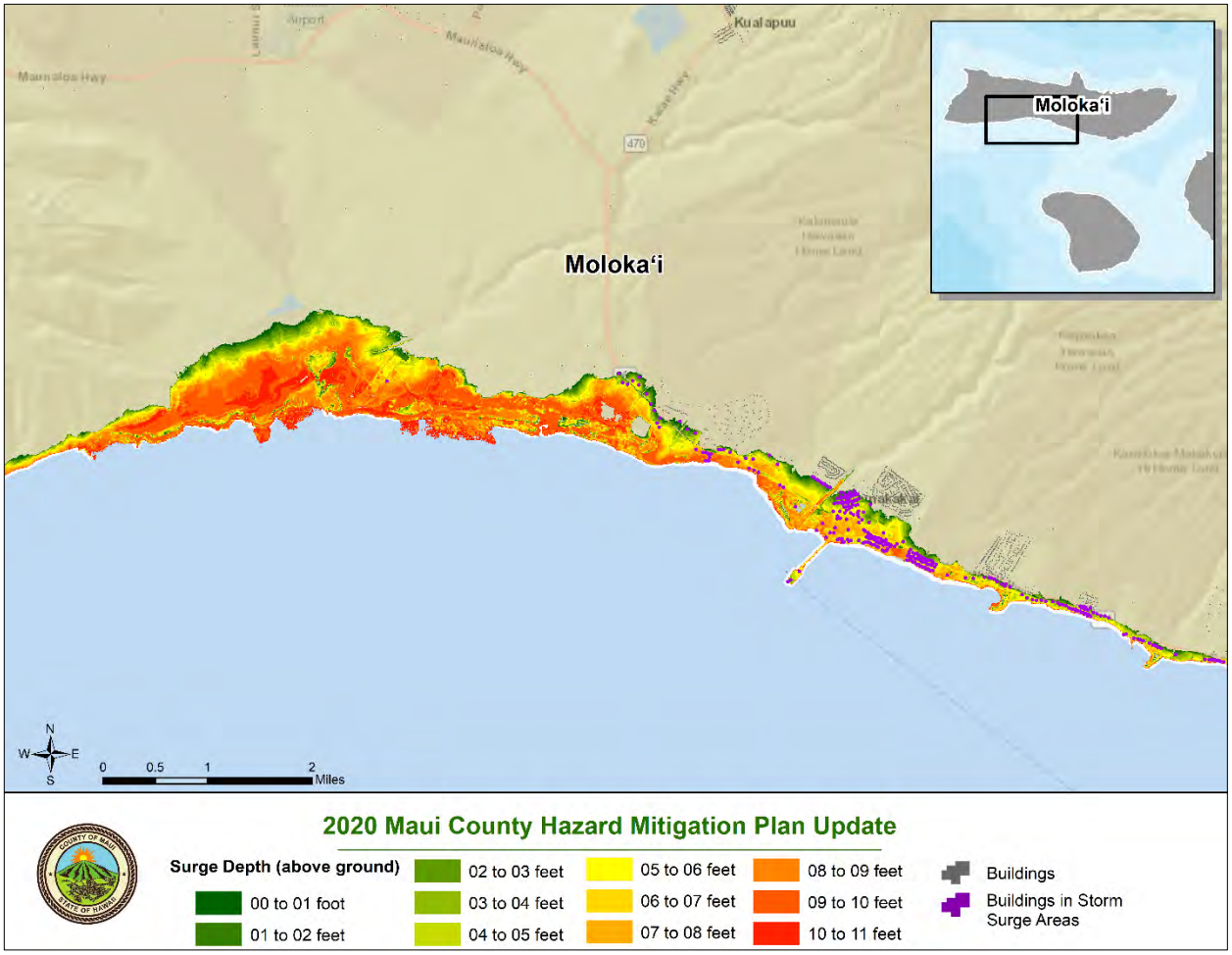

Figure 166. Buildings in Category 4 Storm Surge Areas in the Western Molokaʻi Community Planning Area.

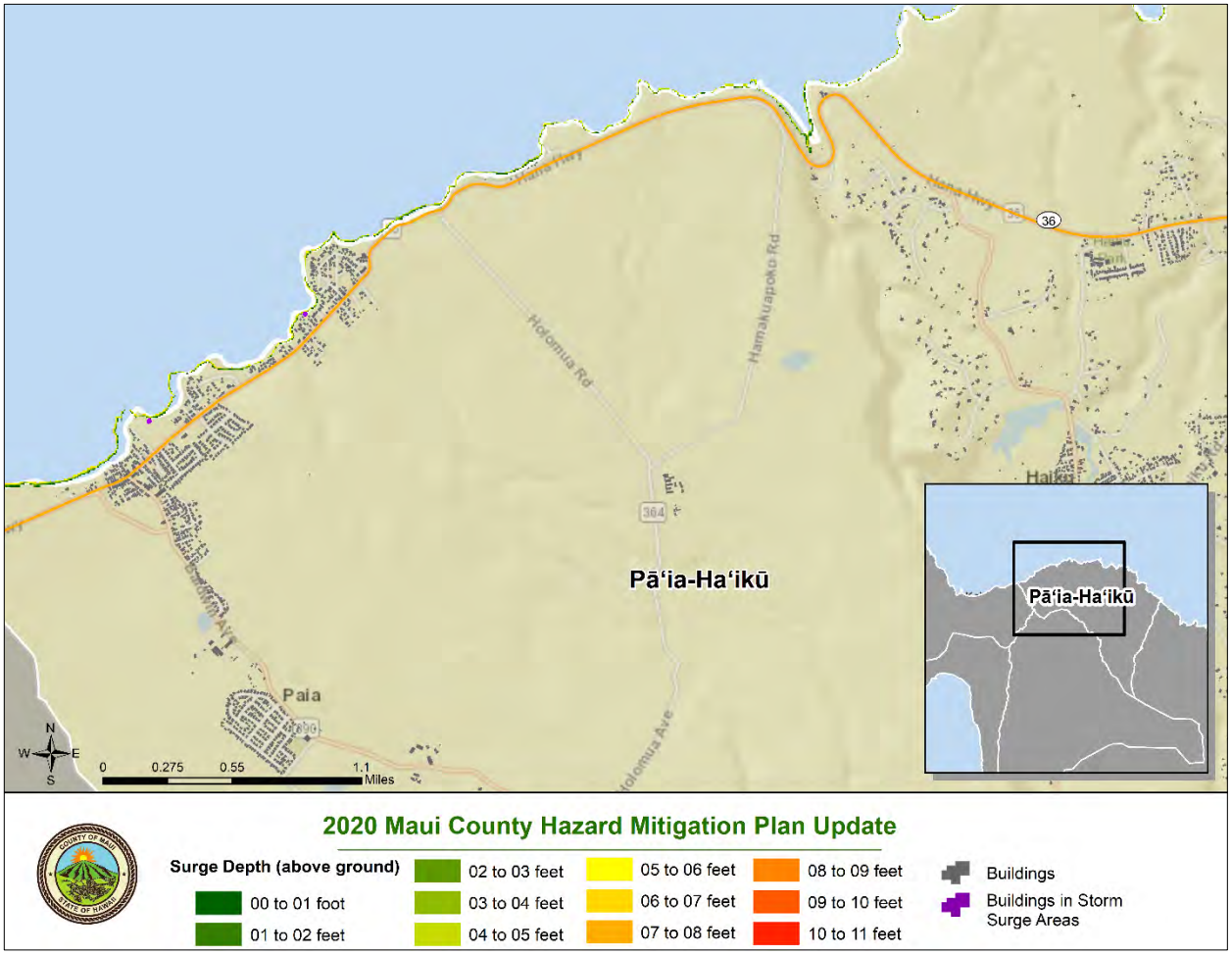

Figure 167. Buildings in Category 1 and Category 2 Storm Surge Areas in the Pāʻia-Haʻikū Community Planning Area.

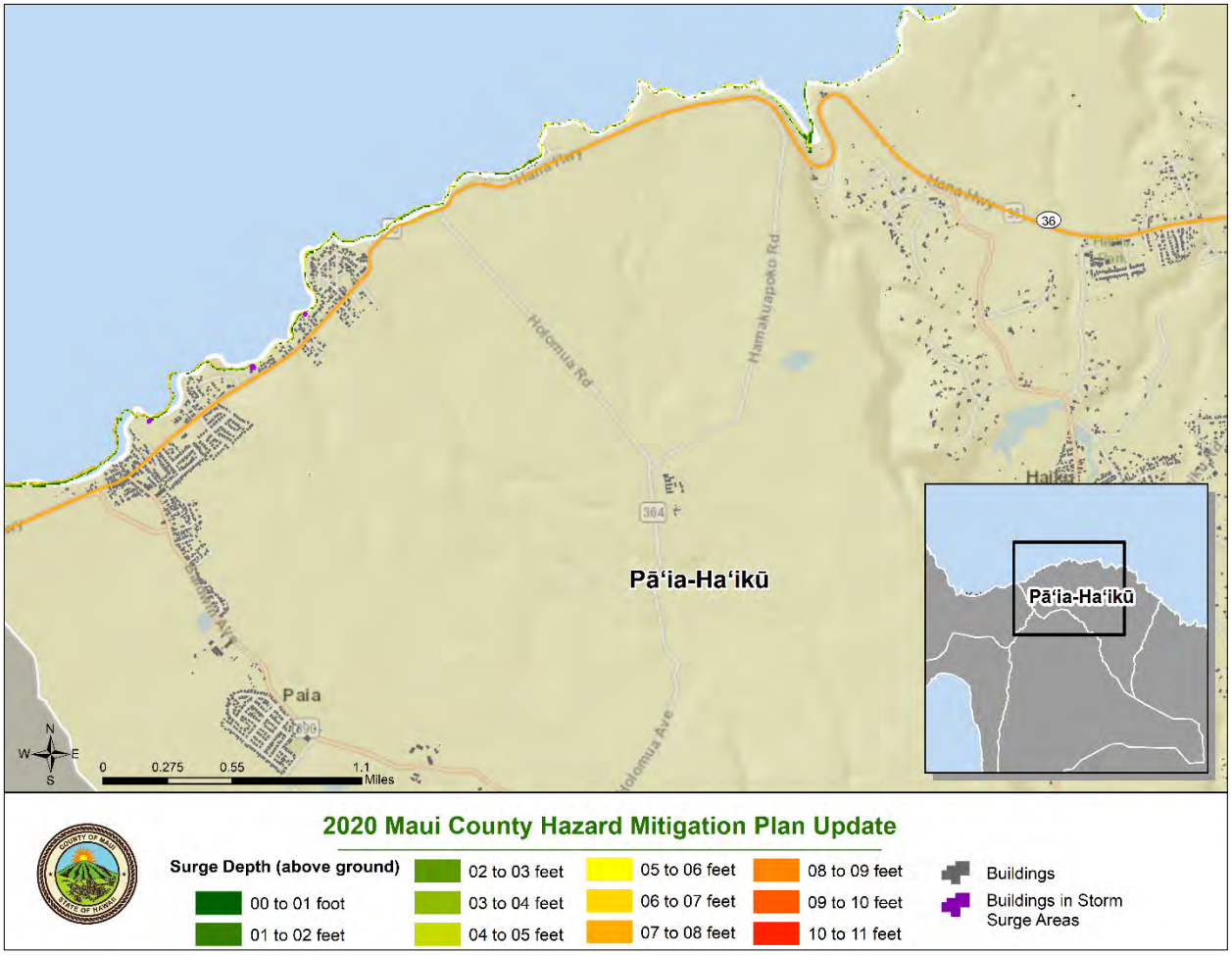

Figure 168. Buildings in Category 3 Storm Surge Areas in the Pāʻia-Haʻikū Community Planning Area.

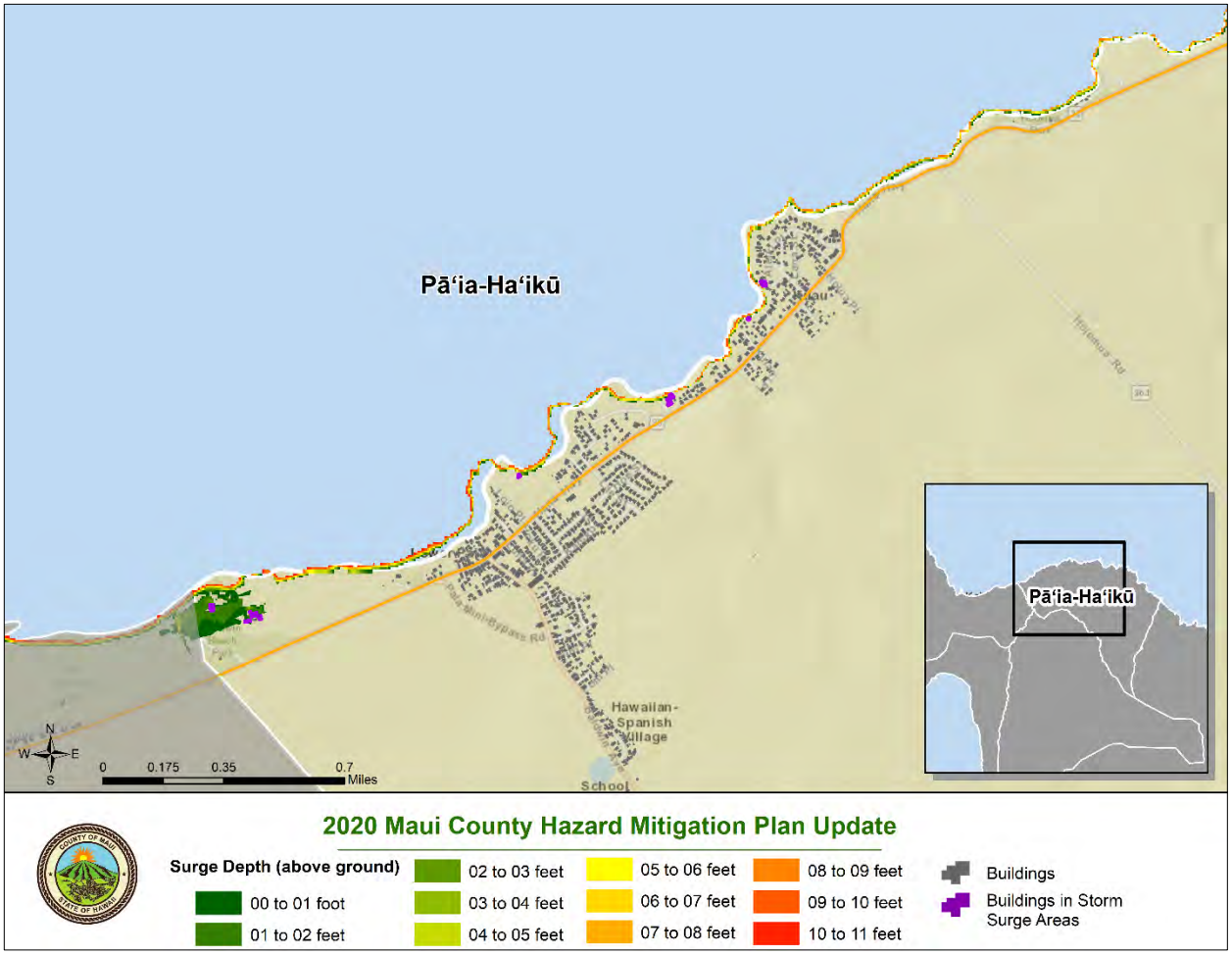

Figure 169. Buildings in Category 4 Storm Surge Areas in the Pāʻia-Haʻikū Community Planning Area.

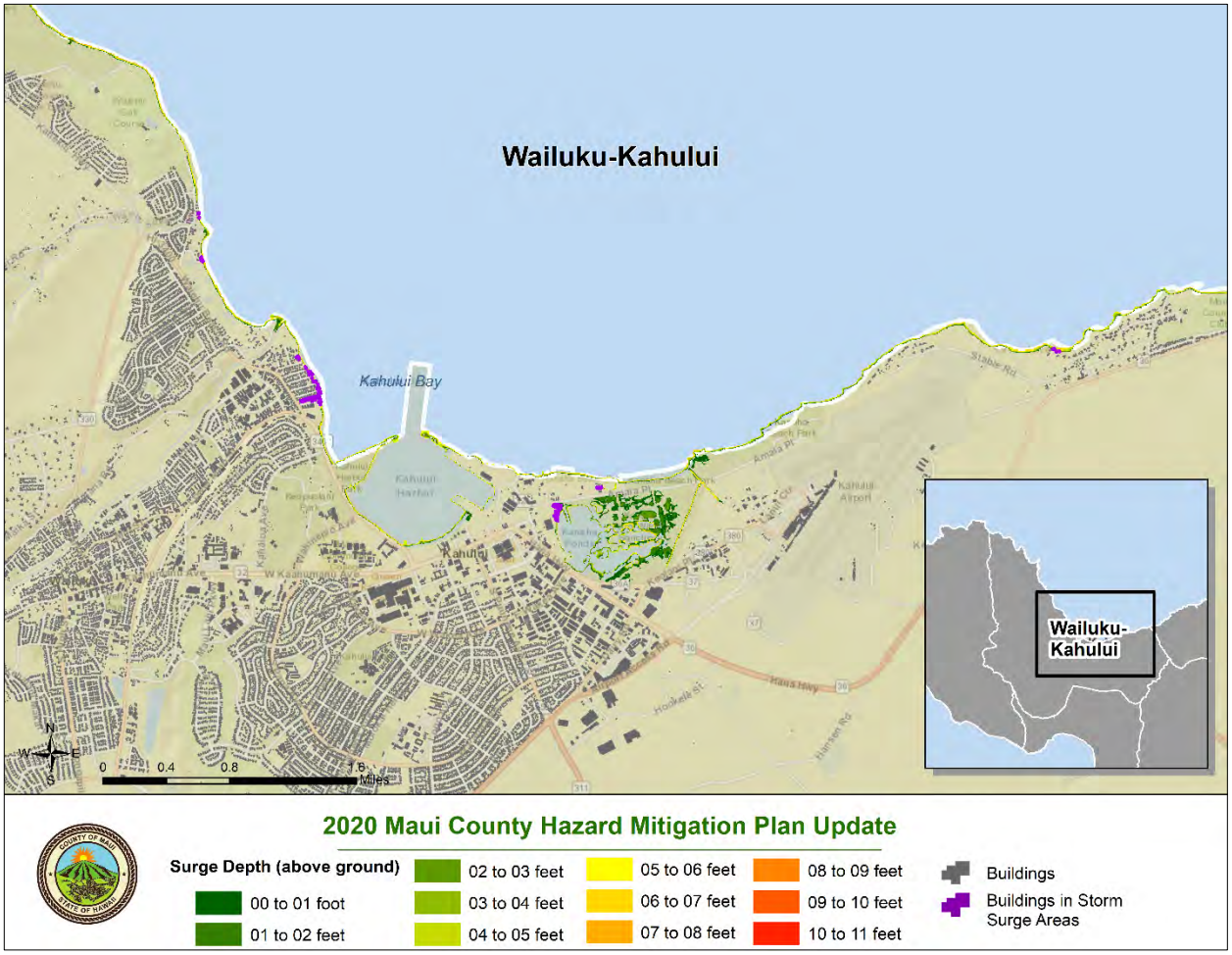

Figure 170. Buildings in Category 1 Storm Surge Areas in the Wailuku-Kahului Community Planning Area.

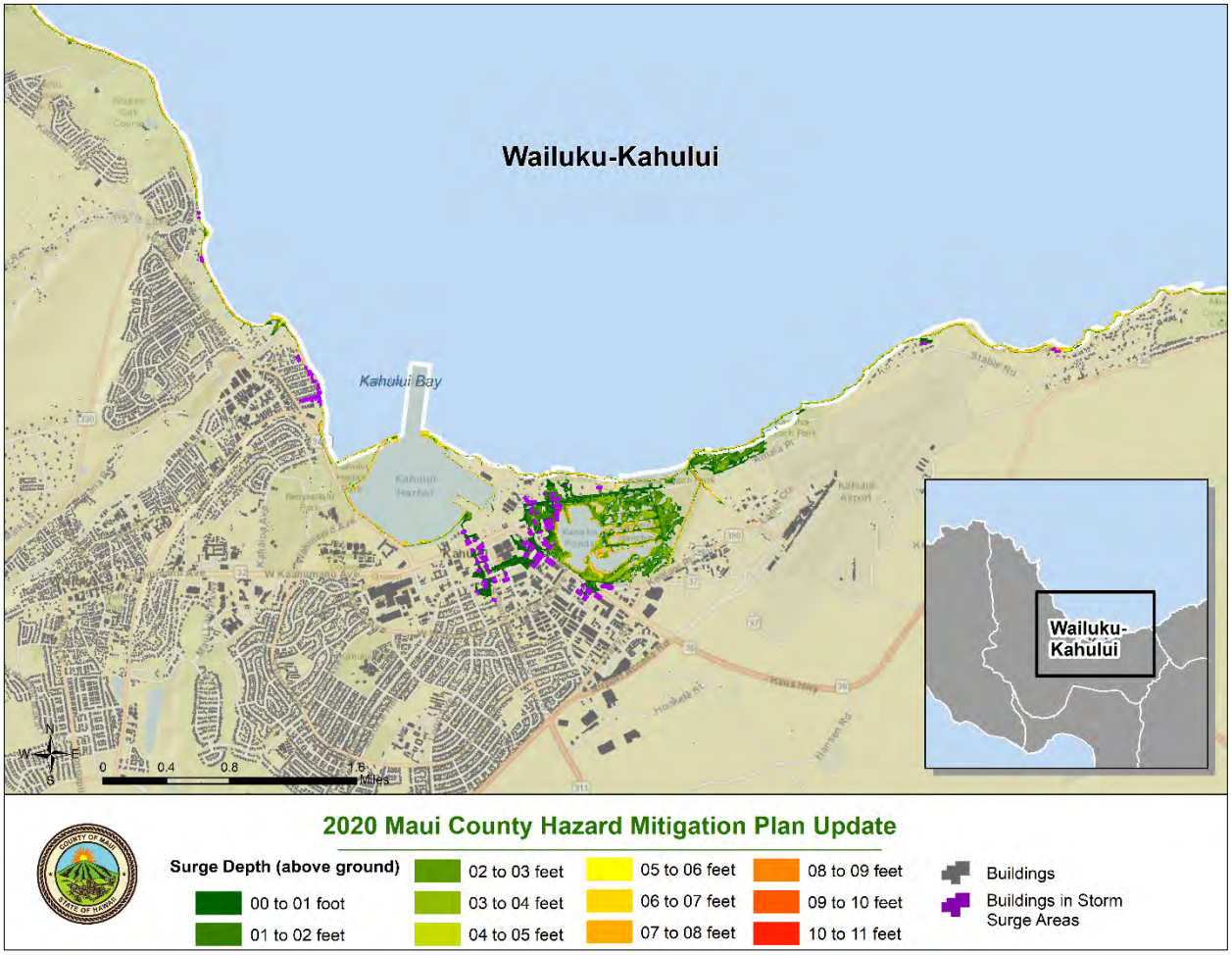

Figure 171. Buildings in Category 2 Storm Surge Areas in the Wailuku-Kahului Community Planning Area.

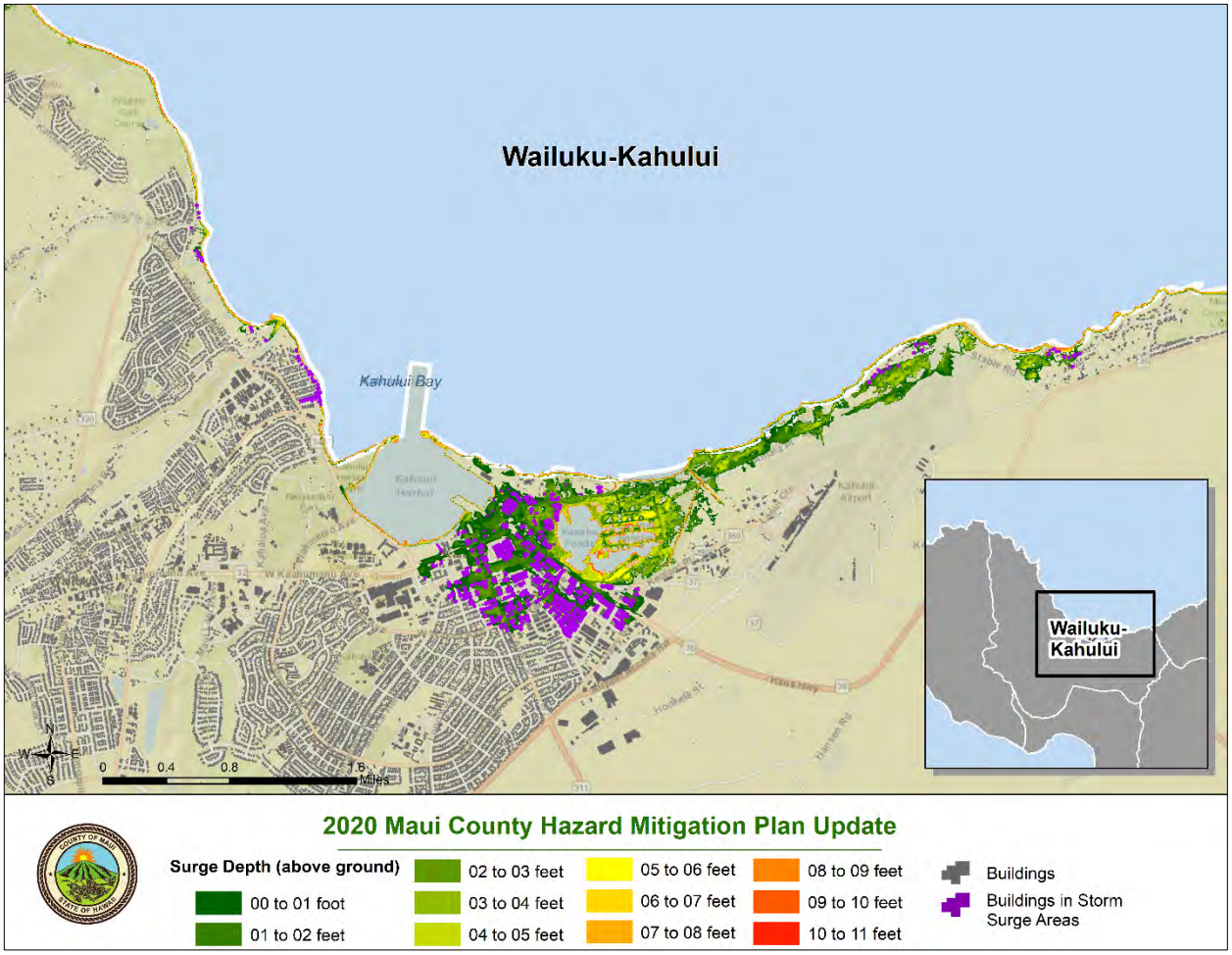

Figure 172. Buildings in Category 3 Storm Surge Areas in the Wailuku-Kahului Community Planning Area.

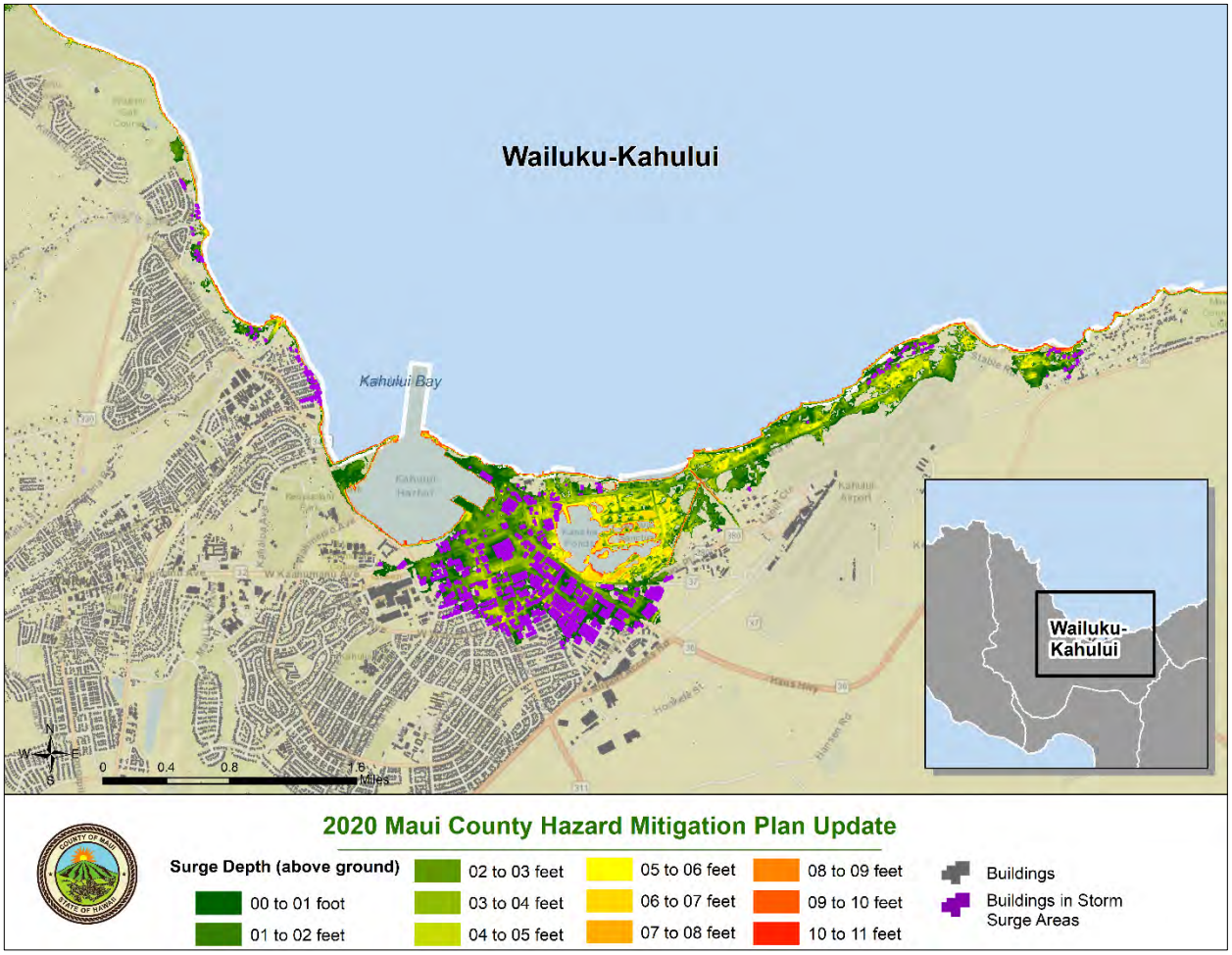

Figure 173. Buildings in Category 4 Storm Surge Areas in the Wailuku-Kahului Community Planning Area.

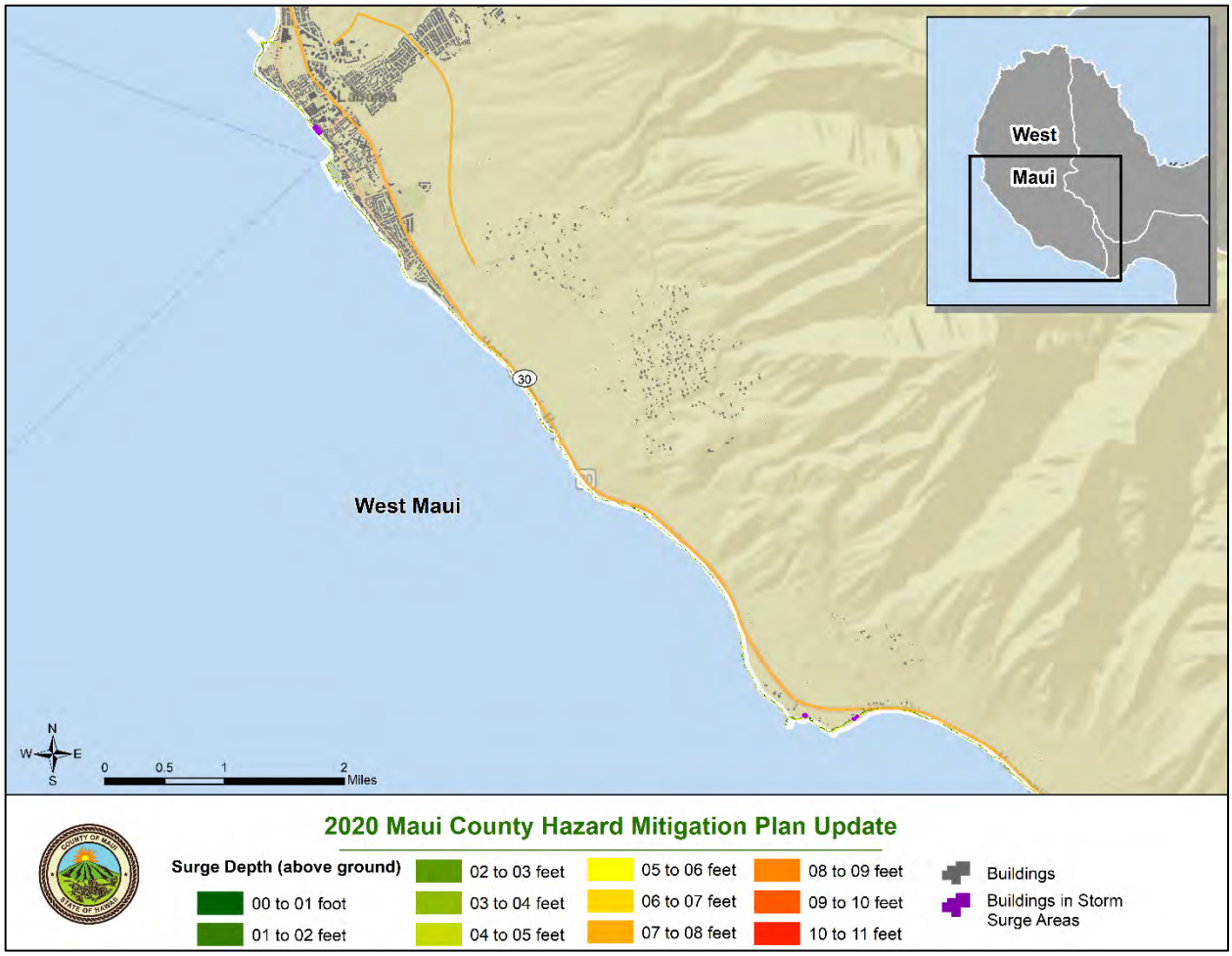

Figure 174. Buildings in Category 1 Storm Surge Areas in the West Maui Community Planning Area.

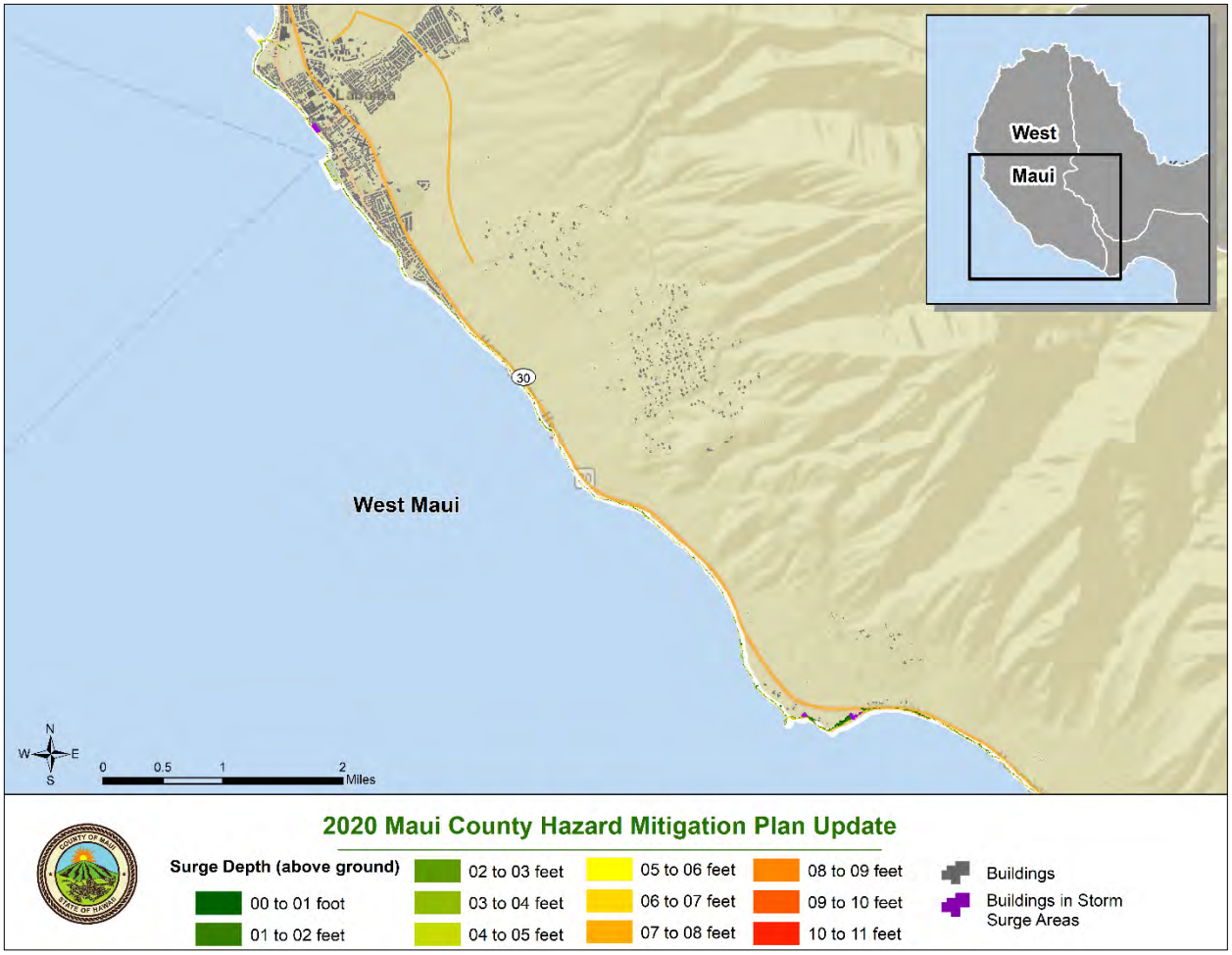

Figure 175. Buildings in Category 2 Storm Surge Areas in the West Maui Community Planning Area.

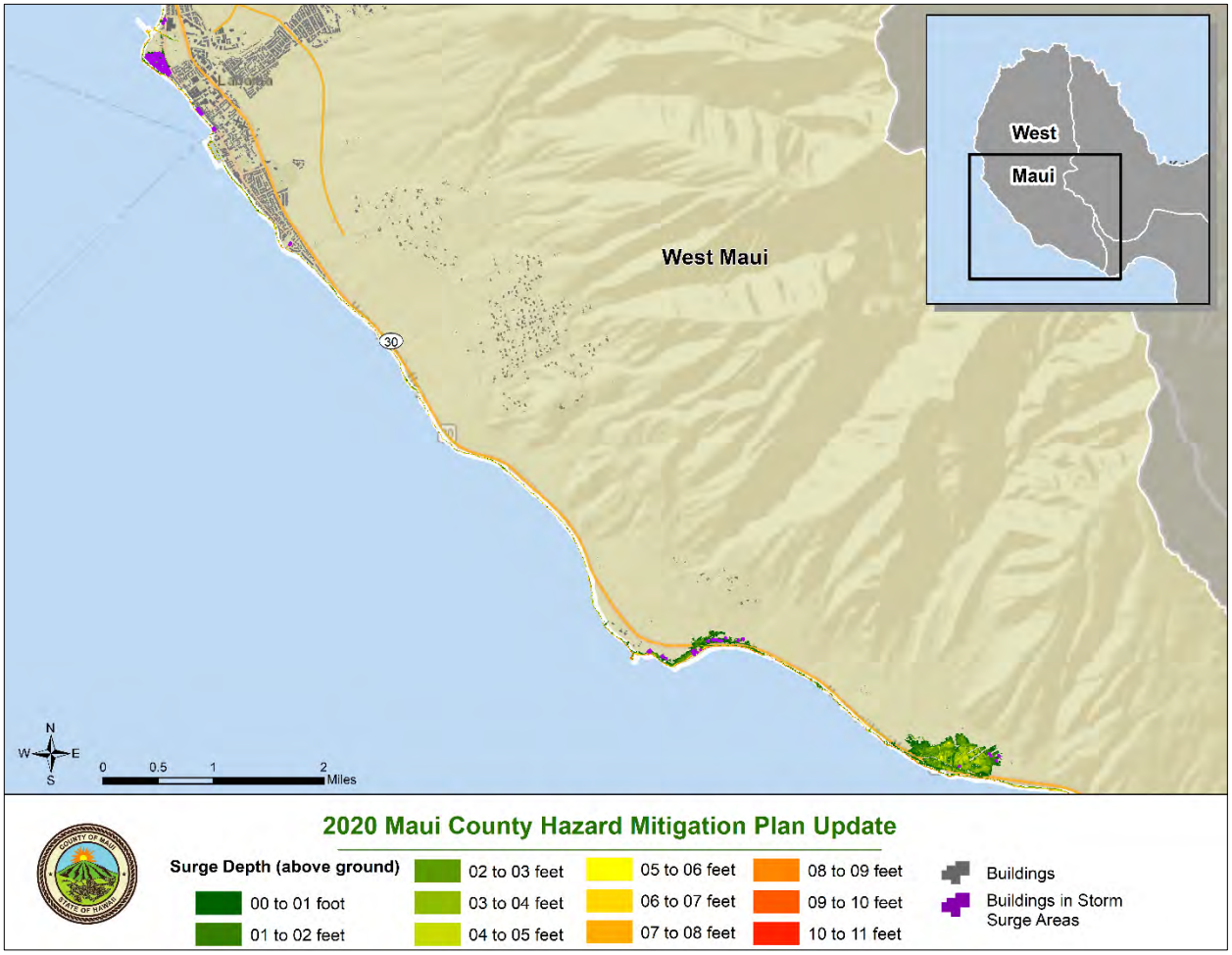

Figure 176. Buildings in Category 3 Storm Surge Areas in the West Maui Community Planning Area.

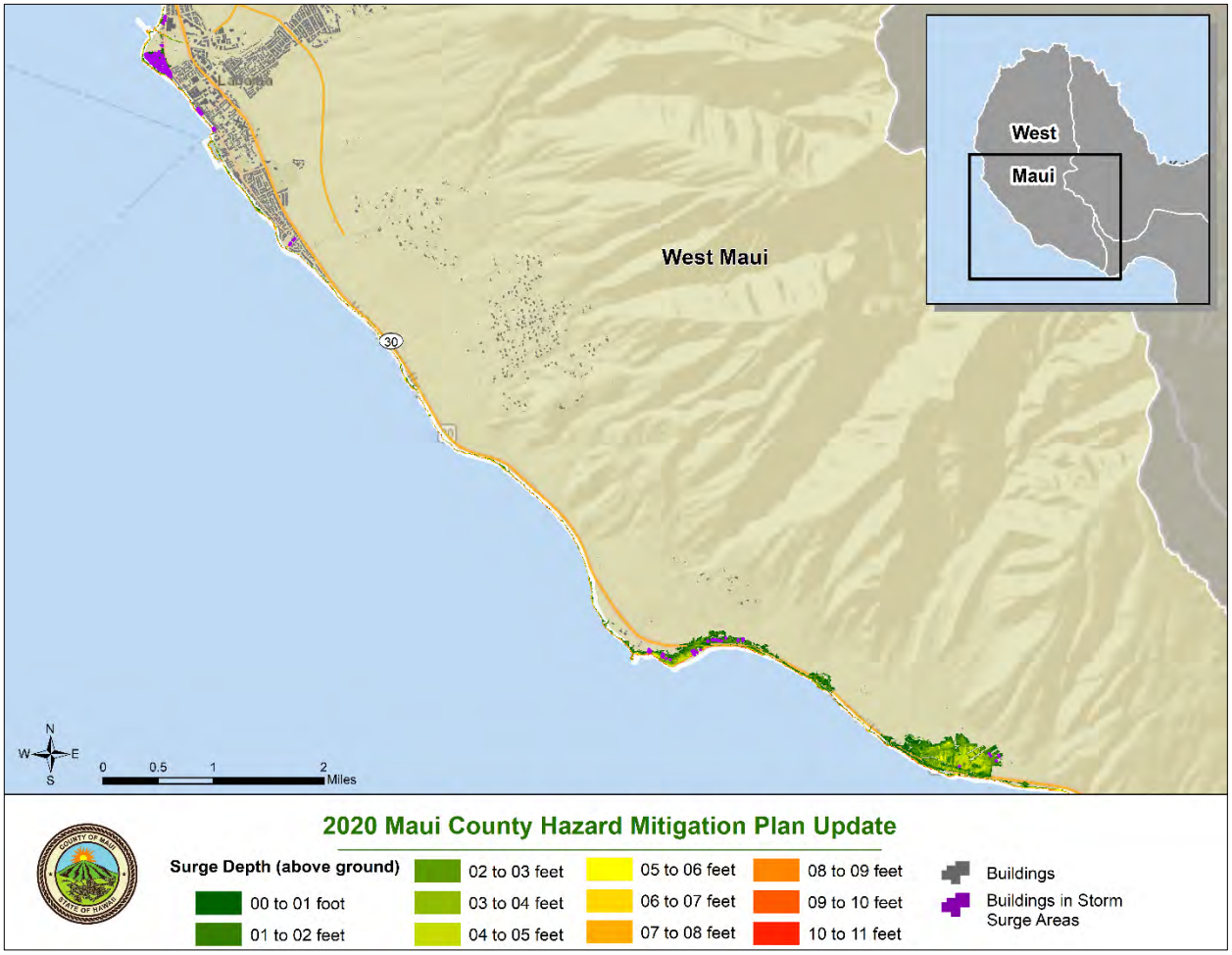

Figure 177. Buildings in Category 4 Storm Surge Areas in the West Maui Community Planning Area.

GIS analysis was used to determine the number of critical facilities within storm surge areas (up to/including Category 4). The table below presents the number of critical facilities within storm surge areas for each community planning area. Overall, there are 34 potentially at-risk critical facilities within Maui County storm surge areas.

Table 58. Potentially At-Risk Critical Facilities in Storm Surge Areas.

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Commercial Facilities	N/A	N/A	N/A	N/A	N/A	N/A	0	N/A	**0 (0%)**
Communications Facilities	0	0	0	0	1	N/A	0	N/A	**1 (13%)**

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Emergency Services	0	0	0	0	4	0	1	0	**5 (14%)**
Energy	N/A	N/A	N/A	N/A	0	N/A	0	N/A	**0 (0%)**
Food and Agriculture	0	0	N/A	N/A	N/A	N/A	0	N/A	**0 (0%)**
Government Facilities	N/A	N/A	N/A	N/A	2	N/A	1	N/A	**3 (21%)**
Healthcare and Public Health	0	0	0	0	2	0	2	0	**4 (8%)**
Mass care	0	1	0	0	3	0	0	0	**4 (5%)**
Transportation	N/A	N/A	0	N/A	0	N/A	6	0	**6 (22%)**
Water and Wastewater Systems	N/A	4	N/A	0	3	0	4	0	**11 (14%)**
TOTAL	**0 (0%)**	**5 (15%)**	**0 (0%)**	**0 (0%)**	**15 (48%)**	**0 (0%)**	**14 (13%)**	**0 (0%)**	**34 (11%)**

The figures below show critical facilities in Maui County storm surge areas by community planning area.

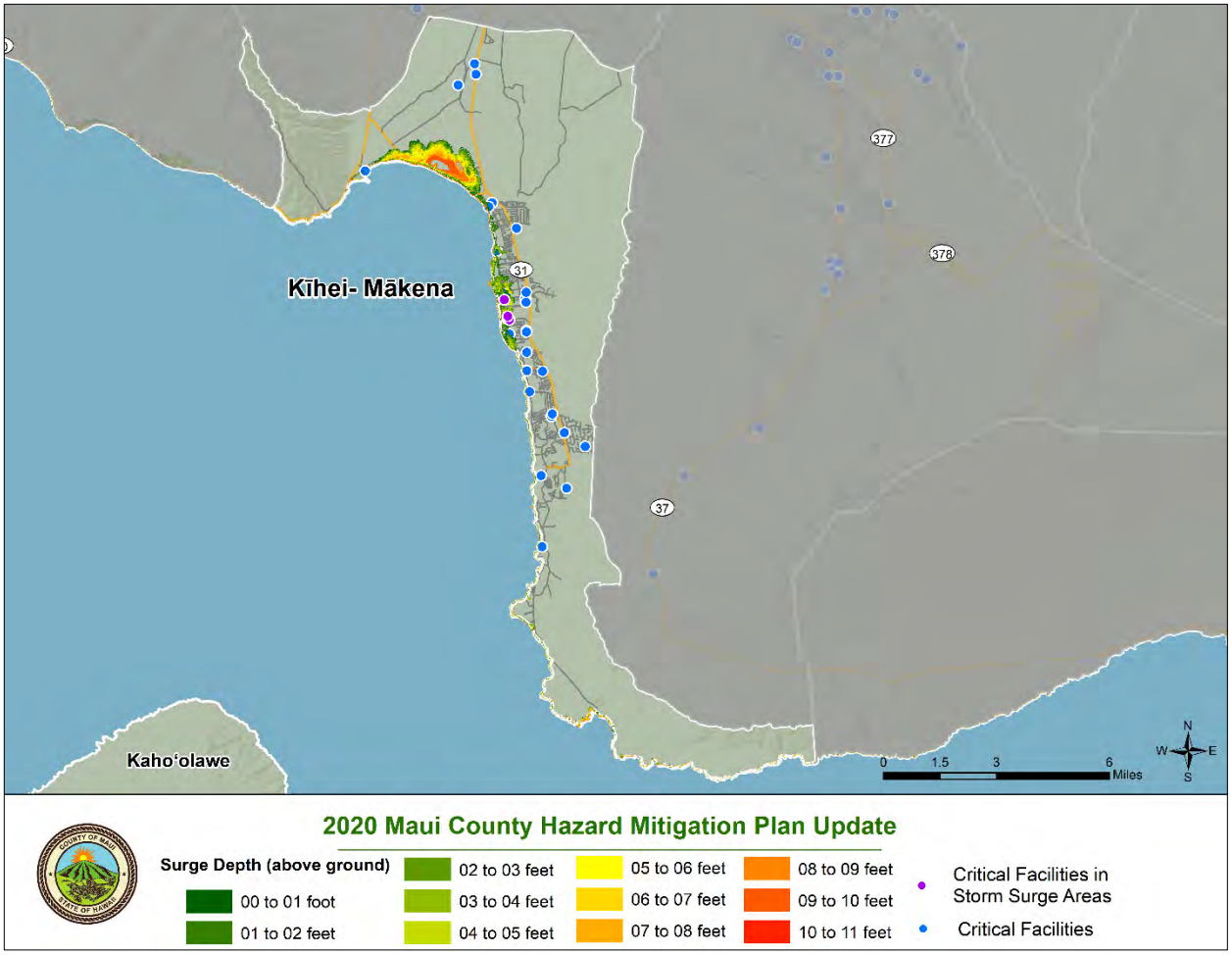

Figure 178. Critical Facilities in Storm Surge Areas in the Kīhei-Mākena Community Planning Area.

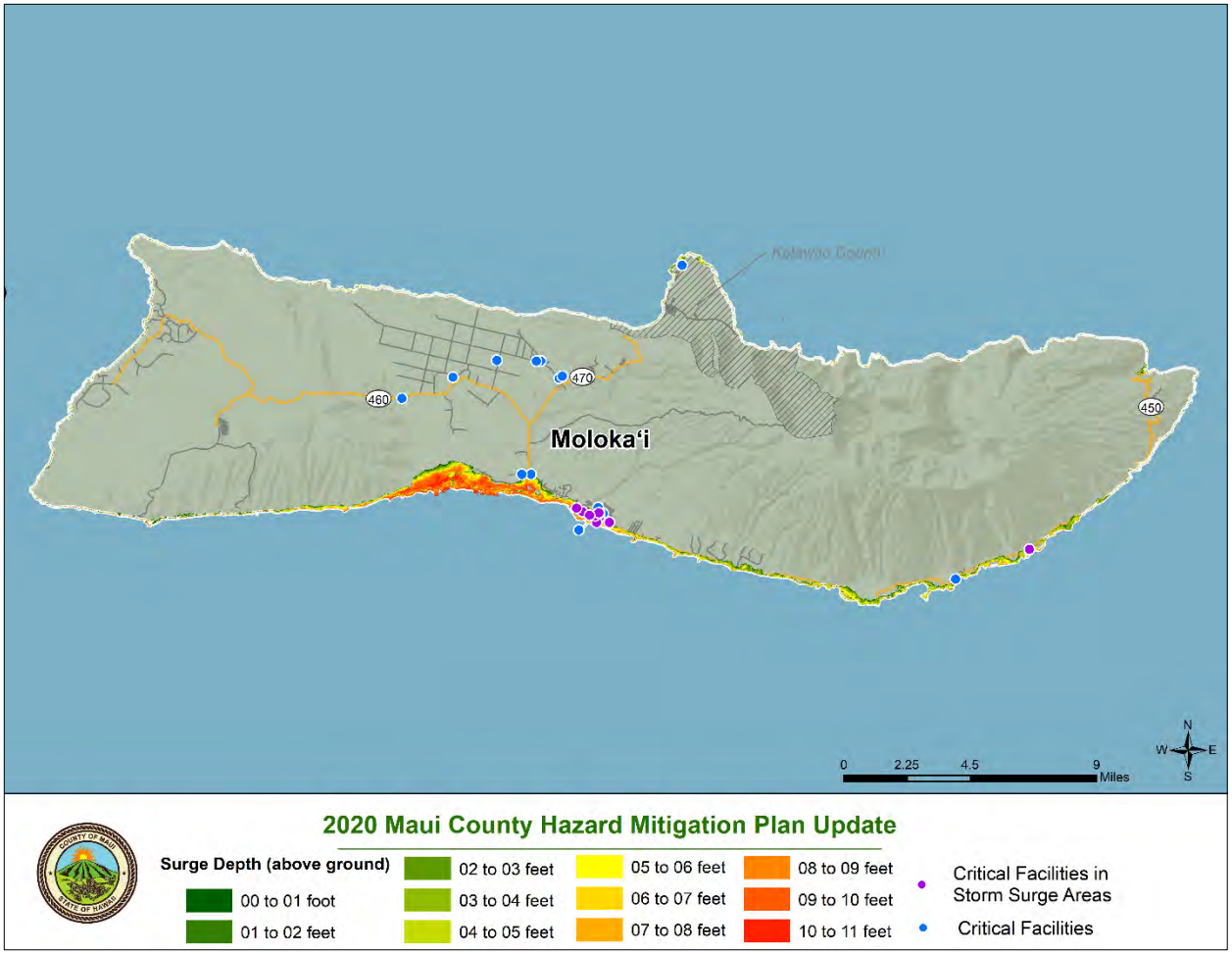

Figure 179. Critical Facilities in Storm Surge Areas in the Moloka'i Community Planning Area.

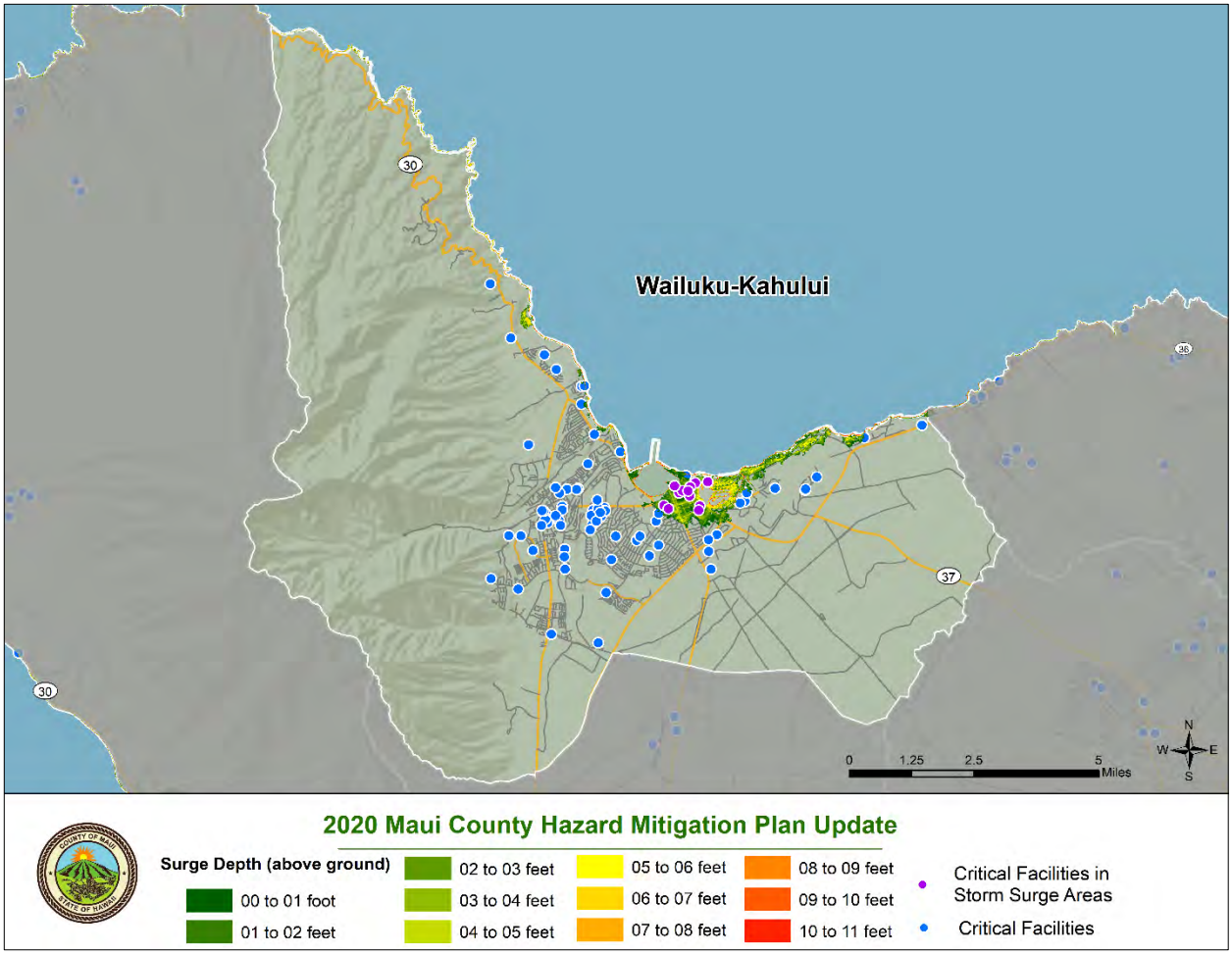

Figure 180. Critical Facilities in Storm Surge Areas in the Wailuku-Kahului Community Planning Area.

In addition to buildings and identified critical facilities, utility lines, roads, and bridges are vulnerable to the impact of hurricanes, tropical storms, and Kona storms. Severe winds associated with these storms can cause damage to communications infrastructure and utility poles, and above ground power lines can be blown down. When utility lines are damaged by hurricanes, functionality of water, sewer, gas, and electricity systems may be compromised. Surges may cause saltwater intrusion into drinking water sources or overwhelm storm sewer systems, which can lead to urban flooding, especially in combination with heavy rainfall. Storm surge may also severely erode or undermine coastal highways and/or bridges. Heavy rains may trigger landslides that block or damage roadways. For instance, during Hurricane Lane, Hāna Highway was blocked in several places due to landslides.

Because of their geographic extent, roads and utility lines can have a greater chance of being impacted by hurricane events. Further, if any section of a road or utility line is damaged or flooded during a hurricane, the entire system may be impacted. For instance, a hurricane that causes one area of a road or a bridge to be impassible may block accessibility to other roads or locations until waters recede,

debris is removed, or in the case of damage (e.g., undermining, scour, or washing out), until repairs can be completed.

Table 59 presents the number of bridges in each community planning area that are within storm surge areas (hurricane categories 1 through 4). Figure 181 and Figure 182 present bridges within wildfire risk areas on the Islands of Maui and Molokaʻi. There are no NBI bridges on the Island of Lānaʻi.

Table 59. Number of NBI Bridges in Maui County Community Planning Areas in Storm Surge Areas.

Community Planning Area	Number of (NBI) Bridges
Hāna	0
Kīhei-Mākena	1
Lānaʻi	N/A
Makawao-Pukalani-Kula	N/A
Molokaʻi	9
Pāʻia-Haʻikū	0
Wailuku-Kahului	1
West Maui	0
MAUI COUNTY TOTAL	**11 (7%)**

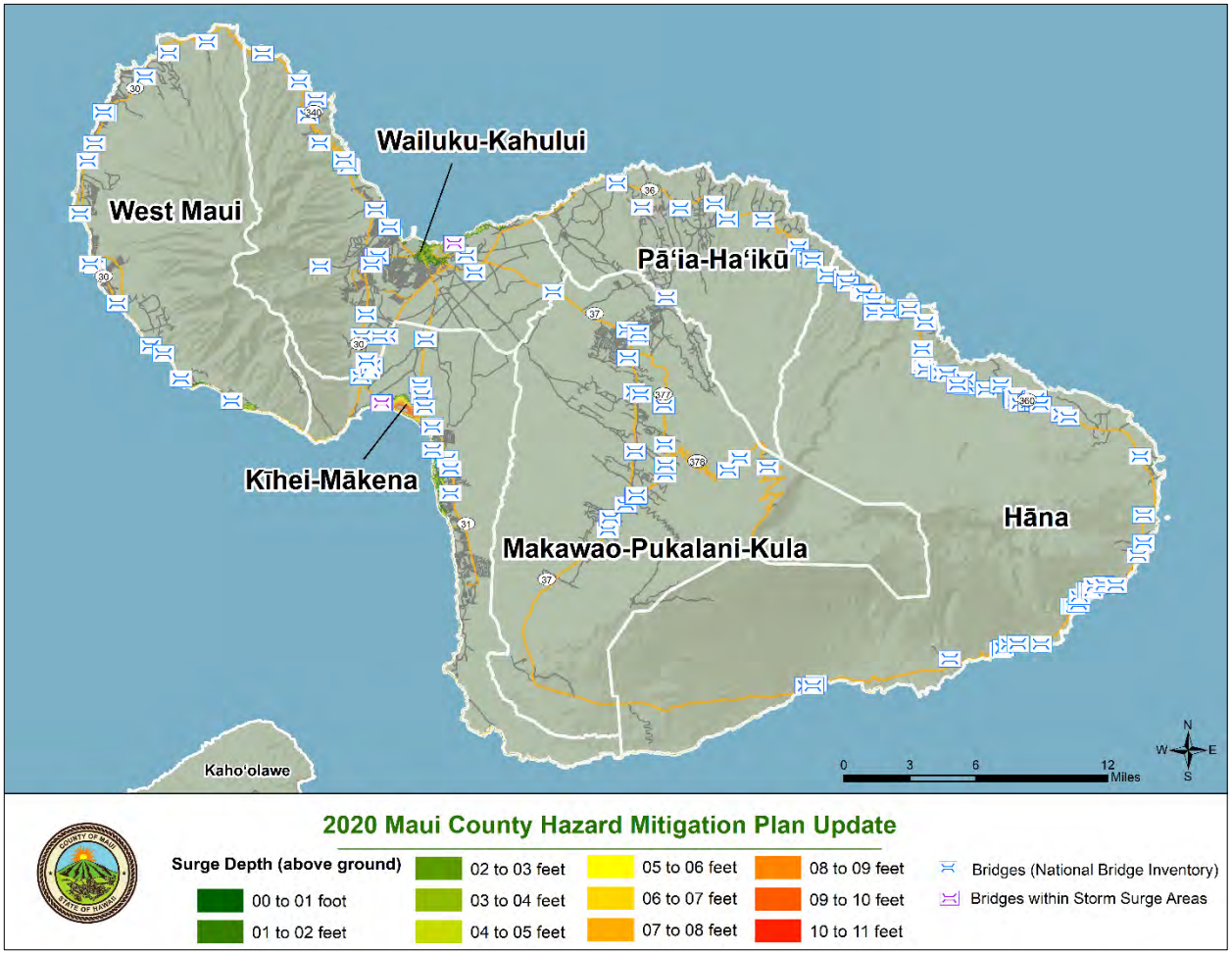

Figure 181. Bridges in Storm Surge Areas on Maui Island.

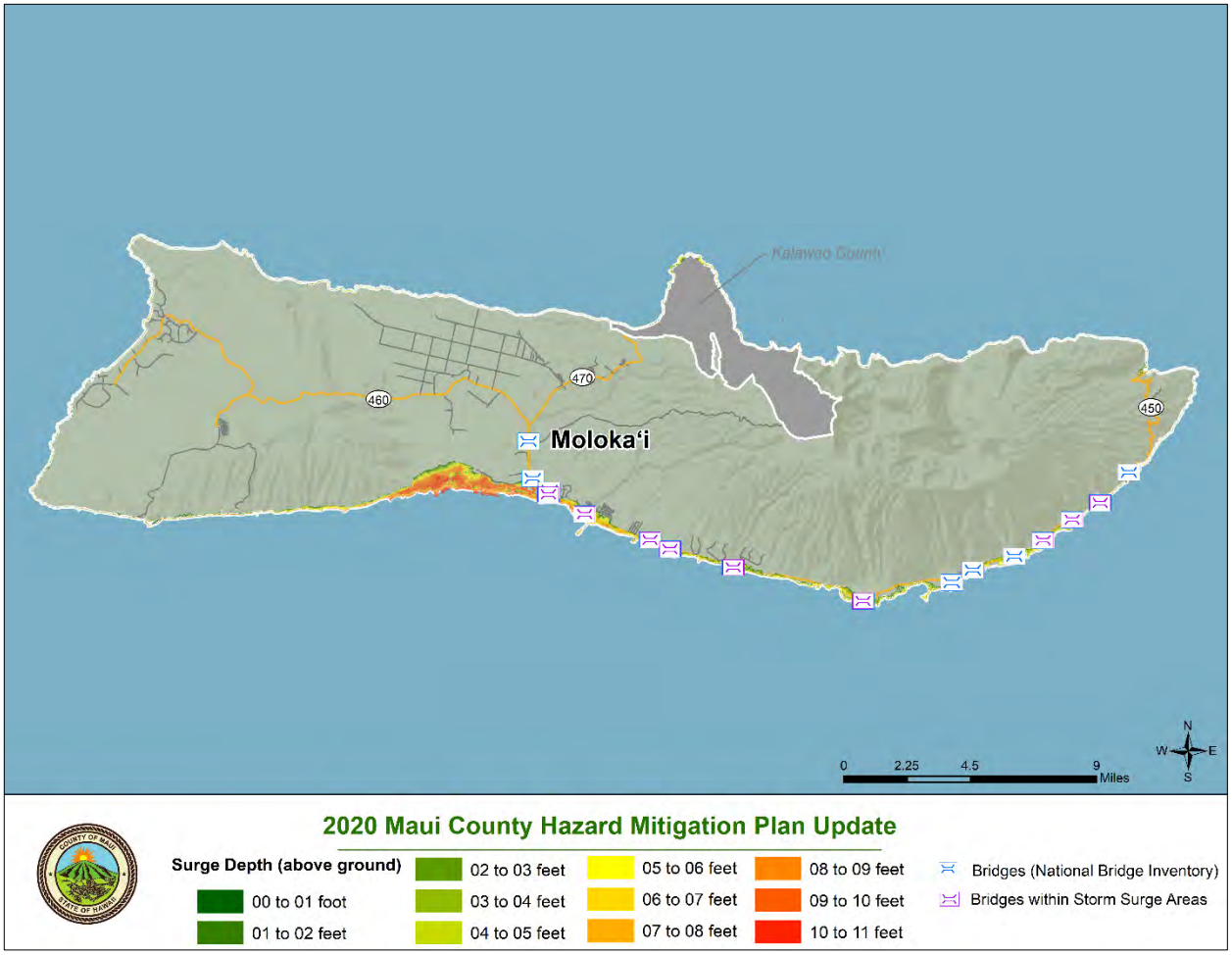

Figure 182. Bridges in Storm Surge Areas on Moloka'i Island.

Further, the maps below show roads, county-owned and others, within storm surge areas. Many roads may have a segment within a potential storm surge area rather than the entire road being within a risk area. Major routes identified as having segments within storm surge areas include Honoapiilani Highway in West Maui, North and South Kīhei Road Kīhei-Mākena, and South Puunene Avenue, Ka'ahumanu Avenue, and Kahului Beach Road in Wailuku-Kahului. On Moloka'i, Maunaloa Highway and Kamehameha V Highway are within storm surge areas with depths of up to 6 feet (Category 4). Kamehameha V Highway is within storm surges areas as it hugs the coast from Kaunakakai in central Moloka'i to Hālawa Beach Park on Moloka'i's eastern tip. Many county-owned local streets are also within surge areas within these planning areas.

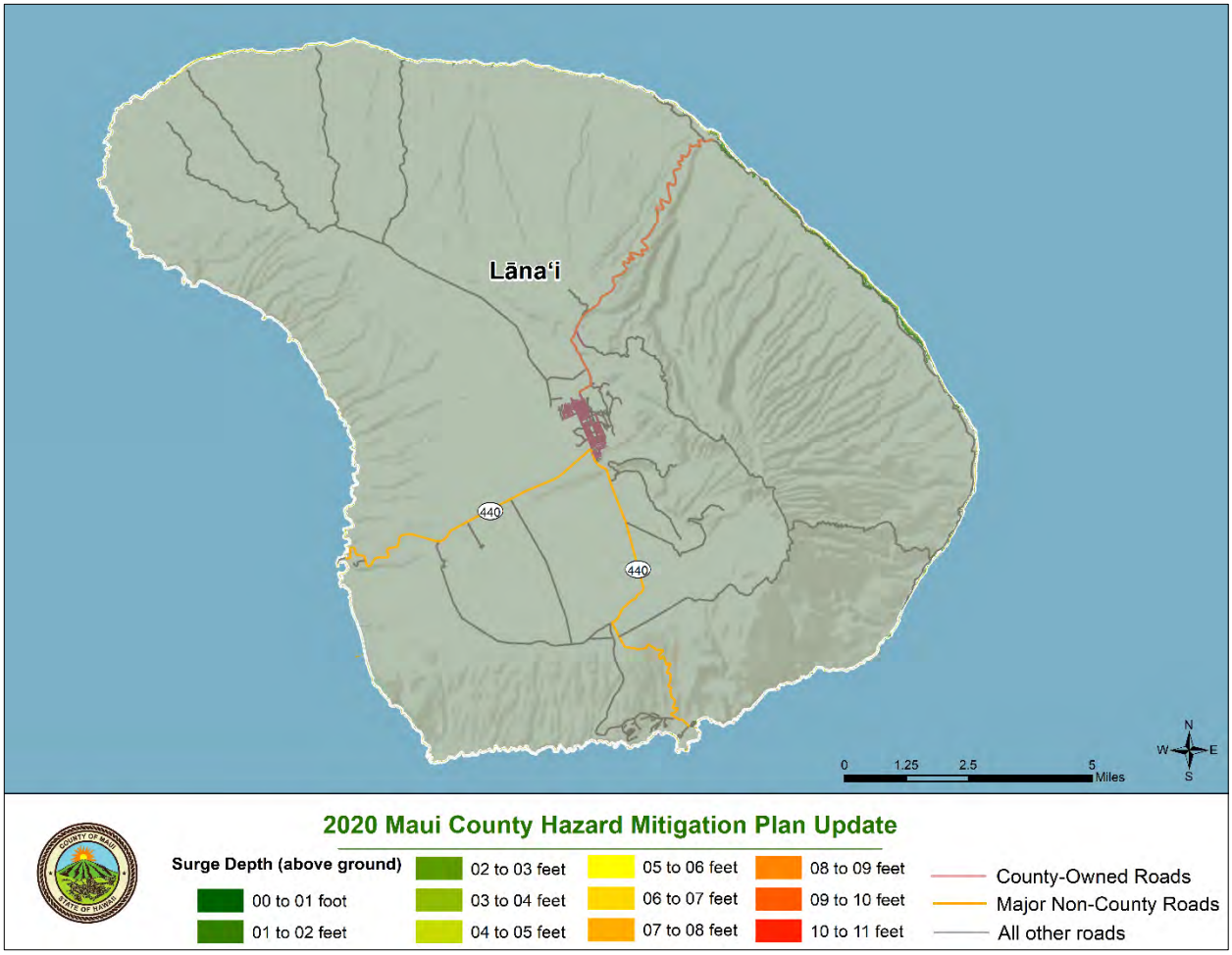

Figure 183. Roads and Storm Surge Areas on Lānaʻi Island.

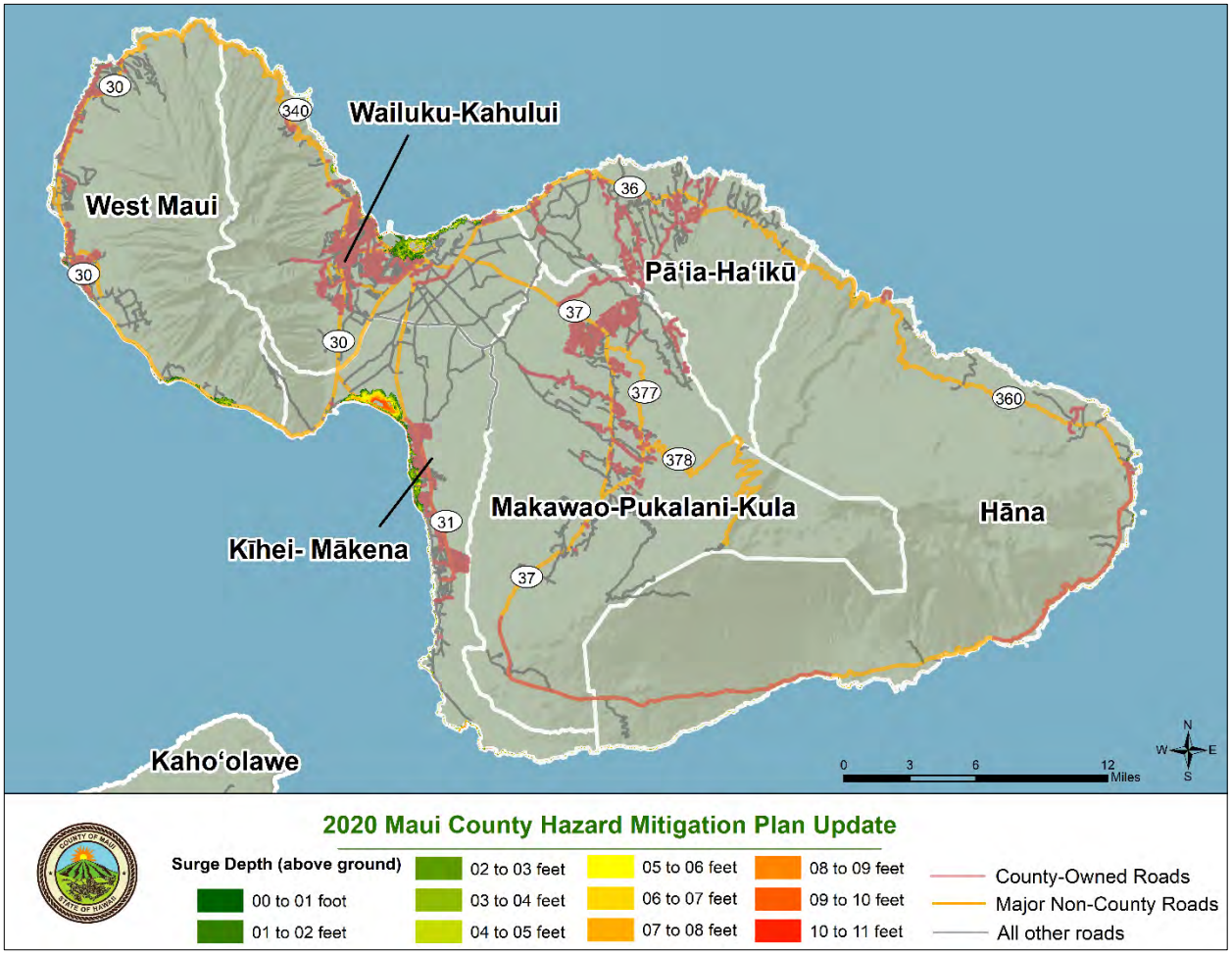

Figure 184. Roads and Storm Surge Areas on Maui Island.

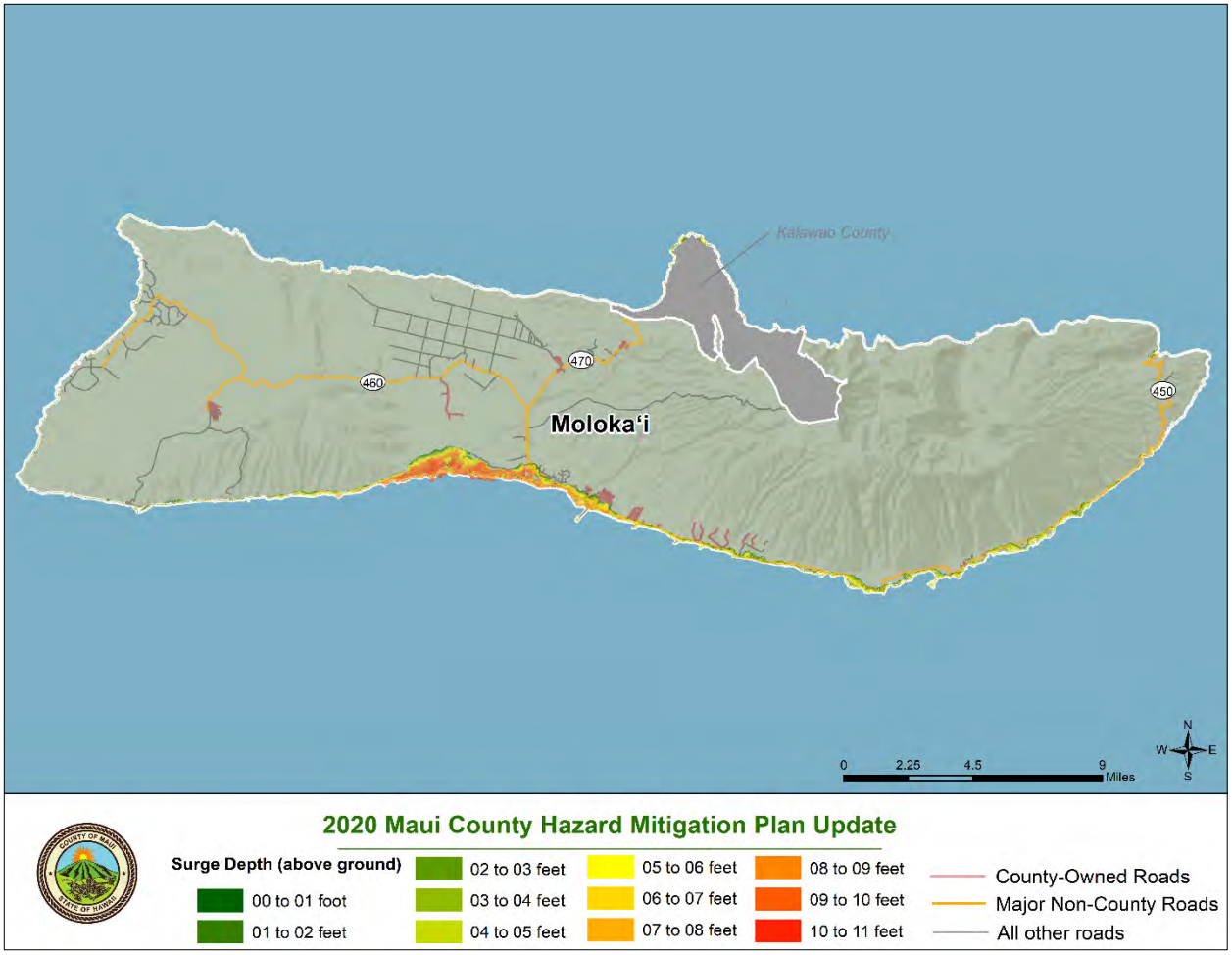

Figure 185. Roads and Storm Surge Areas on Moloka'i Island.

Life Safety, Health, Warning, and Evacuation Impacts

Hurricanes, tropical storms, and Kona storms present serious risks to life safety. Winds, heavy rainfall, and storm surge present risk to drowning, structure collapse, and being struck with fallen trees or wind-driven objects. Powerful surges can turn floating debris into projectiles that can cause injuries, deaths, and property damage. Fires can also ignite from broken gas lines, ruptured tanks, or wildfires fanned by strong winds.[188] Blizzard conditions from Kona storms may trap unprepared hikers at high elevations, such as those at Haleakalā National Park. All populations within Maui County, including residents and visitors, are considered at risk to hurricanes, tropical storms, and Kona storms.

Hurricanes and tropical storms can be closely monitored and tracked. Therefore, accurate warnings are possible within days of an event, and watches may be available up to a week prior to an event as the

[188] International Tsunami Information Center (2020). What are tsunamis, and what causes them? Retrieved from http://itic.ioc-unesco.org/index.php?option=com_content&view=category&layout=blog&id=1004&Itemid=1004.

storm system forms at sea. The National Hurricane Center and Central Pacific Hurricane Center offers watch, warning, and resource products, including:[189]

- **Tropical Cyclone Public Advisories** - Contains a list of all current watches and warnings on a tropical or subtropical cyclone. It also gives the cyclone position in terms of latitude and longitude coordinates and distance from a selected land point or island, as well as the current motion. The advisory includes the maximum sustained winds in miles per hour and the estimated or measured minimum central pressure in millibars and inches. The advisory may also include information on potential storm tides, rainfall or tornadoes associated with the cyclone, as well as any pertinent weather observations.
- **Tropical Cyclone Forecast/Advisory** - Contains a list of all current watches and warnings on a tropical or subtropical cyclone, as well as the current latitude and longitude coordinates, intensity, and system motion. The advisory contains forecasts of the cyclone positions, intensities, and wind fields for 12, 24, 36, 48, 60, and 72 hours from the current synoptic time. The advisory may also include information on any pertinent storm tides associated with the cyclone. All wind speeds in the forecast advisory in given in knots (nautical miles per hour).
- **Tropical Cyclone Discussion** - Explains the reasoning for the analysis and forecast of a tropical or subtropical cyclone. It includes a table of the forecast track and intensity.
- **Tropical Cyclone Surface Wind Speed Probabilities** - Provides probabilities, in percent, of sustained wind speeds equal to or exceeding 34-, 50-, and 64-knot wind speed thresholds. These wind speed probabilities are based on the track, intensity, and wind structure forecasts and uncertainties from the National Hurricane Center and the Central Pacific Hurricane Center and are computed for coastal and inland cities as well as offshore locations (e.g., buoys).
- **Tropical Cyclone Updates** - Issued to inform users of significant changes in a tropical cyclone in between regularly scheduled public advisories.
- **Tropical Weather Outlook** - Discusses significant areas of disturbed weather and their potential for development during the next 5 days, including a categorical forecast of the probability of tropical cyclone formation during the first 48 hours, and during the entire 5-day forecast period. The 48-hour and 5-day probabilities of formation for each disturbance are given to the nearest 10% and expressed in terms of one of the following categories: low probability of development (0-30%), medium probability (40-60%), and high probability of development (70-100%).

Other tools produced by the National Hurricane Center and Central Pacific Hurricane Center include Tropical Cyclone Valid Time Event Codes, Tropical Cyclone Aviation Advisories, Hurricane Local Statements, Monthly Tropical Weather Summaries, and Tropical Cyclone Reports. More information about these products can be found at the National Hurricane Center website.

Hurricane warnings may prompt voluntary or mandatory evacuations ahead of an event, especially in areas vulnerable to storm surge. Shelters may need to be opened to temporarily house evacuees.

[189] NOAA. *NHC Tropical Cyclone Text Product Descriptions*. Retrieved from https://www.nhc.noaa.gov/aboutnhcprod.shtml.

Certain populations, such as those over 65 years, low-income, and disabled may have more difficulty evacuating than others. Impacts on socially vulnerable populations are discussed below.

Unlike hurricanes and tropical storms, Kona storms are more difficult to monitor and track, as forecasting models for Kona storms are not as reliable as those for hurricanes. Further, Kona storms form closer to the Hawaiian Islands which permits less time for tracking. Therefore, warning times for Kona storms may be a few days to a few hours.

Public Health Impacts

Public health impacts from hurricanes, tropical storms, and Kona storms are similar to those of coastal flooding and tsunamis. Aside of direct threats to life and property, hurricanes can result in the contamination of drinking water through saltwater intrusion, inundation of hazardous materials facilities, inundation of wastewater treatment plants, and broken utility or sewer lines. Flood water may contain these hazardous materials and be dangerous to traverse. In estuaries and wetlands, saltwater intrusion endangers the public health, kills vegetation, and can send wildfire fleeing from flooded areas. Further, flooded structures or those with water damage from heavy rainfall may quickly develop mold or wood rot, presenting serious health risks to inhabitants if not treated properly. More information on mold impacts are discussed within the *Flood Vulnerability Assessment*.

Impacts to Vulnerable Populations

All areas within Maui County are exposed to threats associated with hurricane, tropical storm and/or Kona storm hazards, including high winds, flooding and storm surge. All populations may therefore experience one or more of these threats. Those living in low-lying areas, flood plains, along streams and gulches, or in areas along the shoreline are particularly susceptible to flooding associated with tropical cyclones. Community Planning Areas with populations situated near the coast such as West Maui, Kīhei-Mākena, Wailuku-Kahului and Molokaʻi are not only susceptible to flooding and property loss due to storm surge, but as well the run-off from upper elevations due to heavy rainfall.

Molokaʻi has the greatest proportion of total structures potentially exposed to storm surge, while Kīhei-Mākena has the greatest total number of structures in storm surge zones. Additionally, the West Maui Community Planning Area has the potential to experience the greatest losses based on building and content values as a result of flooding. Molokaʻi has the highest overall Vulnerability Index score in Maui County. Kīhei-Mākena ranks sixth, and West Maui ranks third for overall vulnerability.

High winds associated with hurricanes, tropical storms and/or Kona storms have the potential to severely damage homes and critical infrastructure such as roads, power delivery and communication systems. Impacts to homes and lifelines present particular hardships to vulnerable populations who may already experience challenges related to accessing information or services, or adequately preparing their families and protecting their homes. These vulnerable populations may also struggle to recover in a timely manner due to socioeconomic constraints.

Populations exhibiting constraints related to all subcomponents of vulnerability: household composition, socioeconomic status, access to information, housing characteristics and access to lifelines are likely to

experience negative consequences as a result of hurricanes, tropical storms or Kona storms. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are described below under each subcomponent theme.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty with mobilizing and evacuating or taking protective action in a timely fashion during a hurricane. Further, the deaf or hard of hearing may not hear audible hazard watch or warning information. If evacuated, these populations will require additional services and care considerations during sheltering and recovery. Special accommodations for these populations must be considered in disaster planning processes.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a hurricane. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate preparedness actions such as stocking extra food and supplies or establishing a safe room for sheltering in place. Nor would they have the capacity to fund mitigation actions (e.g., purchase hurricane insurance, install hurricane clips) that would protect their homes and property from hurricane impacts. These populations would also be challenged to make necessary repairs to damaged structures.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon hazard warning information. Additionally, those who do not speak English well, may not comprehend hazard warning information to the extent that enables them to make timely preparations and take life-saving actions before and during a hurricane.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living in housing built before 1950, and prior to the enactment of modern building codes, are more susceptible to damages and losses due to structural damage as a result of hurricane impacts, as these structures may be located in floodplains, situated closer to the shoreline than modern setback regulations allow, and lack structural integrity that would allow them to withstand hurricane-force winds. In addition, higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences as a result of hazard exposure.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges during an evacuation, and have difficulty accessing needed supplies and services before and after a hurricane event. Those living in areas with limited road networks could become completely isolated should roadways be blocked or damaged as a result of the high winds, flooding rainfall and coastal inundation associated with hurricanes. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Moloka‘i households also do not have access to a vehicle.

Economic Impacts

Hurricanes, tropical storms, and Kona storms can have wide-reaching economic impacts. Direct economic impacts may result from destroyed buildings and infrastructure, including power utility poles and lines, potable water and wastewater facilities, bridges, and roadways. The force of storm surges may destroy piers, breakwaters, and seawalls. Ships, marinas, and fishing fleets may be battered, sunk, moored, or stranded, impacting the fishing and tourism industries. Confined harbors, especially in combination with storm tides, are vulnerable to surges. Business interruptions can occur, and damages or changes to eroded beaches may impact tourism for periods long after the storm.

Climate Change Impacts

Hurricane and tropical storm frequency and intensity are projected to increase in the central Pacific region under climate warming scenarios. While research is still unclear, this phenomenon may be driven by warmer ocean waters, which feed tropical cyclone development. In addition, hurricane and tropical storm frequency in Maui County is highly variable based on ENSO patterns, as hurricanes are much more likely to impact Hawai‘i during El Niño years. While it is unknown exactly how the timing and intensity of ENSO patterns will change in the future, climate model results indicate a doubling of El Niño and La Niña extremes in the 21st century when compared to the 20th century.[190] Similarly, projected sea level rise combined with storm surges could mean hurricanes impact areas further and further inland over time,

[190] U.S. Global Change Research Program (2018). *Fourth National Climate Assessment. Chapter 27: Hawai’i and U.S.-Affiliated Pacific Islands*. Retrieved from https://nca2018.globalchange.gov/chapter/27/.

and could have impacts from which coastal communities are unable to fully recover.[191] Further, warming ocean trends are known to cause coral bleaching episodes. Coral reefs provide protection against storm surges by forming an offshore barrier that works to dissipate wave energy.

Impacts on Kona storms due to climate change are unknown but, similar to hurricanes, are likely to increase in frequency and intensity.

Landslides

Description

A landslide is the downward and outward movement of slope-forming soil, rock, and vegetation driven by gravity. Both natural and human-induced changes in the environment can trigger landslides. These changes can include heavy rain, rapid snow melt, steepening of slopes due to construction or erosion, earthquakes, volcanic eruptions, and changes in groundwater levels. Landslides can be further categorized into several types of landslides:

- Rock falls are rapid movements of bedrock, which result in bouncing or rolling.
- A topple is a section or block of rock that rotates or tilts before falling to the slope below.
- Slides are movements of soil or rock along a distinct surface of rupture, which separates the slide material from the more stable underlying material.
- Mudflows, sometimes referred to as mudslides, mudflows, lahars, or debris avalanches, are fast-moving rivers of rock, earth, and other debris saturated with water. They develop when water rapidly accumulates in the ground, such as heavy rainfall or rapid snowmelt, changing the soil into a flowing river of mud or "slurry."
- Slurry can flow rapidly down slopes or through channels and can strike with little or no warning at avalanche speeds. Slurry can travel several miles from its source, growing larger as it picks up trees, cars, and other materials along the way. As the flows reach flatter ground, the mudflow spreads over a broad area where it can accumulate in thick deposits.

In areas burned by forest and brush fires, a lower threshold of precipitation may initiate landslides. Some landslides move slowly and cause damage gradually, whereas others move so rapidly that they can destroy property and take lives suddenly and unexpectedly.

Among the most destructive types of debris flows are those that accompany volcanic eruptions. A spectacular example in the United States was a massive debris flow resulting from the 1980 eruptions of Mount St. Helens, Washington. Areas near the bases of many volcanoes in the Cascade Mountain Range of California, Oregon, and Washington are at risk from the same types of flows during future volcanic eruptions.

[191] U.S. Global Change Research Program (2018). *Fourth National Climate Assessment. Chapter 27: Hawai'i and U.S.-Affiliated Pacific Islands*. Retrieved from https://nca2018.globalchange.gov/chapter/27/.

Areas that are generally prone to landslide hazards include previous landslide areas, the bases of steep slopes, the bases of drainage channels, and developed hillsides where leach-field septic systems are used. Areas that are typically considered safe from landslides include areas that have not moved in the past, relatively flat-lying areas away from sudden changes in slope, and areas at the top or along ridges set back from the tops of slopes.

According to USGS, each year landslides cause nearly $6.5 billion (2017 dollars) in damage and between 25 and 50 deaths in the United States.[192]

Location

Landslides occur along steep slopes when the pull of gravity can no longer be resisted. Heavy rain, especially on wildfire-scarred land where the ground is unstable due to vegetation loss, often catalyzes a landslide event. Human development can also exacerbate risk by building on previously undevelopable steep slopes and constructing roads by cutting through mountains. Maui Island is comprised of two mountainous area – Haleakalā in the southeast and the West Maui Mountains in the northwest. The Islands of Lānaʻi and Molokaʻi also contain steep slopes associated with mountain ranges and extinct shield volcanoes. While susceptibility to landslides varies throughout the county, landslides are possible throughout the planning area.

Figure 186 shows landslide susceptibility across Maui County (maps showing county structure and critical facility exposure to landslide susceptibility at a closer scale are provided in the *Vulnerability Assessment* section of this profile). Susceptibility is categorized into three classes – "very high," "high," or "moderate." This data shows the susceptibility of a landslide originating in an area, not necessarily where a landslide will deposit.[193]

It should be noted that landslides, especially shallow ones like rock falls and debris slides, can occur outside of areas categorized as susceptible on the landslide map.

[192] United States Geological Survey (USGS) (2005). United States Department of the Interior. "Landslide Hazards – A National Threat."

[193] USGS (2018). P*reliminary Landslide Susceptibility Maps and Data for Hawai'i*. Retrieved from https://www.usgs.gov/natural-hazards/landslide-hazards/science/preliminary-landslide-susceptibility-maps-and-data-Hawai'i?qt-science_center_objects=0#qt-science_center_objects.

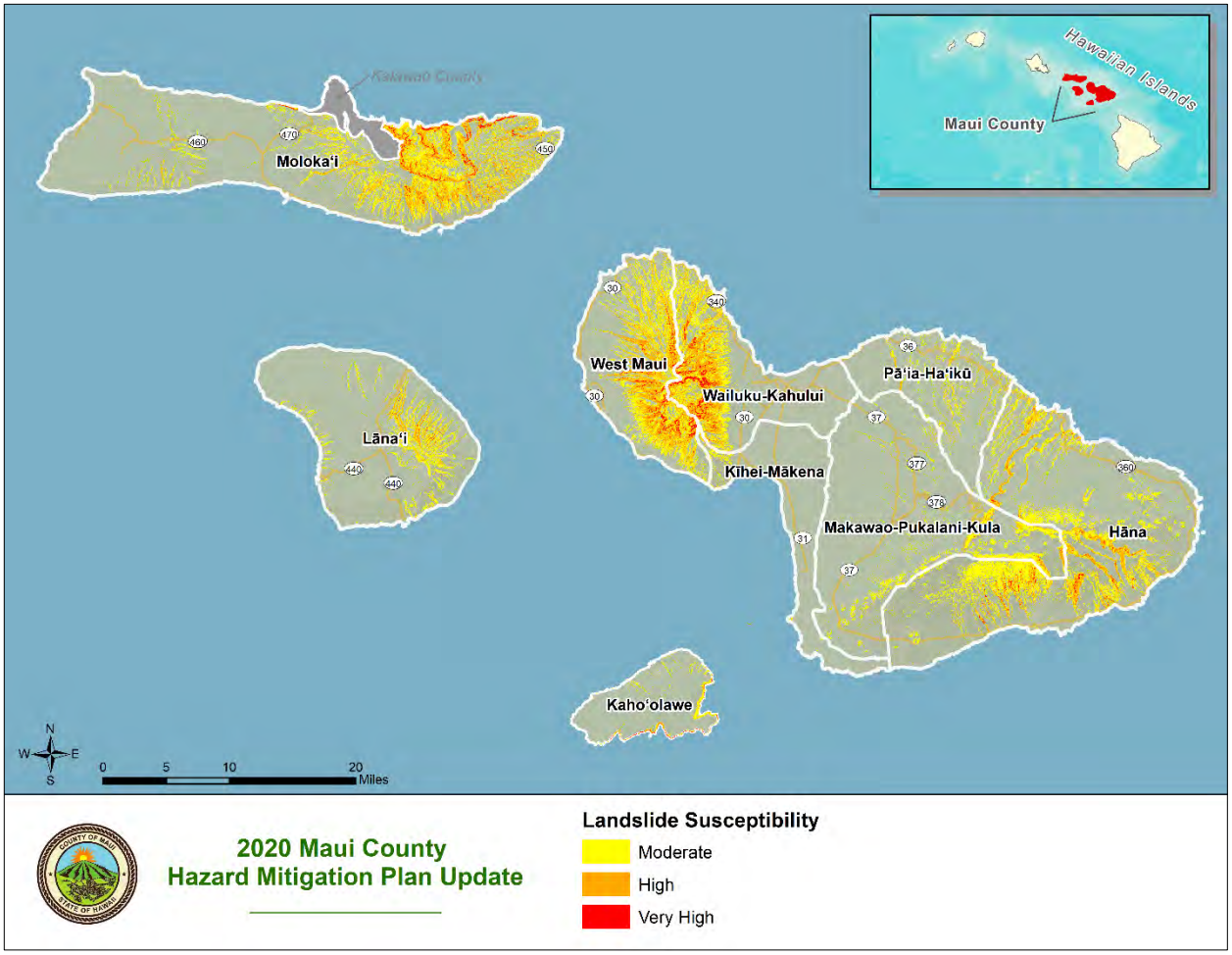

Figure 186. Landslide Susceptibility in Maui County.

Previous Occurrences

Previous landslide occurrences were gleaned from previous plans, the NCEI Storm Events Database, previous disaster declarations, and local news sources. In all, 15 landslide events were reported in Maui County between 2004 and May 2020. While all community planning areas have been impacted by landslides, the Hāna community planning area was most effected, with 12 of the 15 events impacting the community planning area. The table below provides details for these events. It is possible that events have occurred that were not reported.

Table 60. Previous Landslide Events in Maui County.

Date	Source	Community Planning Area(s)	Description
09/14/2004	2015 Maui County Hazard	Hāna	A female ranger at Haleakalā National Park was fatally injured while trying to clear a rockslide on Piilani Highway (State Highway 31) near Kipahulu. The ranger was on duty when she was hit by a

Date	Source	Community Planning Area(s)	Description
	Mitigation Plan		falling rock from the nearby hillside while removing rocks on the narrow road.
10/15/2006	2015 Maui County Hazard Mitigation Plan	Hāna; Kīhei-Mākena	Rockfalls occurred throughout Maui County as a result of shaking from the Kiholo Bay and Mahukona earthquakes. Rockfall debris on the highway at the Kalepa cliffs near Manawainui and a bridge closure at Paihi cut off 500 Maui residents until a temporary steel truss bridge was constructed in late November. A few days after the opening of the temporary bridge, new rockfalls at Kalepa closed the highway again. In the vicinity of Kaupo and Kipahulu a 10-mile stretch of road was undermined and blocked to traffic due to another rockfall. The road did not reopen until October 2008 – nearly 2 years after the earthquakes. At Mākena State Park, 10 rockfalls occurred along the rocky coastal cliffs, impacting Black Sand Beach, Big Beach, and Small Beach.
11/05/2007	2015 Maui County Hazard Mitigation Plan	Moloka‘i	Heavy rains resulted in rockfalls and debris flows along different portions of Kamehameha V Highway (State Highway 450) on the east side of the Island of Moloka‘i.
12/01/2007	2015 Maui County Hazard Mitigation Plan; Disaster Declaration	Kīhei-Mākena; West Maui; Makawao-Pukalani-Kula	A strong Kona storm hit the Island of Maui causing runoff induced debris flows across several roads and highways. In the Kīhei area, runoff from gathering from the slopes of Haleakalā volcano pushed boulders and debris onto Highway (State Highway 31) forcing temporary closure of the road. Similarly, debris was carried across portions of Honoapiilani Highway (State Highway 30) near Napili. The storm also generated debris flows in the Kula region of upcountry Maui. Mud, rocks, and loosen vegetation were carried across Lower Kula Road. A debris flow across Polipoli Road included remains of a private residence and forced the closure of the road for several days until county crews removed all the debris. A disaster was declared for this event.
03/21/2009	2015 Maui County Hazard Mitigation Plan	Hāna	A mudslide on northeast Maui forced the closure of the Hāna Highway (State Highway 360). The incident occurred near mile-post 21. State and county public works crews cleared the mud and debris using heavy equipment. The highway reopened 5 hours after the mudslide. The areas had not been previously identified as a potential slide problem area.
04/23/2009	2015 Maui County Hazard Mitigation Plan	Hāna; Wailuku-Kahului	Hāna Highway closed in both directions between mile-post 19 near the Wailua lookout and mile-post 21 due to a debris and rock falls. The cleanup work was postponed for several days due to unsafe conditions. Another rockfall occurred on Kahekili Highway (State Highway 340). The rockfall resulted in large boulders blocking the highway near Waihale Gulch.
03/03/2012	Disaster Declaration	All	Landslides and flooding occurred during a severe storm event. In total, this event resulted in over $3 million in damages.

Date	Source	Community Planning Area(s)	Description
05/03/2014	2015 Maui County Hazard Mitigation Plan	Hāna	Hāna Highway, near mile-post 14.8 on the Kahului side of Ke'anae, succumbed to a large landslide that spanned 100 feet and was an estimated 20 feet in height. Approximately 2,000 cubic yards of mud and debris from the landslide were cleared.
03/01/2015	2015 Maui County Hazard Mitigation Plan	Hāna	Winter weather caused landslides on roads heading to eastern Maui.
09/11/2016	Disaster Declaration	All	Severe Storms resulted in flooding, landslides, and mudslides. This event resulted in almost $4 million in damages.
08/26/2018	Maui Now[194]	Hāna	Multiple landslides were reported along Hāna Highway in East Maui at mile markers 10, 21, and 23.
09/12/2018	KITV4 Island News[195]; NCEI Storm Events Database	Hāna	Moisture from Tropical Storm Olivia caused a landslide that closed both directions of traffic on Hāna Highway near Honomanu.
02/19/2019	Maui Now[196]	Hāna	Heavy rains caused a landslide that closed Hāna Highway at mile marker 11.
02/26/2019	The Star-Advertiser[197]	West Maui	Heavy rains led to landslides on Pali Highway and caused extensive damage to the portion of Honoapiilani Highway (Route 30) between mile markers 36 and 42.
05/04/2020	The Maui News[198]	Hāna	A landslide blocked one lane of Hāna Highway near Kipahulu. Repairs are estimated at $835,000 and are not expected to be completed until September 2020.

[194] Maui Now (2018). Traffic Alert: *Multiple landslides on Hāna Highway*. Retrieved from https://mauinow.com/2018/08/26/traffic-alert-multiple-landslides-on-hana-highway/.
[195] Schweizer, Laura (2018). *Hāna Hwy closed in both directions due to landslide*. ABC KITV4 Island News. Retrieved from https://www.kitv.com/story/39077626/hana-hwy-closed-in-both-directions-due-to-landslide.
[196] Maui Now (2019). *Landslides along Maui's Hāna Highway cleared*. Retrieved from https://mauinow.com/2019/02/19/landslides-along-mauis-hana-hwy-cleared/.
[197] The Star-Advertiser (2019). *State declares portion of Maui Highway a disaster area after landslides*. Retrieved from https://www.staradvertiser.com/2019/02/26/Hawai'i-news/state-declares-portion-of-maui-highway-a-disaster-area-after-landslides/.
[198] The Maui News (2020). *Landslide repairs in Kipahulu start*. Retrieved from https://www.mauinews.com/news/local-news/2019/07/landslide-repairs-in-kipahulu-start/.

Boulders from the February 2019 rockfall block Honoapiilani Highway
Source: Hawai'i DOT

Debris blocks Hāna Highway from an August 2018 Landslide Event
Source: Maui Now

Figure 187 Rockfall and Landslide Pictures

Extent

Extent can be defined using a variety of measures including the USGS Landslide Susceptibility classifications for the State of Hawai'i. Landslide size can also be used. For the USGS measure, the greatest extent possible is "very high susceptibly." The highest category present in Maui County is "very high" susceptibility. Lastly, landslide extent can be measured in terms of size (width of slide or tonnage of debris generated). This data was reported for one of the recorded landslides. This was the May 2014 event on Hāna Highway, which reported a landslide 100 feet long and 20 feet high, which resulted in 2,000 cubic yards of debris being cleared. Larger, more severe landslide events are possible.

Probability of Future Events

With 15 landslide events occurring in Maui County in the last 16 years, the county experiences roughly one landslide event each year. As landslides are often caused by intense rainfall events or wildfires, the frequency of landslides is often related to the frequency of these other hazards. Therefore, landslide occurrences may increase with climate change as the frequency of intense storms and droughts, which can contribute to wildfire frequency, also increase. Within Maui County, certain community planning

areas are more likely to experience landslides than others. The table below presents landslide probabilities for each community planning area.

Table 61. Landslide Probabilities for Maui County Community Planning Areas.

Community Planning Area	Landslide Probability
Hāna	Highly Likely (greater than 90% annual chance)
Kīhei-Mākena	Likely (10% to 90% annual chance)
Lānaʻi	Possible (1% to 10% annual chance)
Makawao-Pukalani-Kula	Likely (10% to 90% annual chance)
Molokaʻi	Likely (10% to 90% annual chance)
Pāʻia-Haʻikū	Likely (10% to 90% annual chance)
Wailuku-Kahului	Likely (10% to 90% annual chance)
West Maui	Likely (10% to 90% annual chance)

Vulnerability

All current and future buildings, infrastructure, and populations on or at the base of steep slopes, especially those in mapped landslide susceptibility areas, are considered at risk to landslides. Specific impacts to buildings, infrastructure, socially vulnerable populations, life safety, public heath, and the economy from landslide hazards are described below. Climate-related impacts on landslides are also described.

Building and Infrastructure Impacts (including Critical Facilities)

All current and future buildings and infrastructure, including critical facilities, located within or downslope of landslide susceptibility areas are considered at risk to landslide. Landslides directly damage structures by disrupting structural foundations caused by deformation of the ground upon which the structure sits, and by the physical impact of debris moving down-slope against structures located in the travel path. As a landslide breaks away from a slope and moves, it deforms the ground into an uneven surface.

When situated on top of a landslide, the deformation distresses structural foundations and the structures themselves by settlement, cracking, and tilting. This can occur slowly, over years, or rapidly within days/hours. A water-saturated, fast-moving debris flow (or “mudslide”) can destroy all in its path, collapsing walls and shifting structures off their foundations.

USGS has mapped landslide susceptibility for the State of Hawaiʻi. GIS analysis was used to determine buildings and infrastructure within susceptible areas, using USGS data, building footprints, critical facilities data, and parcel data from county tax assessor records.

For buildings, the determination of assessed value at-risk (exposure) was calculated by summing the total assessed building values for building footprints that were confirmed to be located within or partially within identified landslide susceptibility areas. The number of parcels, building footprints, and

their associated value are presented by community planning area in Table 62. This is an approximate analysis for planning purposes. This analysis does not account for building elevations or other protections.

Table 62. Potentially At-Risk Parcels, Buildings, and Improvement Value in Tsunami Evacuation Areas.

Landslide Susceptibility	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Hāna								
Very High	96	5%	0	0%	$0	$0	$0	0%
High	286	14%	10	1%	$2,540,727	$1,270,364	$3,811,091	1%
Moderate	656	32%	39	2%	$6,523,999	$3,262,000	$9,785,999	3%
TOTAL	**1,038**	50%	**49**	**3%**	**$9,064,726**	**$4,532,364**	**$13,597,090**	4%
Kīhei-Mākena								
Very High	1	0%	0	0%	$0	$0	$0	0%
High	19	0%	0	0%	$0	$0	$0	0%
Moderate	254	1%	2	0%	$7,364,900	$3,682,450	$11,047,350	0%
TOTAL	**274**	2%	**2**	**0%**	**$7,364,900**	**$3,682,450**	**$11,047,350**	0%
Lānaʻi								
Very High	1	0%	0	0%	$$0	$0	$0	0%
High	4	0%	0	0%	$$0	$0	$0	0%
Moderate	23	2%	1	0%	$44,708	$22,354	$67,062	0%
TOTAL	**28**	2%	**1**	**0%**	**$44,708**	**$22,354**	**$67,062**	0%
Makawao-Pukalani-Kula								
Very High	7	0%	0	0%	$0	$0	$0	0%
High	193	2%	8	0%	$1,242,807	$621,403	$1,864,210	0%
Moderate	1,376	14%	251	2%	$57,718,440	$28,859,221	$86,577,661	2%
TOTAL	**1,576**	16%	**259**	**2%**	**$58,961,247**	**$29,480,624**	**$88,441,871**	2%
Molokaʻi								
Very High	101	2%	0	0%	$0	$0	$0	0%
High	319	5%	5	0%	$341,100	$170,550	$511,650	0%
Moderate	790	13%	25	0%	$7,109,100	$3,554,550	$10,663,650	1%
TOTAL	**1,210**	20%	**30**	**0%**	**$7,450,200**	**$3,725,100**	**$11,175,300**	1%
Pāʻia-Haʻikū								
Very High	29	1%	1	0%	$375,816	$187,908	$563,724	0%
High	302	6%	12	0%	$4,587,102	$2,293,551	$6,880,653	0%
Moderate	1,602	30%	332	4%	$66,204,673	$33,102,327	$99,307,000	5%
TOTAL	**1,933**	37%	**345**	**5%**	**$71,167,591**	**$35,583,786**	**$106,751,377**	5%
Wailuku-Kahului								
Very High	31	0%	0	0%	$0	$0	$0	0%
High	153	1%	10	0%	$3,995,729	$1,997,864	$5,993,593	0%

Landslide Susceptibility	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Moderate	948	5%	275	2%	$89,424,190	$44,712,096	$134,136,286	2%
TOTAL	**1,132**	6%	**285**	2%	**$93,419,919**	**$46,709,960**	**$140,129,879**	2%
West Maui								
Very High	52	0%	0	0%	$0	$0	$0	0%
High	265	1%	0	0%	$0	$0	$0	0%
Moderate	1,219	7%	30	0%	$169,864,345	$84,932,173	$254,796,518	3%
TOTAL	**1,536**	8%	**30**	0%	**$169,864,345**	**$84,932,173**	**$254,796,518**	3%
MAUI COUNTY TOTAL	**8,727**	**48%**	**1,001**	**16%**	**$417,337,636**	**$208,668,811**	**$626,006,447**	**3%**

All community planning areas have some vulnerability to landslide hazards in terms of building exposure. The data in the table above indicates that buildings in several community planning areas have greater vulnerability to landslides than others. With 345 buildings, Pāʻia-Haʻikū has the most buildings within landslide susceptibility areas, as well as the highest proportion of buildings (5%) and building value (5%) within susceptible areas. In all, there are 1,001 buildings within or partially within landslide susceptibility areas in Maui County, with an estimated value of approximately $626 million.

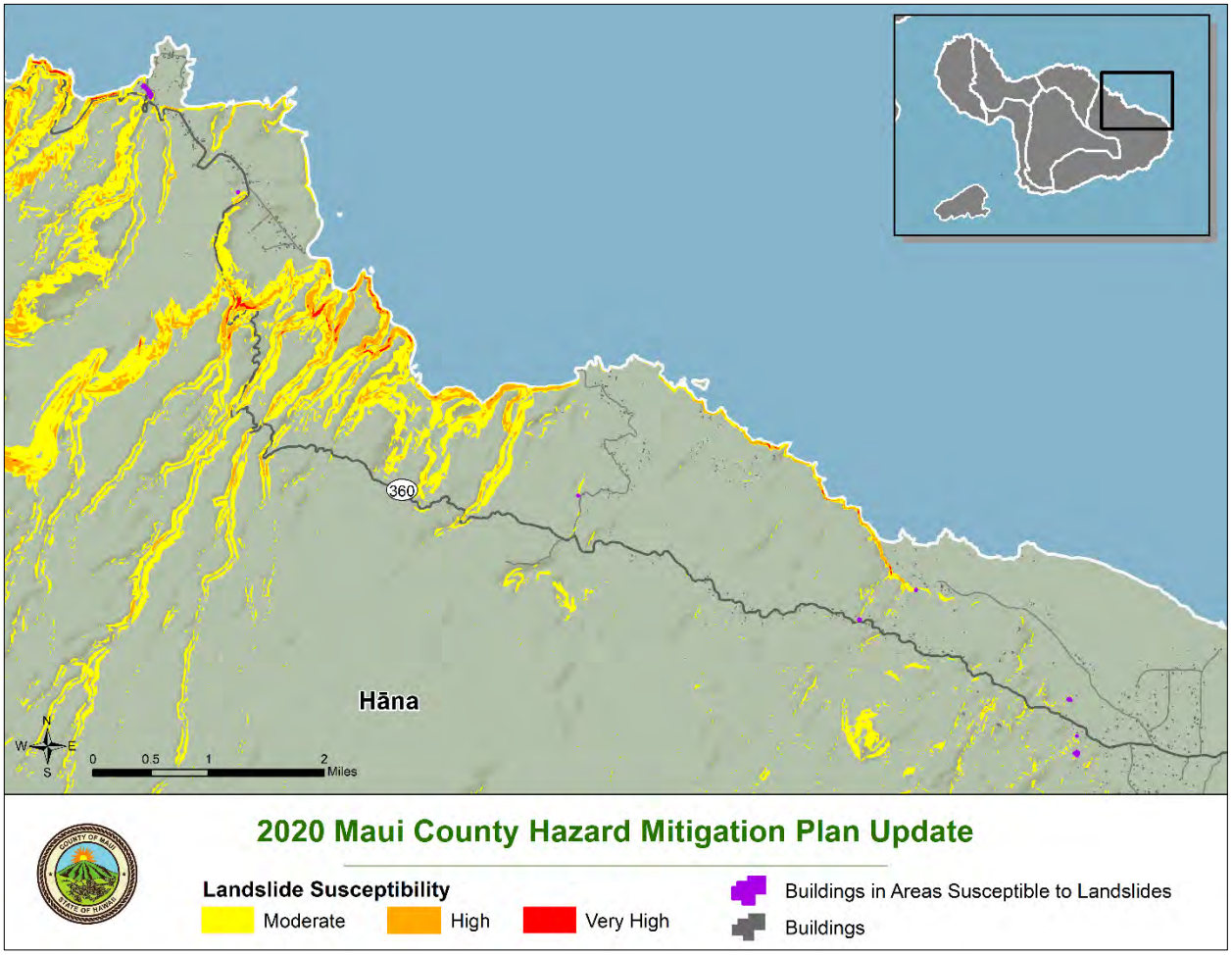

Figure 188. Buildings in Areas Susceptible to Landslides in the Northern Hāna Community Planning Area.

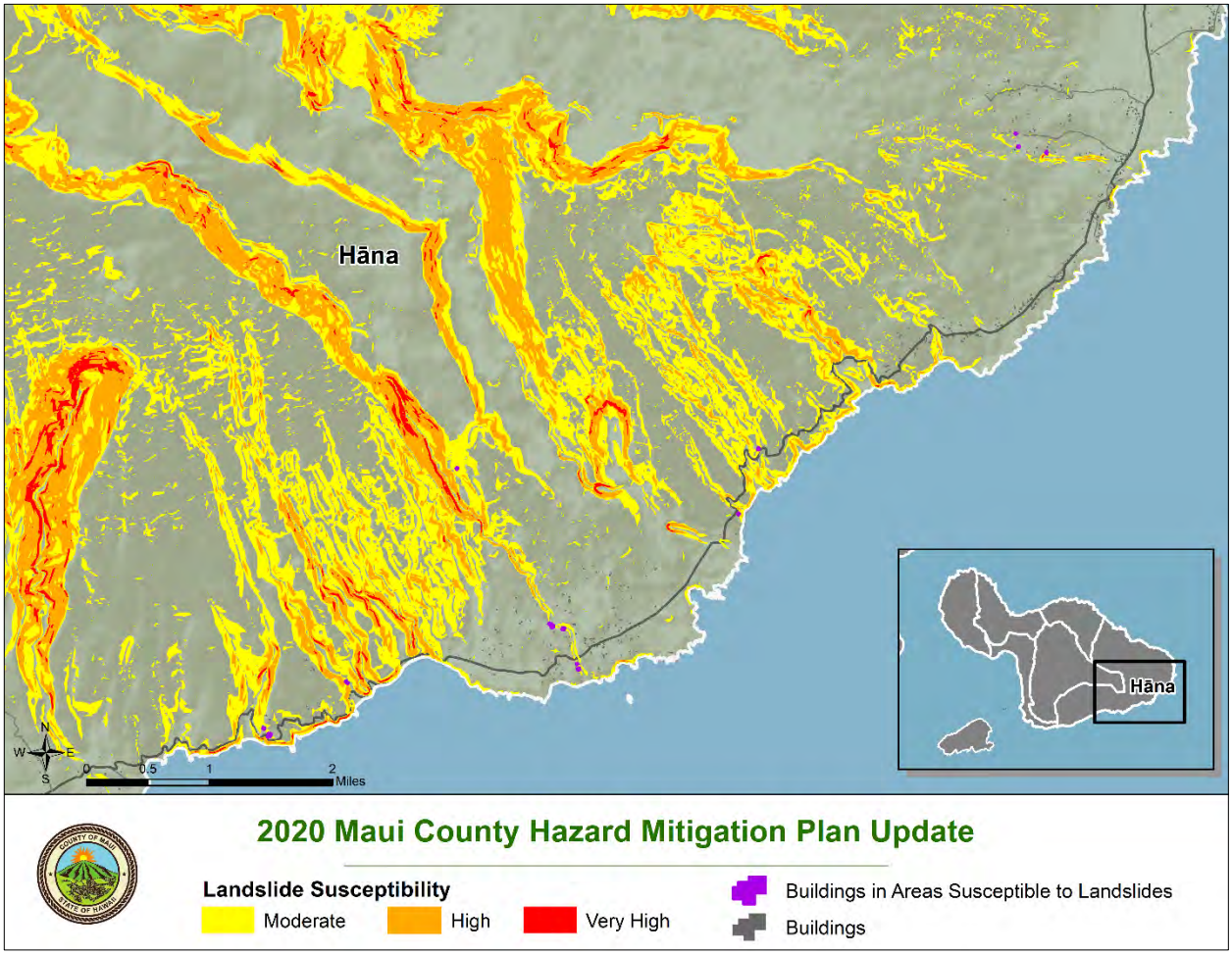

Figure 189. Buildings in Areas Susceptible to Landslides in the Southern Hāna Community Planning Area.

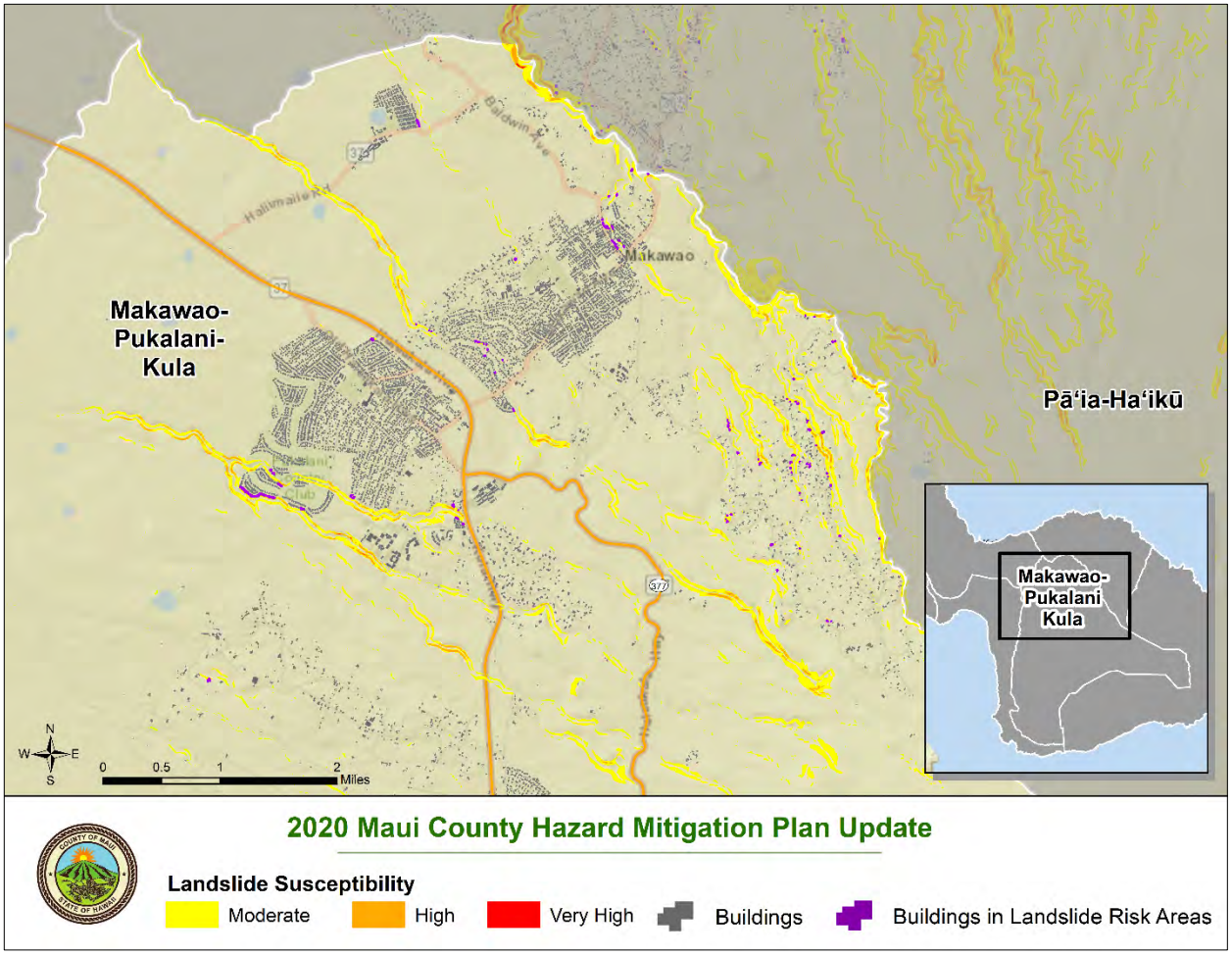

Figure 190. Buildings in Areas Susceptible to Landslides in the Northern Makawao-Pukalani-Kula Community Planning Area.

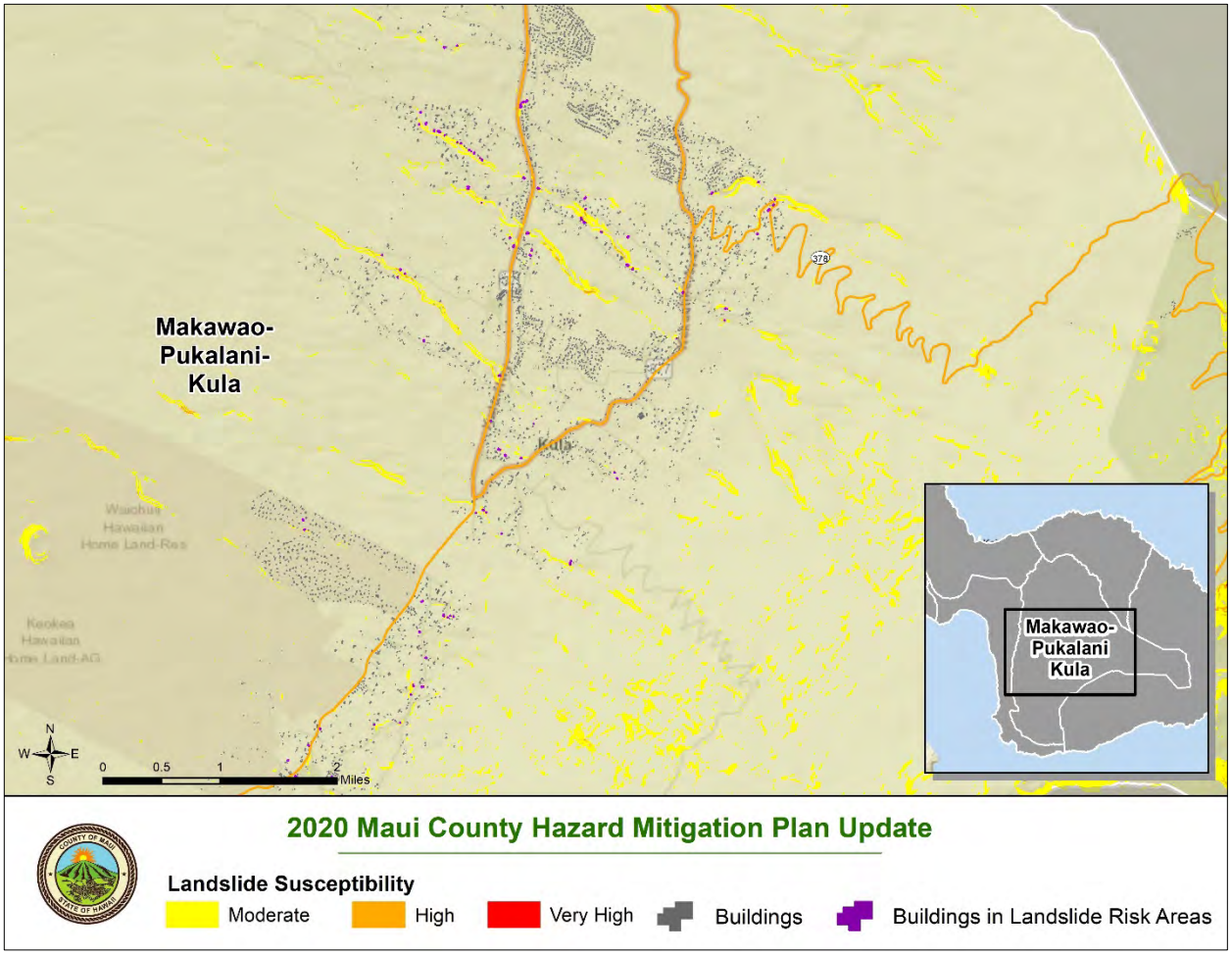

Figure 191. Buildings in Areas Susceptible to Landslides in the Southern Makawao-Pukalani-Kula Community Planning Area.

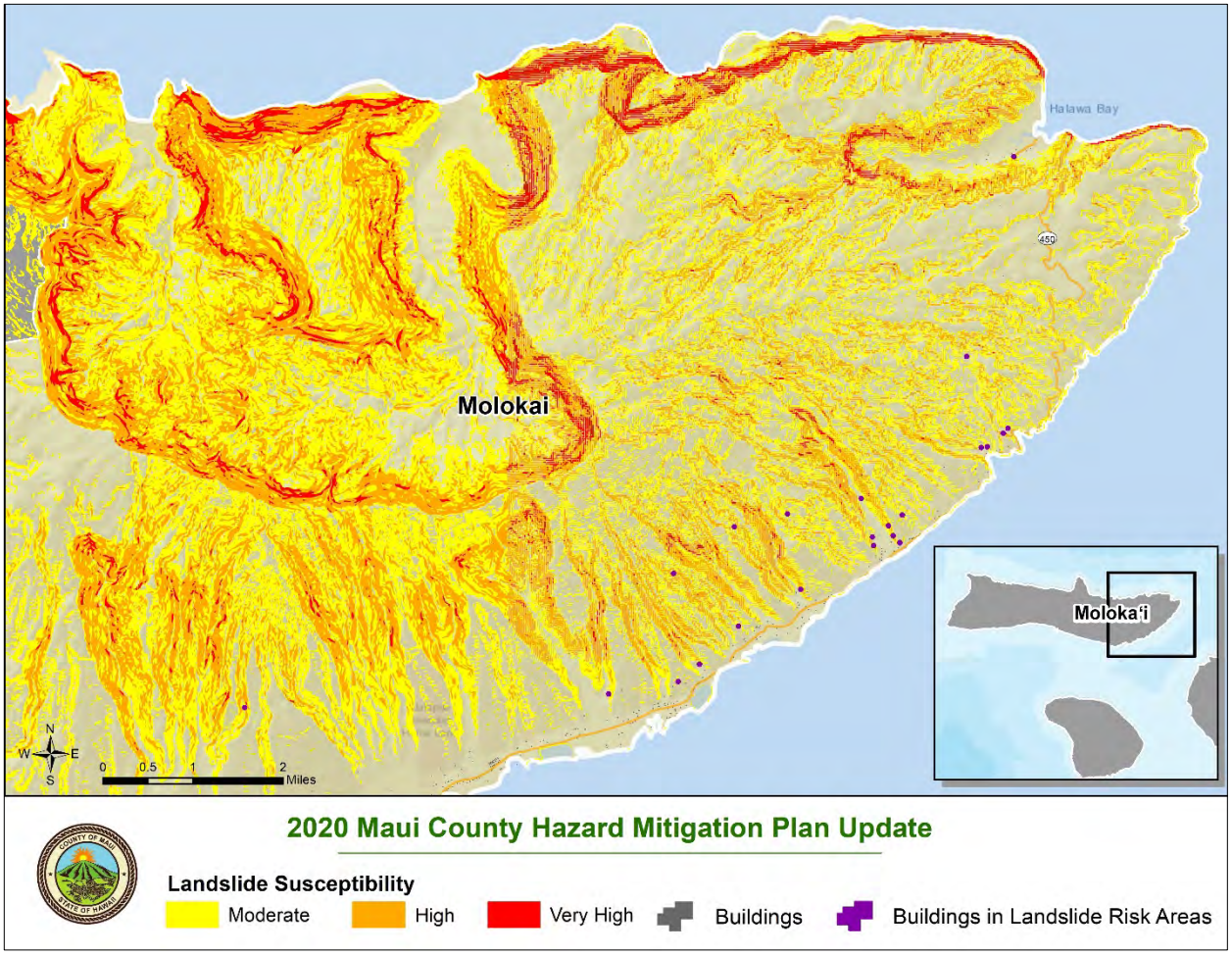

Figure 192. Buildings in Areas Susceptible to Landslides in the Eastern Moloka'i Community Planning Area.

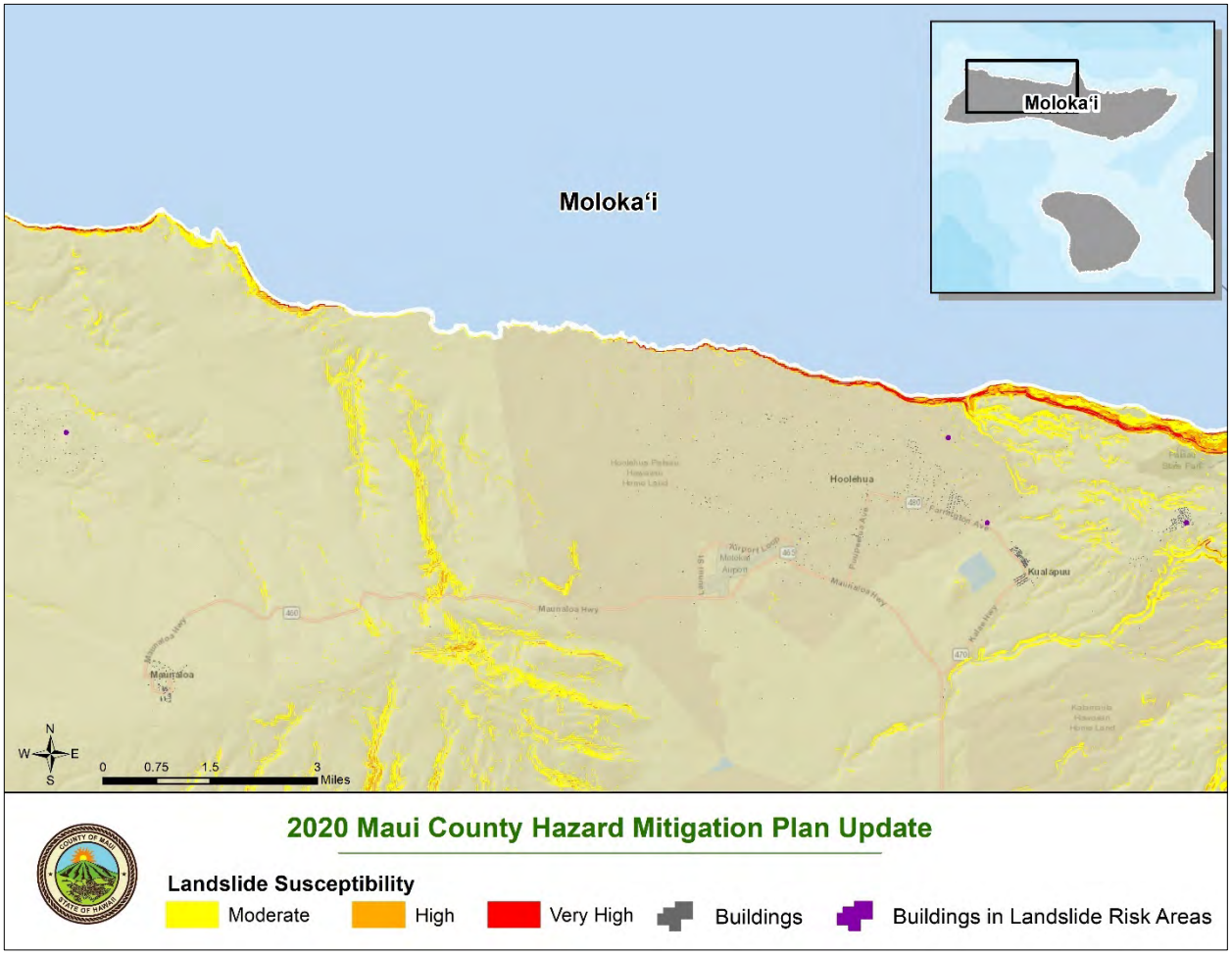

Figure 193. Buildings in Areas Susceptible to Landslides in the Western Moloka'i Community Planning Area.

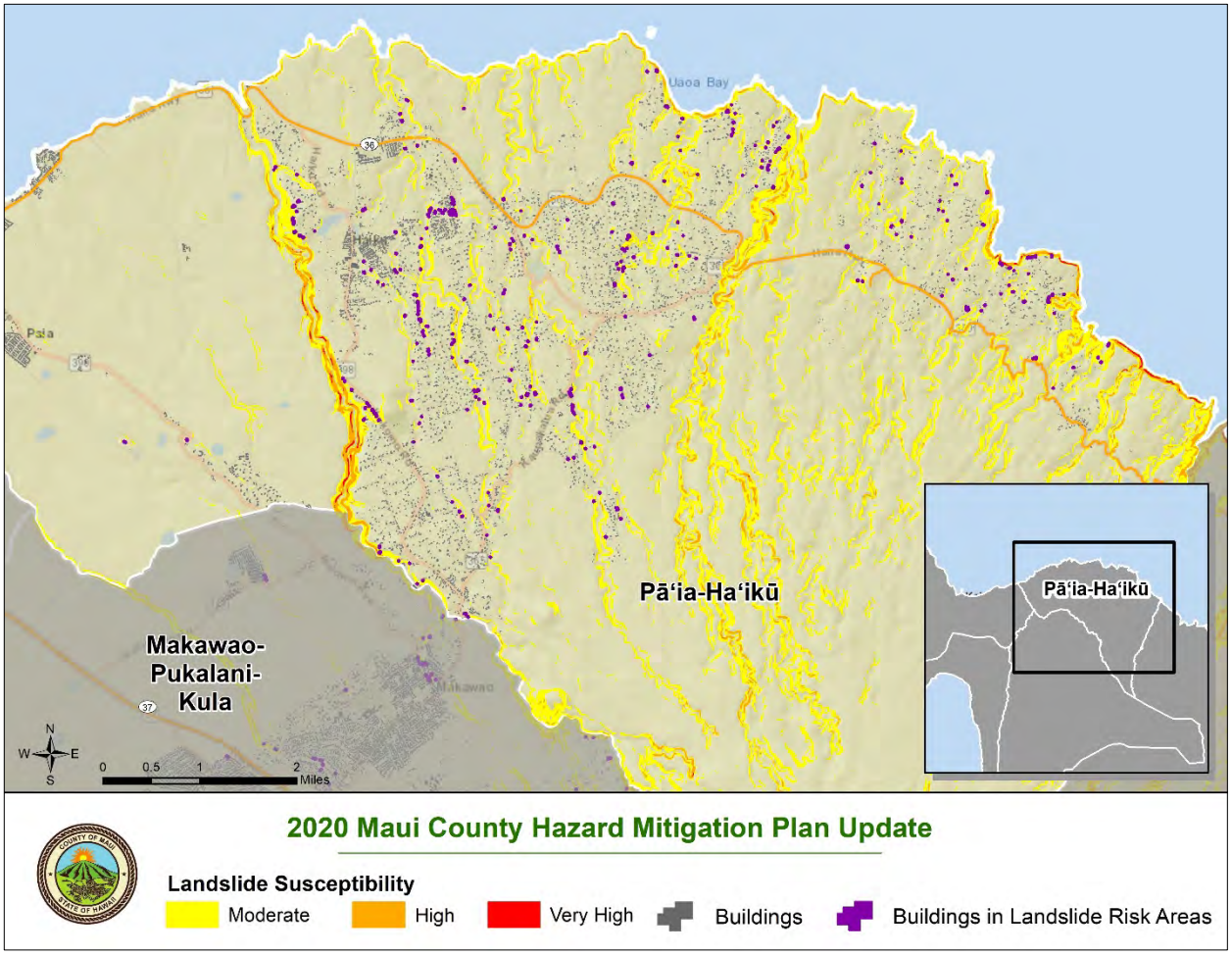

Figure 194. Buildings in Areas Susceptible to Landslides in the Pāʻia-Haʻikū Community Planning Area.

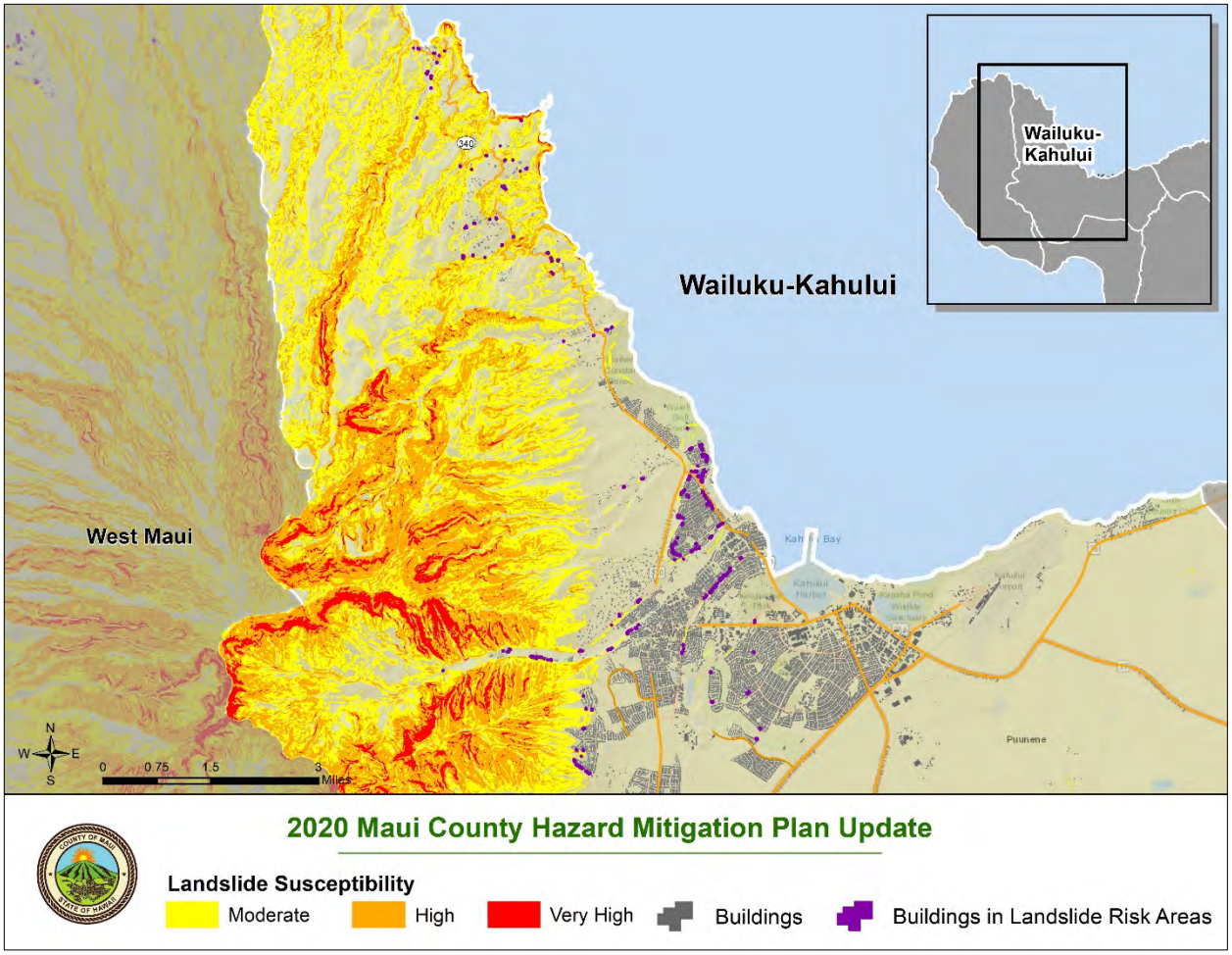

Figure 195. Buildings in Areas Susceptible to Landslides in the Wailuku-Kahului Community Planning Area.

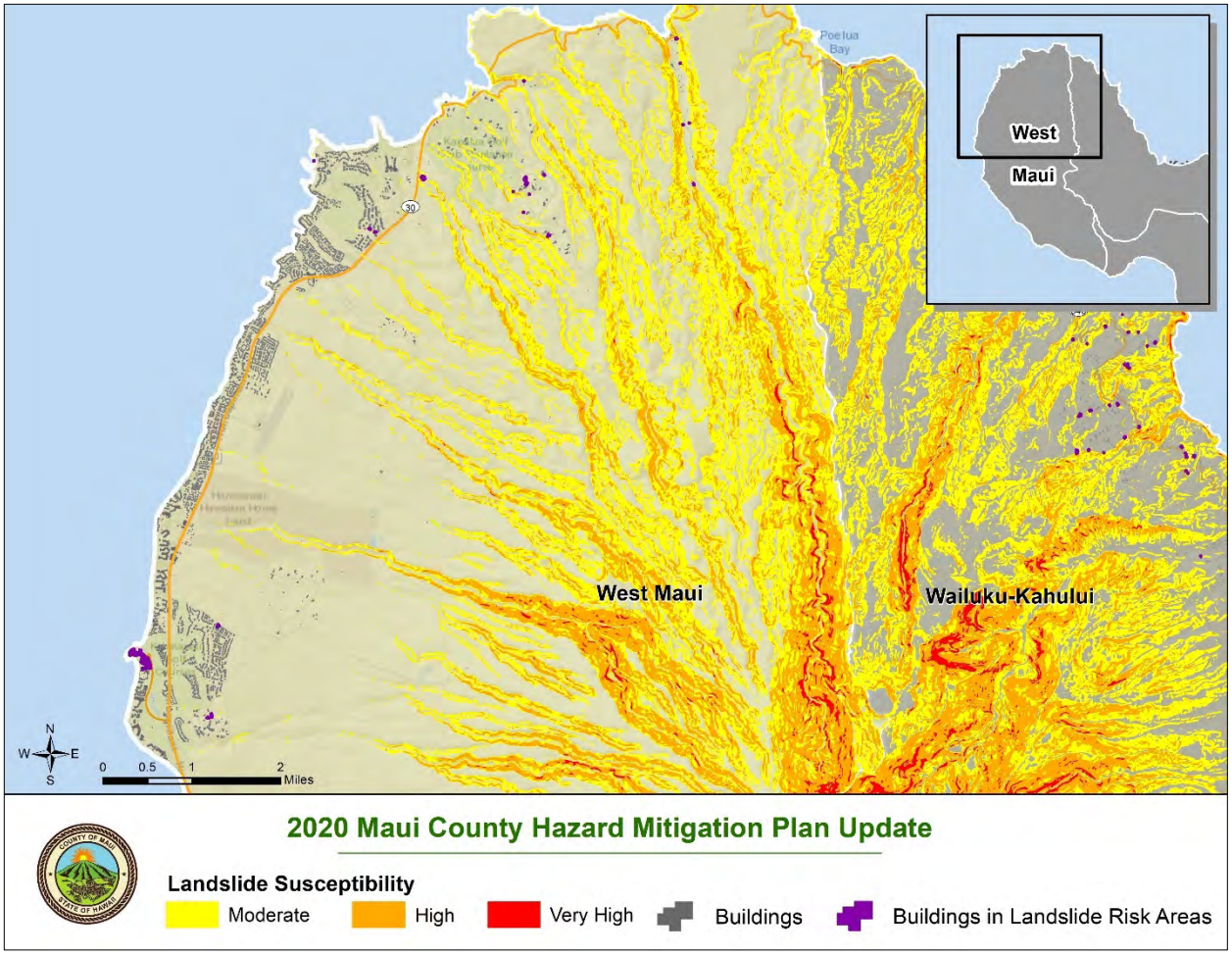

Figure 196. Buildings in Areas Susceptible to Landslides in the West Maui Community Planning Area.

GIS analysis was used to determine number of critical facilities within areas susceptible to landslides. Overall, there are three critical facilities within landslide susceptibility areas in Maui County, including:

- One water, waste, and wastewater system facility in the Wailuku-Kahului Community Planning Area
- One water, waste, and wastewater system facility in the West Maui Community Planning Area
- One mass care facility in the Hāna Community Planning Area

These facilities are shown in the figures below.

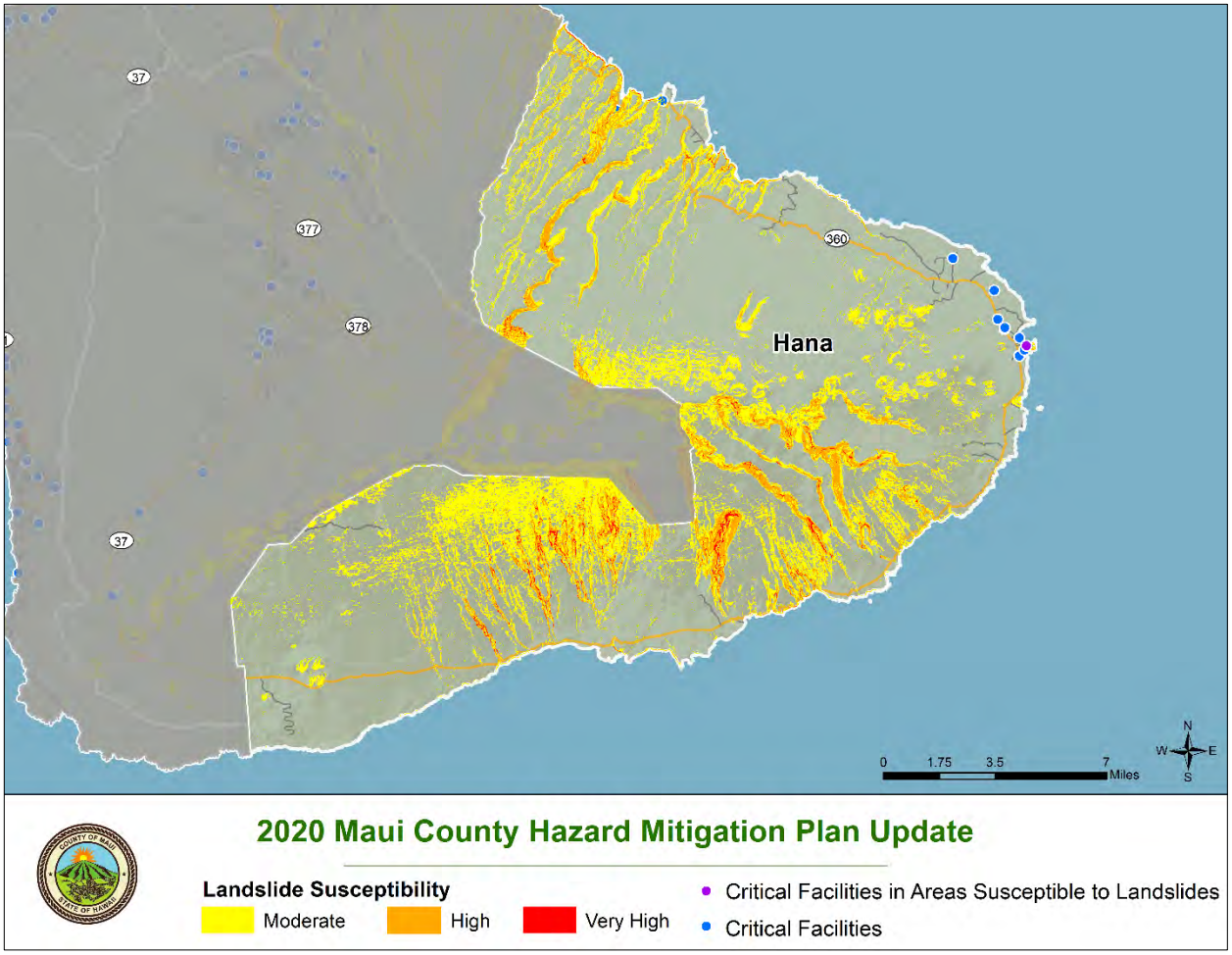

Figure 197. Critical Facilities in Wildfire Risk Areas in the Hāna Community Planning Area.

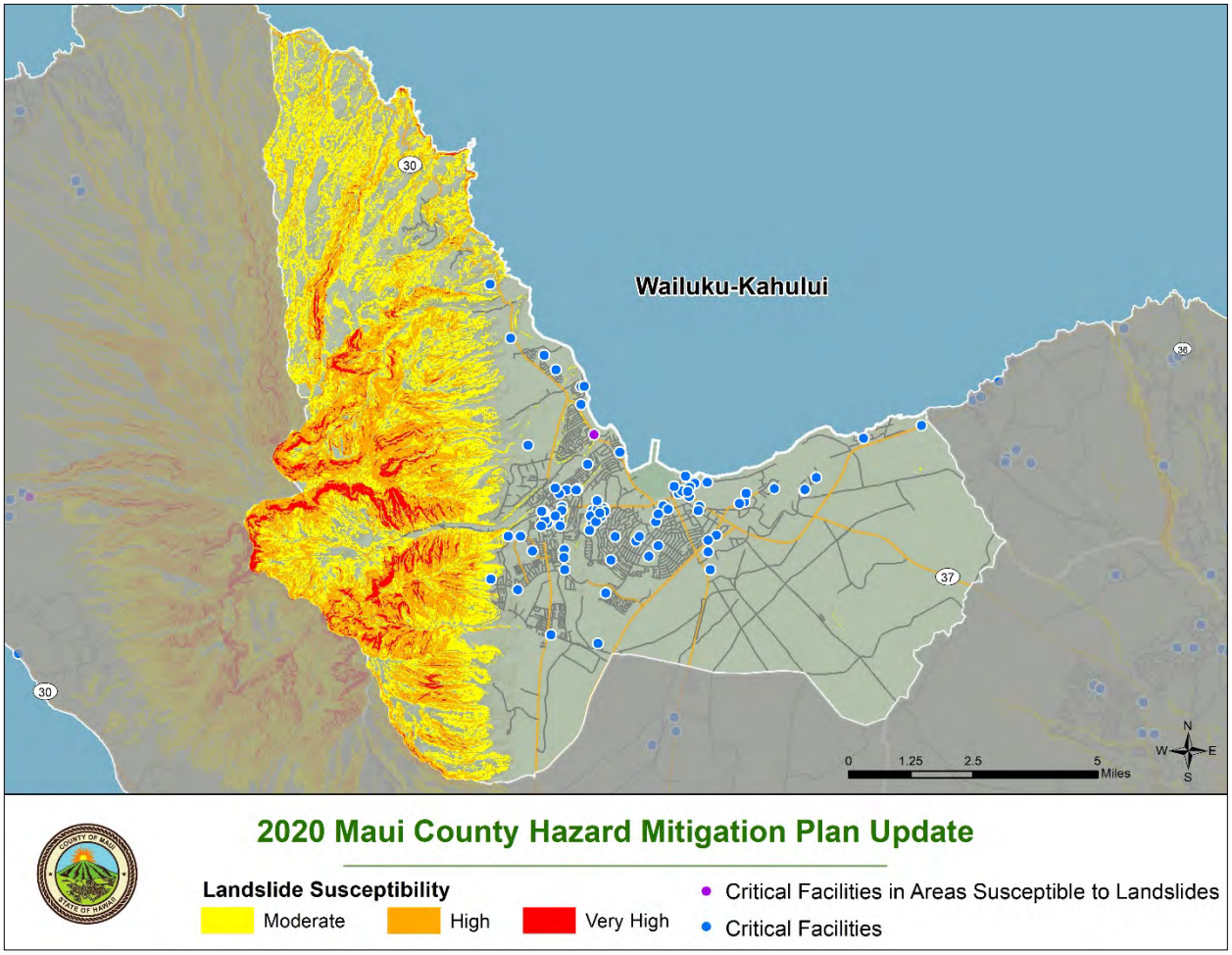

Figure 198. Critical Facilities in Wildfire Risk Areas in the Wailuku-Kahului Community Planning Area.

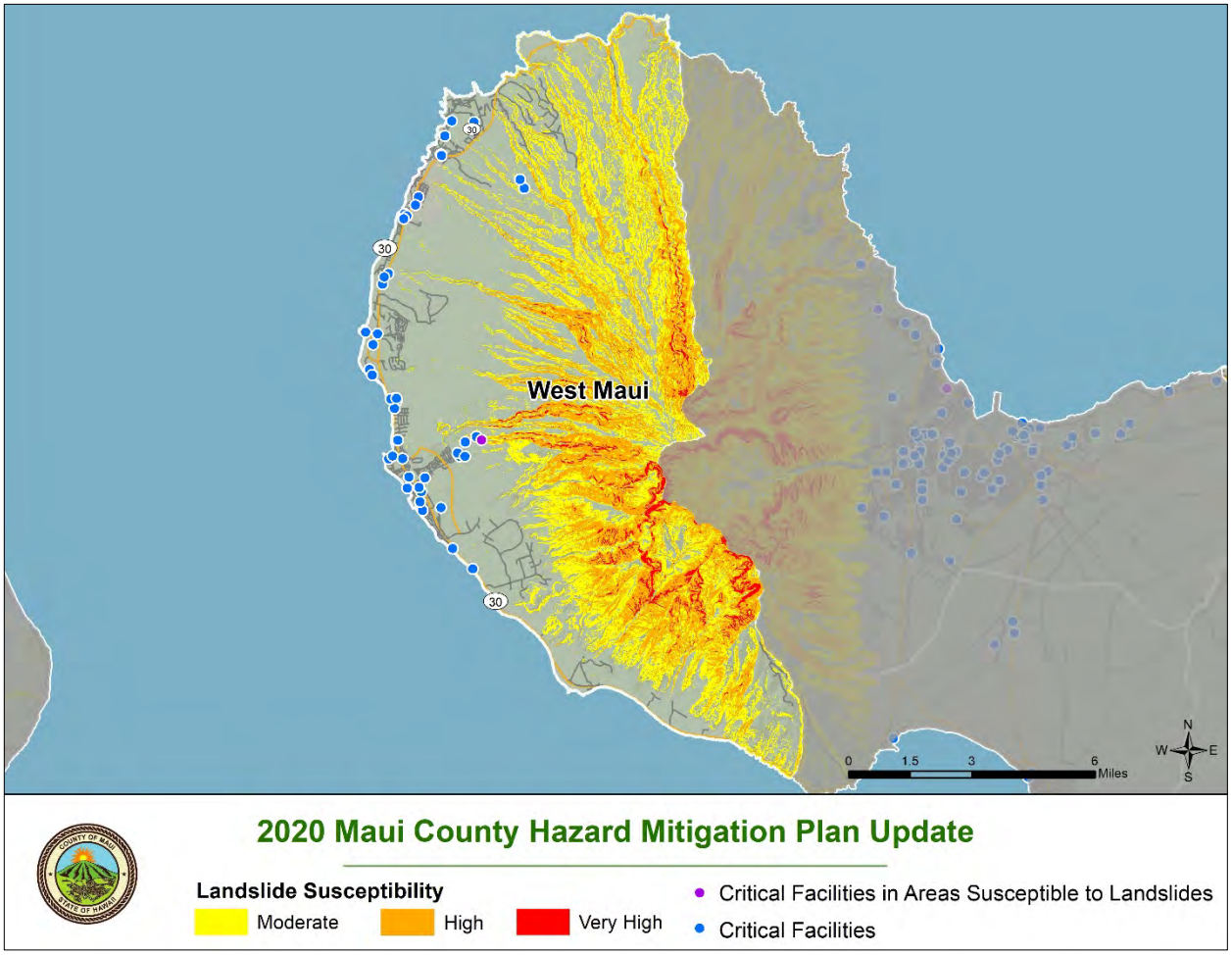

Figure 199. Critical Facilities in Wildfire Risk Areas in the West Maui Community Planning Area.

In addition to buildings, utilities, roads, and bridges are vulnerable to the impact and ground deformation caused by landslides and other earth movements. When utility lines are damages by landslides, functionality of water, sewer, gas, and electricity systems may be compromised.[199] Because of their geographic extent, roads and utility lines can have a greater chance of being impacted by landslide events. Further, if any section of a roads or utility line is damaged by a landslide, the entire system may be impacted. For instance, a landslide that results in one area of a road or a bridge being impassible may block accessibility to other roads or locations.

There are six bridges from the NBI that are in landslide susceptibility areas - three in the West Maui Community Planning Area, one in the Pāʻia-Haʻikū Community Planning Area, and two in the Hāna Community Planning Area. These bridges are shown in the figure below.

[199] 2018 California State Hazard Mitigation Plan, Public Review Draft, pg. 312. Cal EOS. Retrieved from http://www.caloes.ca.gov/HazardMitigationSite/Documents/009-2018%20SHMP_Public%20Review%20Draft_April%202018_CH6.pdf.

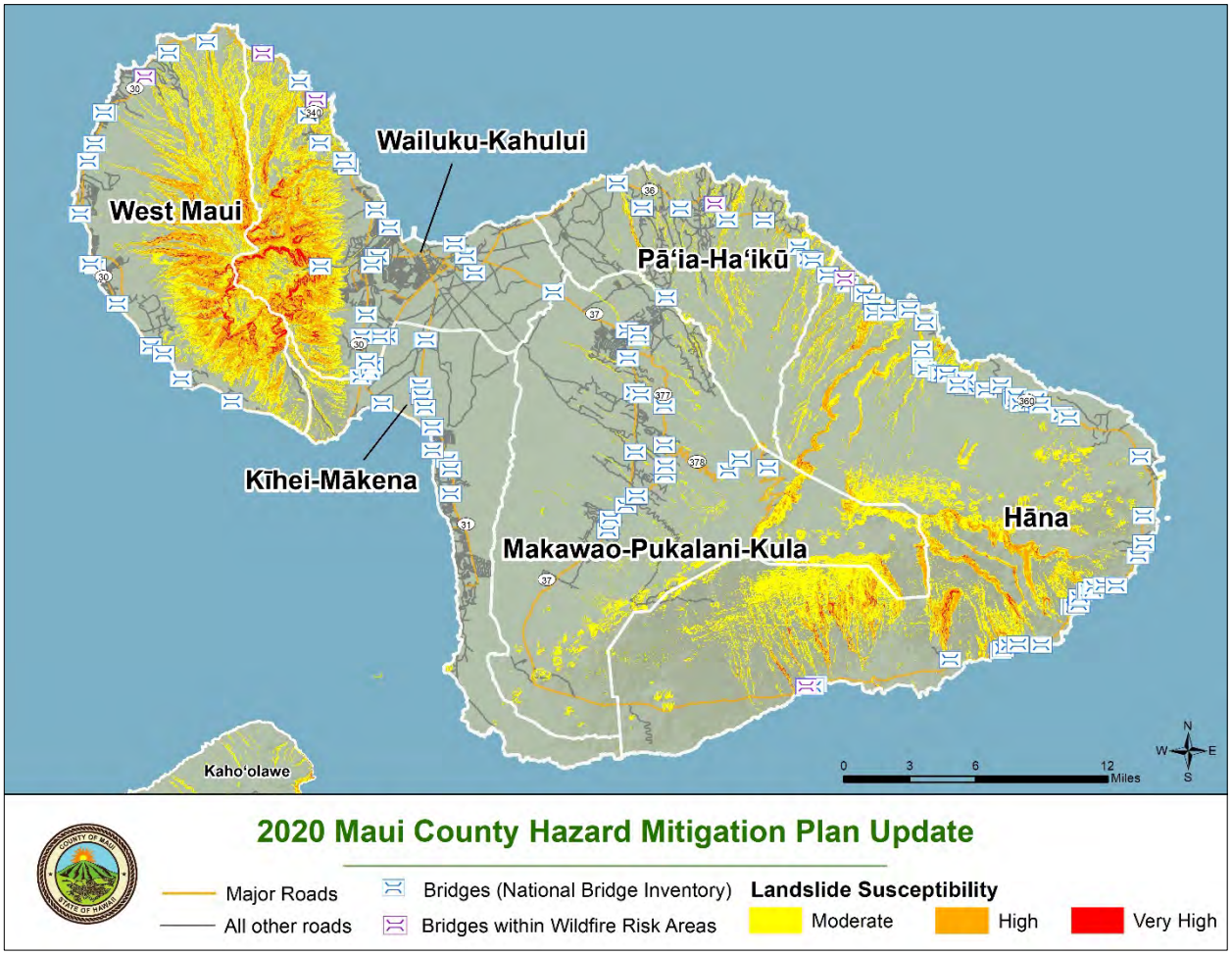

Figure 200. Bridges in Landslide Susceptibility Areas on Maui Island.

As shown in the vulnerability maps above, many major roads in Maui County have segments within areas susceptible to landslides. As most landslide areas follow flow paths from high elevations down to the sea, many of these paths cross Hāna Highway as it winds around the edge of Maui Island in the Pāʻia-Haʻikū and southern Hāna community planning areas. Hāna Highway has also been impacted by many previous landslide incidents. Similarly, parts of Kahekili Highway north of Wailuku are susceptible to landslides. In addition, many parts of Kamehameha V Highway (State Route 450) on the eastern side of the Island of Molokaʻi are within areas susceptible to landslides. Other roads throughout the county are also within areas considered susceptible to landslides.

Life Safety, Health, Warning, and Evacuation Impacts

Landslides can have severe life safety impacts. People in buildings or cars that are impacted by landslides may suffer death or injury. Landslide movement can occur quickly, without warning, or slowly. Movement can range from feet per second to a slow creep of inches per year. Therefore, no official

warning system is in place for landslides. The 2018 State of Hawaiʻi Hazard Mitigation Plan provides warning signs that may be noticeable prior to a landslide, including:

- Springs, seeps, or saturated ground appearing in areas usually not wet
- New cracks or unusual bulges in the ground, street pavements, or sidewalks
- Soil moving away from foundations
- Ancillary structures (e.g. decks) tilt or move relative to the house
- Concrete floors or foundations tilt or crack
- Water lines and other underground utilities break
- Telephone poles, trees, retaining walls, or fences tilt
- Roadbeds sink or drop down

Public Health Impacts
In instances where landslides rupture utility lines (e.g., sewer lines, natural gas) or rupture chemical storage tanks, released of sewage or hazardous materials could pose of public health hazard, especially in cases where drinking water or public swimming areas may become contaminated.

Impacts to Vulnerable Populations
Landslides may affect the entire county of Maui but have the greatest probability of occurring in the Hāna Community Planning Area based on the number of historical occurrences. Community Planning Areas with significant numbers of buildings located within areas of moderate to very high landslide susceptibility includes Pāʻia-Haʻikū, Wailuku-Kahului, and Makawao-Pukalani-Kula. While all vulnerability subcomponents are summarized below, vulnerable populations exhibiting constraints related to household composition, housing characteristics and access to lifelines may be most susceptible to negative consequences resulting from landslides. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are also described.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty with mobilizing or taking protective action in response to a landslide. In addition, these populations will require additional services and care considerations during recovery processes.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a natural disaster. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate recovery, such as repairing of homes after a landslide, or fund mitigation actions that would protect their homes and property from future hazard impacts.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon urgent hazard warning information. Additionally, those who do not speak English well, may not comprehend hazard warning information to the extent that enables them to make timely decisions and take life-saving actions.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living in housing built before 1950, and prior to the enactment of modern building codes, are more susceptible to damages and losses due to landslides as they

may be situated in landslide-prone areas and lack the structural or foundational integrity to sustain impacts. In addition, higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences as a result of exposure to landslides.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges and have difficulty accessing needed supplies and services before, during and after a hazard event. Landslides can severely damage or destroy roadways. Those living in areas with limited transportation routes may experience temporary or long-term isolation as a result of a landslide event. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Molokaʻi households also do not have access to a vehicle.

Economic Impacts

Landslides can result in economic losses in several ways. Direct losses may occur due to damaged destroyed structures, cars or utility lines. Roads may become damaged or undermined. Costs may be incurred by the state or county to dispatch crews in order to clear debris from roadways. Indirectly, landslides may cause business interruptions by cutting off access or disrupting utility services. Even if a

small section of a road or utility line is damaged by a landslide, the entire system may be impacted. For instance, a landslide that results in one area of a road being impassible may block accessibility to other roads or locations, preventing evacuations, delivery of goods and services, and disrupting schools and businesses. For example, during the 2006 landslides associated with the Kiholo Bay and Mahukona earthquakes, damage to a truss bridge and debris blocking a road impeding access, isolating approximately 500 Maui residents.

Climate Change Impacts

Climate change may increase the frequency and intensity of storm events, and intense rainfall events often trigger landslides. Further, warming temperatures are projected to increase the frequency and duration of droughts, which in turn could increase wildfire occurrences. Wildfires are able to rapidly move up steep slopes, and fire-scorched land on steep slopes, without the support of rooted vegetation, are more susceptible to landslides. All of these factors would increase the probability for landslide occurrences in Maui County.

Tsunami

Description

Tsunamis are a series of giant waves created by a disturbance such as an earthquake, landslide, volcanic eruption, or meteorite. From the area where the tsunami originates, waves travel outward in all directions. A tsunami can move hundreds of miles per hour in the deep open ocean, where it may only be a few inches or feet high. As a tsunami travels inland and ocean depth decreases, a tsunami's wave height becomes higher and higher, and it can hit land with waves as high as 100 feet or more.[200]

Tsunamis are characterized as shallow-water waves—that is the ratio between the water depth and its wavelength gets very small. Shallow-water waves are different from wind-generated surf waves. Wind-generated waves usually have a period (time between two successional waves) of 5 to 20 seconds and a wavelength (distance between two successional waves) of about 100 to 200 meters (300 to 600 feet). A tsunami wave can have a period in the range of five minutes to two hours and an open ocean wavelength in excess of 100 miles.

Although landslides and volcanoes cause some local tsunamis, more than 95 percent of tsunamis result from subduction earthquakes. The earthquakes associated with tsunamis are referred to as "tsunamigenic" earthquakes. The association between earthquakes and tsunamis results from the fact that both are generated by the tectonic displacement of the earth's crust. Earthquakes generate tsunamis when the sea floor abruptly deforms and displaces the overlying water from its equilibrium position. Waves are formed as the displaced water mass, which acting under the influence of gravity, attempts to regain its equilibrium. The main factor that determines the initial size of a tsunami is the amount of vertical sea floor deformation resulting from subduction zone earthquakes. The earthquake's

[200] International Tsunami Information Center (2020). What are tsunamis, and what causes them? Retrieved from http://itic.ioc-unesco.org/index.php?option=com_content&view=category&layout=blog&id=1004&Itemid=1004.

magnitude, depth, fault characteristics, and coincident slumping of sediments or secondary faulting control the size of the tsunami.

The second most common cause of tsunamis is landslides. A tsunami may be generated by a landslide originating above sea level but plunging into the sea or by a submarine landslide. The water displaced by the landslide causes the tsunami. Other geologic disturbances, such as volcanic activity, can also generate tsunamis. A tsunami can be generated by any disturbance that displaces a large water mass from its equilibrium position.

When a tsunami finally reaches the shore, it may appear as a rapidly rising or falling tide, a series of breaking waves, or even a bore (a step-like wave with a steep breaking front). Although most people imagine a tsunami as a large, steep wave breaking on the shore, tsunamis generally appear as an advancing tide without a developed wave face and produce rapid flooding of low-lying coastal areas. Areas at greatest risk to tsunami impacts are those less than 25 feet above sea level and within a mile of the shoreline.

Reefs, bays, entrances to rivers, undersea features and the slope of the beach all help to modify the tsunami as it approaches the shore. Because the long-period wave can bend around obstacles, the tsunami can enter bays and gulfs with intricate shapes. Previous events have shown that wave heights increase in bays that narrow from the entrance to the head (like a funnel) but decrease in bays that have narrow entrances. Shorelines protected by reefs typically do not sustain extensive damage from tsunamis as the reefs disperse the wave energy. Further, islands in a group may “shadow” one another reducing the tsunami effect, and small islands may experience reduced runup as the tsunami waves may refract around them.[201]

Location

Low-lying coastal areas are at highest risk to tsunamis. Areas at risk to tsunamis and extreme tsunamis are placed into tsunami evacuation zones. The extreme tsunami refers to a tsunami sourced near the Aleutian Islands in Alaska, as a study completed after the 2011 Japan earthquake found that the greatest tsunami threat facing Hawai‘i is from the Aleutians.[202] Tsunami evacuation zones are shown in the figure below. In addition to mapped evacuation zones, areas adjacent to inland waterways may flood due to surges. Further, locally tsunamis may impact different areas.

[201] State of Hawai’i Hazard Mitigation Plan (2018). *Section 4.13 – Tsunamis.*
[202] State of Hawai’i Hazard Mitigation Plan (2018). *Section 4.13 – Tsunamis.*

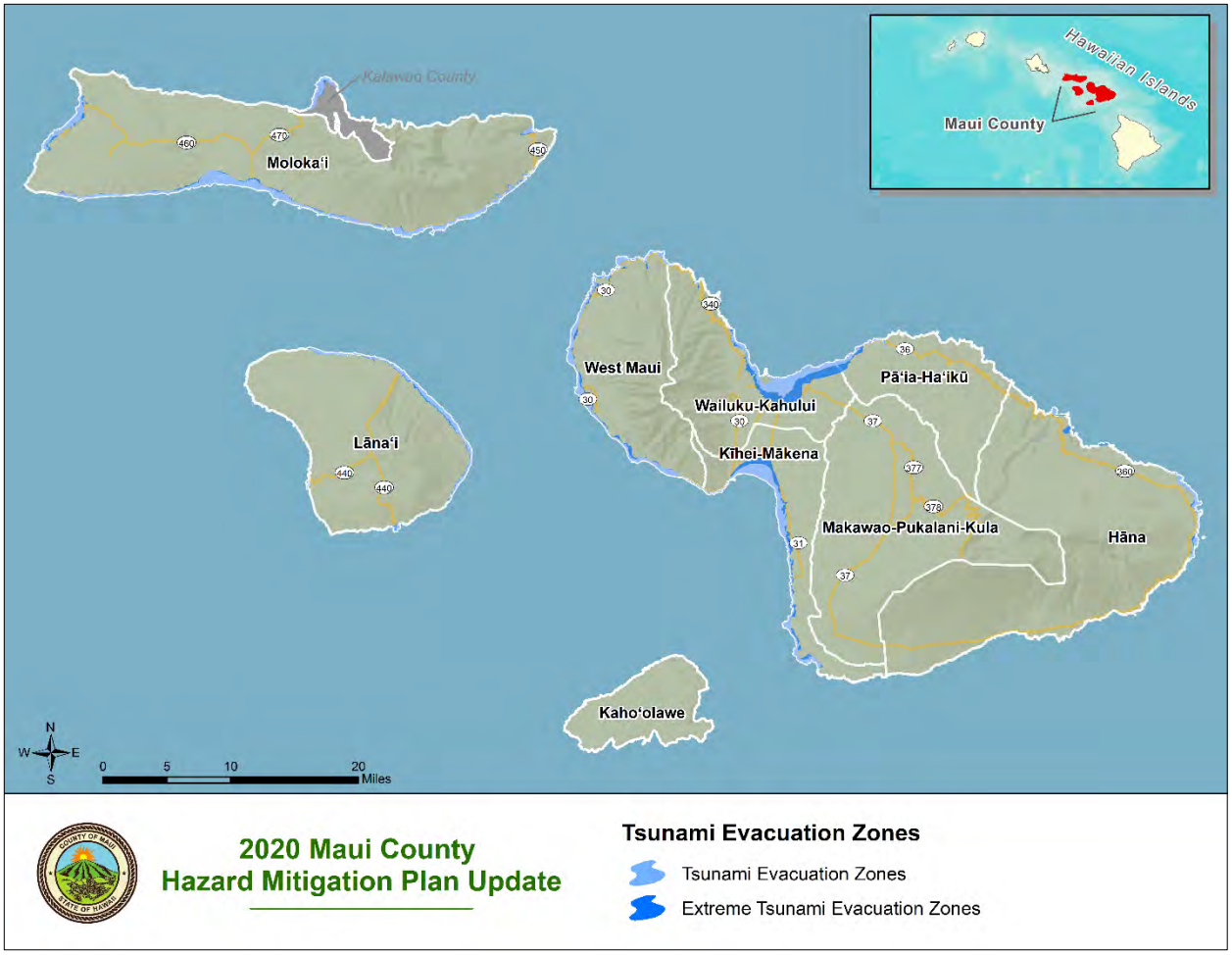

Figure 201. Tsunami and Extreme Tsunami Evacuation Zones in Maui County.

Previous Occurrences

Several local, state, and federal data sources were used to investigate previous tsunami occurrences. These sources include:

- NOAA's Global Historical Tsunami Database[203]
- The 2018 State of Hawai'i Hazard Mitigation Plan
- The 2015 Maui County Hazard Mitigation Plan Update
- Presidential Disaster Declarations for Maui County

NOAA's Global Historical Tsunami Database reported 61 tsunami events impacting Maui County between 1800 and 2020 (many of these events include multiple waves and locations impacted). Seven of these events resulted in damages, injuries and/or loss of life. These events, along with others

[203] NOAA (2020). NGDC/WDS Global Historical Tsunami Database. Retrieved from https://www.ngdc.noaa.gov/hazard/tsu_db.shtml.

reported by the state and previous county hazard mitigation plans or by disaster declarations, are described below.

- **1819** – This tsunami destroyed three homes on the Island of Molokaʻi.
- **1837** – This tsunami destroyed three homes of the Island of Molokaʻi and caused two fatalities in Kahului.
- **1868** – This tsunami damaged two homes in Kanaio.
- **1878** – This tsunami destroyed two homes in Halehaku and damaged two more.
- **April 1946** – This tsunami generated waves up to 33 feet that struck the shoreline at Kahakuloa and destroyed three homes approximately 20 feet above sea level. At Honolua and Honokohau, 24 to 28-foot waves destroyed homes, roads, and bridges. Ten deaths were reported at Hamoa, and two deaths and two injuries were reported at Keʻanae. Further, Lower Pāʻia and Mala each reported one death. In total, this event resulted in 14 fatalities, two injuries, and three destroyed homes.
- **March 1957** – A tsunami impacting the Wailuku-Kahului Community Planning District resulted in a disaster declaration after causing an estimated $5 million in damages.
- **May 1960** – This tsunami (generated by the magnitude 9.5 Great Valdivia Earthquake in Chile) was most destructive in Kahului, where six homes were destroyed. The Kahului Shopping Center and immediate vicinity were damaged. One home was destroyed in Spreckelsville. The damage estimate was about $763,000 in the low coastal areas. The waves washed inland for a distance of about 3,000 feet to ground elevations of about 6 feet. This event resulted in a disaster declaration.
- **March 1964** – This tsunami (generated by the magnitude 9.2 Great Alaskan Earthquake) had a recorded maximum run-up at Kahului of 12 feet and caused an estimated $53,000 (1964 dollars) in damage.
- **February 2010** – generated by magnitude 8.8 earthquake off the coast of Chile – no damages, injuries, or loss of life.
- **March 2011** – a tsunami impacting south and west Maui resulted in a disaster declaration after causing an estimated $6.37 million in damages.

Extent

Tsunami extent, or severity, can be measured in several ways. One way to determine severity is by wave height, or the maximum water height above sea level. The maximum water height reported by NOAA for a tsunami event in Maui County was 16.5 meters (approximately 54 feet) on the north coast of Molokaʻi during the 1946 tsunami. On Maui Island, the highest recorded wave height (33 feet) also occurring the 1946 tsunami event.

Tsunami extent can also be measured in terms of damages or fatalities. The 1946 tsunami was the deadliest in Maui's recorded history, with a total of 14 reported deaths, while the March 2011 tsunami is the costliest, with almost $6.4 million in reported damages. More severe and more damaging tsunami events are possible. With climate change, rising sea levels may result in tsunami waves and surges that

reach farther inland. Further, loss of coral associated with climate change may increase the intensity of tsunami events, as coral reefs systems protect coastlines against tsunami impacts by helping to dissipate wave energy.

Probability

Based on available data, 61 tsunami events were reported in 220 years, meaning a tsunami event impacts the county approximately every 3.5 years, on average. Therefore, a probability of "likely" (1% to 10% annual chance) was assigned to the tsunami hazard. It should be noted that large, damaging tsunami events may be less frequent.

Vulnerability

All current and future buildings, infrastructure, and populations in low-lying coastal areas, tidal flats, and river deltas, especially those in mapped tsunami evacuation areas, are considered at risk to tsunami. Specific impacts to buildings, infrastructure, socially vulnerable populations, life safety, public heath, and the economy from the tsunami hazards are described below. Climate-related impacts to the tsunami events are also described.

Building and Infrastructure Impacts (including Critical Facilities)

All current and future buildings and infrastructure, including critical facilities, located within low-lying coastal areas are considered at risk to tsunami. PDC has mapped evacuation zones for tsunami and extreme tsunami hazards areas. GIS analysis was used to determine buildings and infrastructure within tsunami evacuation zones, using PDC data, building footprints, critical facilities data, and parcel data from county tax assessor records.

For buildings, the determination of assessed value at-risk (exposure) was calculated by summing the total assessed building values for building footprints that were confirmed to be located within or partially within an identified tsunami evacuation zone. The number of parcels, building footprints, and their associated value are presented by community planning district in Table 63. This is an approximate analysis for planning purposes. This analysis does not account for building elevations or other protections.

Table 63. Potentially At-Risk Parcels, Buildings, and Improvement Value in Tsunami Evacuation Areas.

Tsunami Risk Areas	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Hāna								
Tsunami	331	16%	159	8%	$25,307,333	$12,653,662	$37,960,995	12%
Extreme Tsunami	468	23%	219	11%	$29,233,934	$14,616,958	$43,850,892	13%
Kīhei-Mākena								
Tsunami	8,924	49%	2,427	28%	$3,656,184,658	$1,828,092,333	$5,484,276,991	32%
Extreme Tsunami	12,127	67%	3,701	43%	$6,023,972,951	$3,011,986,472	$9,035,959,423	53%

Tsunami Risk Areas	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Lānaʻi								
Tsunami	56	4%	26	1%	$1,914,767	$957,383	$2,872,150	0%
Extreme Tsunami	58	4%	26	1%	$1,914,767	$957,383	$2,872,150	0%
Makawao-Pukalani-Kula								
Tsunami	1	0%	0	0%	$0	$0	$0	0%
Extreme Tsunami	2	0%	0	0%	$0	$0	$0	0%
Molokaʻi								
Tsunami	2,809	46%	830	33%	$301,143,400	$150,571,700	$451,715,100	37%
Extreme Tsunami	2,998	49%	927	37%	$338,614,100	$169,307,050	$507,921,150	42%
Pāʻia-Haʻikū								
Tsunami	539	10%	569	8%	$154,152,018	$77,076,000	$231,228,018	11%
Extreme Tsunami	683	13%	743	10%	$185,396,263	$92,698,122	$278,094,385	14%
Wailuku-Kahului								
Tsunami	2,052	11%	1,893	11%	$1,020,384,271	$510,192,140	$1,530,576,411	18%
Extreme Tsunami	4,519	25%	4,480	26%	$1,694,025,352	$847,012,691	$2,541,038,043	29%
West Maui								
Tsunami	12,385	68%	2,435	38%	$8,736,930,394	$4,368,465,213	$13,105,395,607	68%
Extreme Tsunami	13,334	74%	3,102	48%	$9,364,256,805	$4,682,128,415	$14,046,385,220	73%
MAUI COUNTY TOTAL								
Tsunami	**27,097**	**34%**	**8,339**	**14%**	**$13,896,016,841**	**$6,948,008,421**	**$20,844,025,262**	**39%**
Extreme Tsunami	**34,189**	**43%**	**13,198**	**22%**	**$17,637,414,172**	**$8,818,707,086**	**$26,456,121,258**	**49%**

All community planning areas have some exposure to tsunami hazards, with the exception of Makawao-Pukalani-Kula, which is located inland. The data in the table above indicates that several community planning areas have greater vulnerability to tsunami than others in terms of building exposure. West Maui has the greatest amount of exposure, with approximately 48% of all buildings, which compromise 73% of total estimated building value, located in the extreme tsunami evacuation area. It should be noted that it is expected that the percentage of total building value at-risk to tsunami is higher than the percentage of total buildings, as some of the most expensive buildings in the planning area (e.g., resorts, condominium buildings) are located along the beachfront. The Kīhei-Mākena community planning area also has a relatively high proportion of buildings in projected tsunami evacuation areas, with 43% of all buildings and 53% of all estimated building value location within the extreme tsunami evacuation zone. It should be noted that value refers to improvement value, which is not synonymous with insured or replacement value. The figures below show building exposure within tsunami evacuation zones by community planning area.

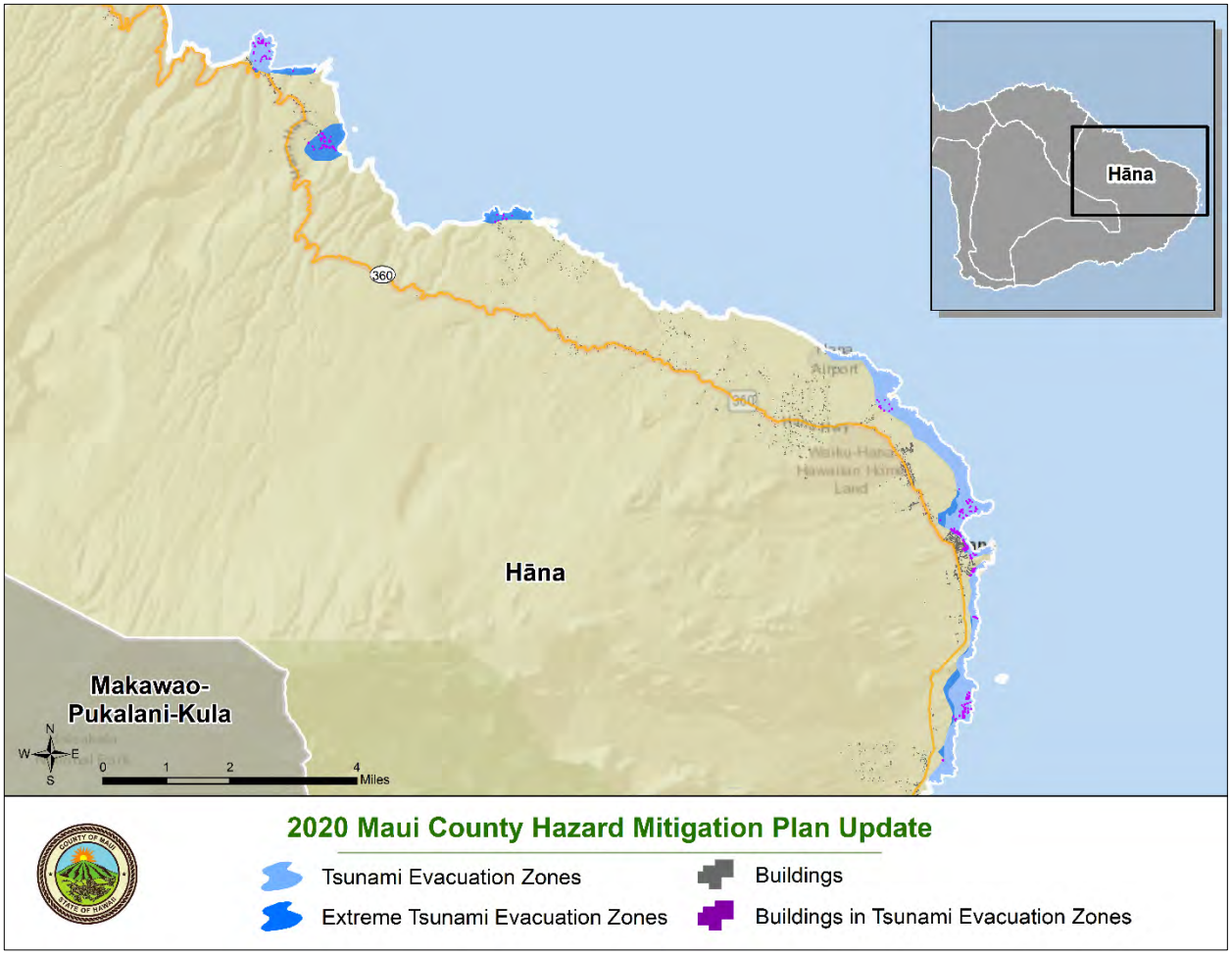

Figure 202. Buildings in Tsunami Evacuation Zones in the Hāna Community Planning Area.

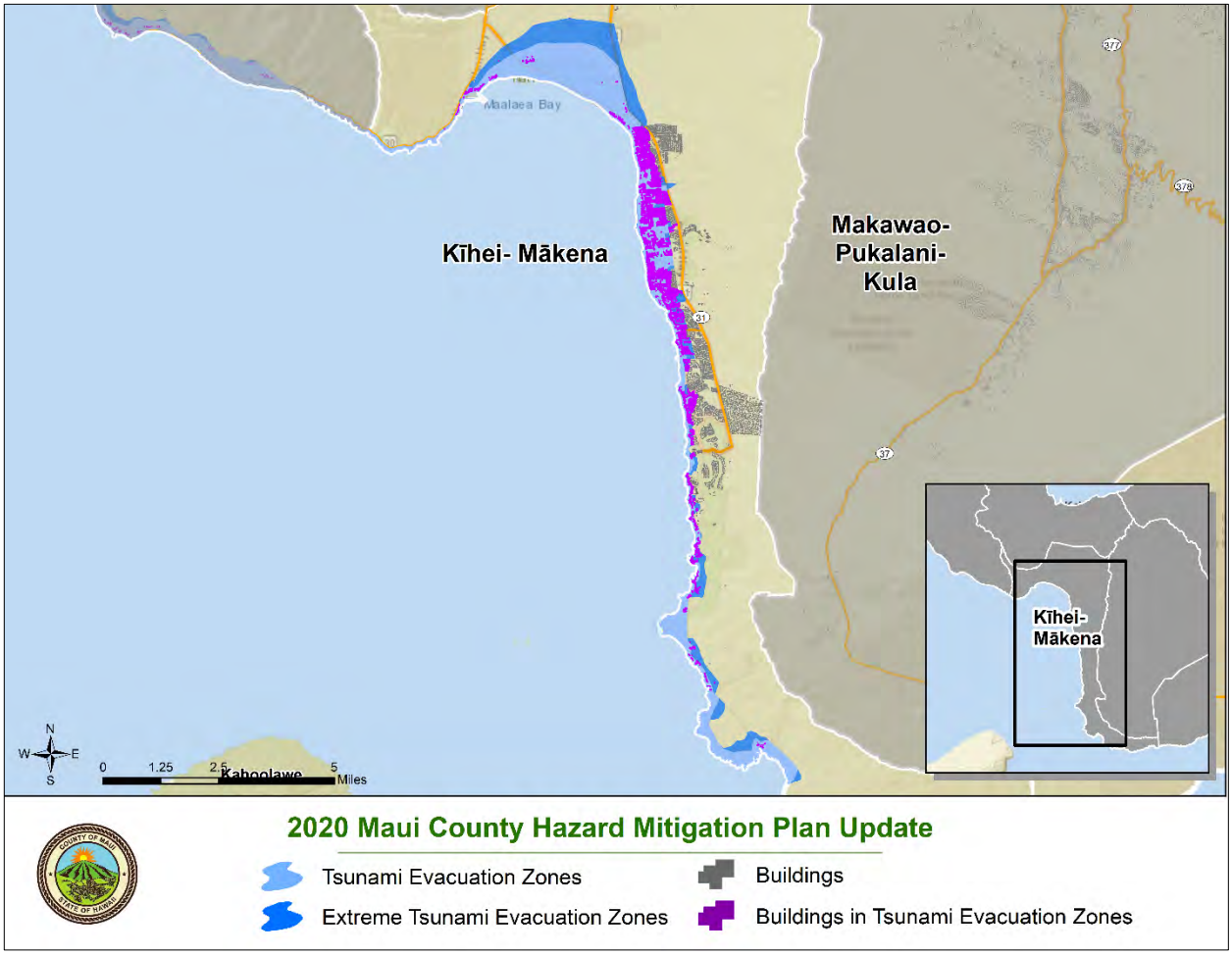

Figure 203. Buildings in Tsunami Evacuation Zones in the Kīhei-Mākena Community Planning Area.

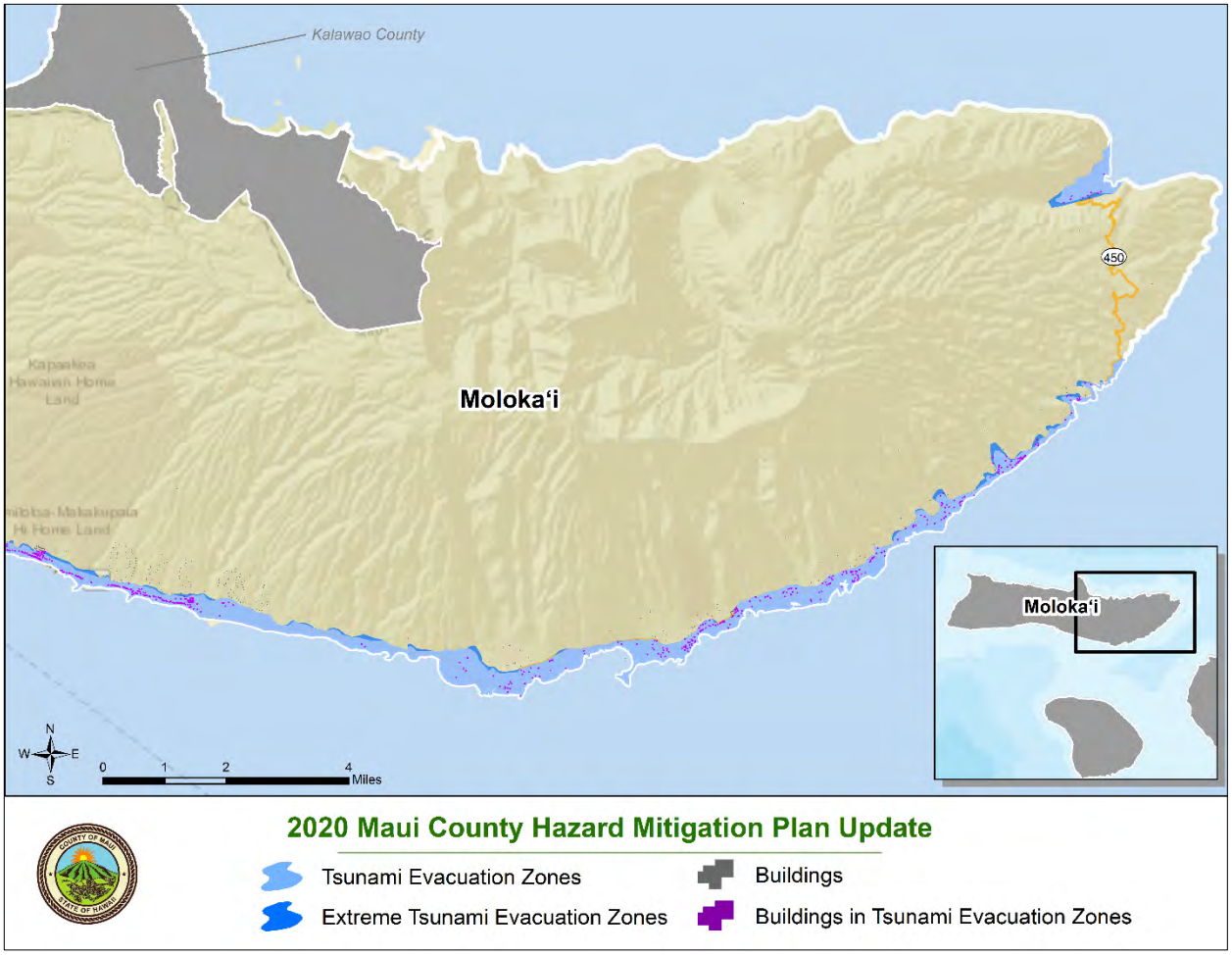

Figure 204. Buildings in Tsunami Evacuation Zones in the Eastern Moloka'i Community Planning Area.

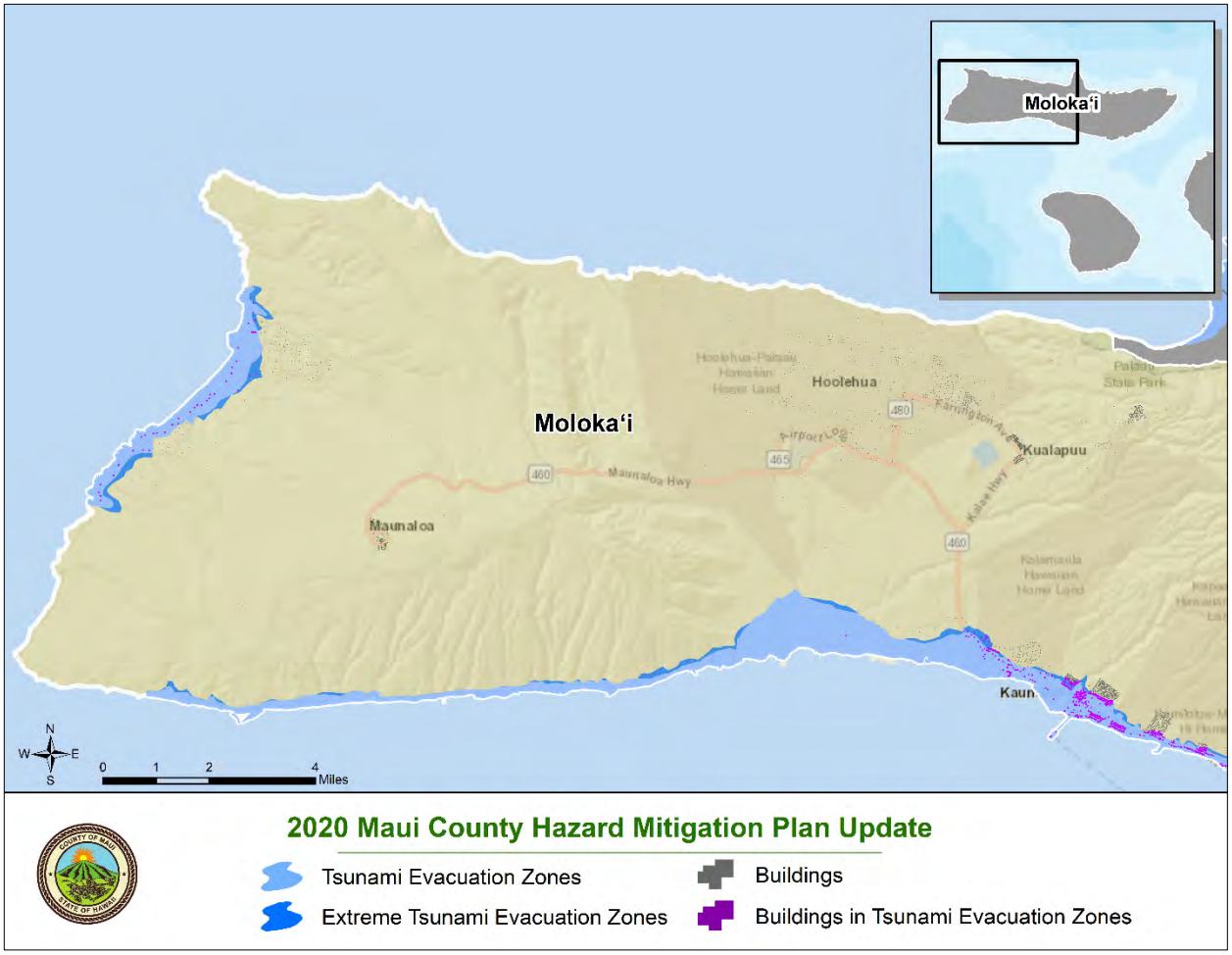

Figure 205. Buildings in Tsunami Evacuation Zones in the Western Moloka'i Community Planning Area.

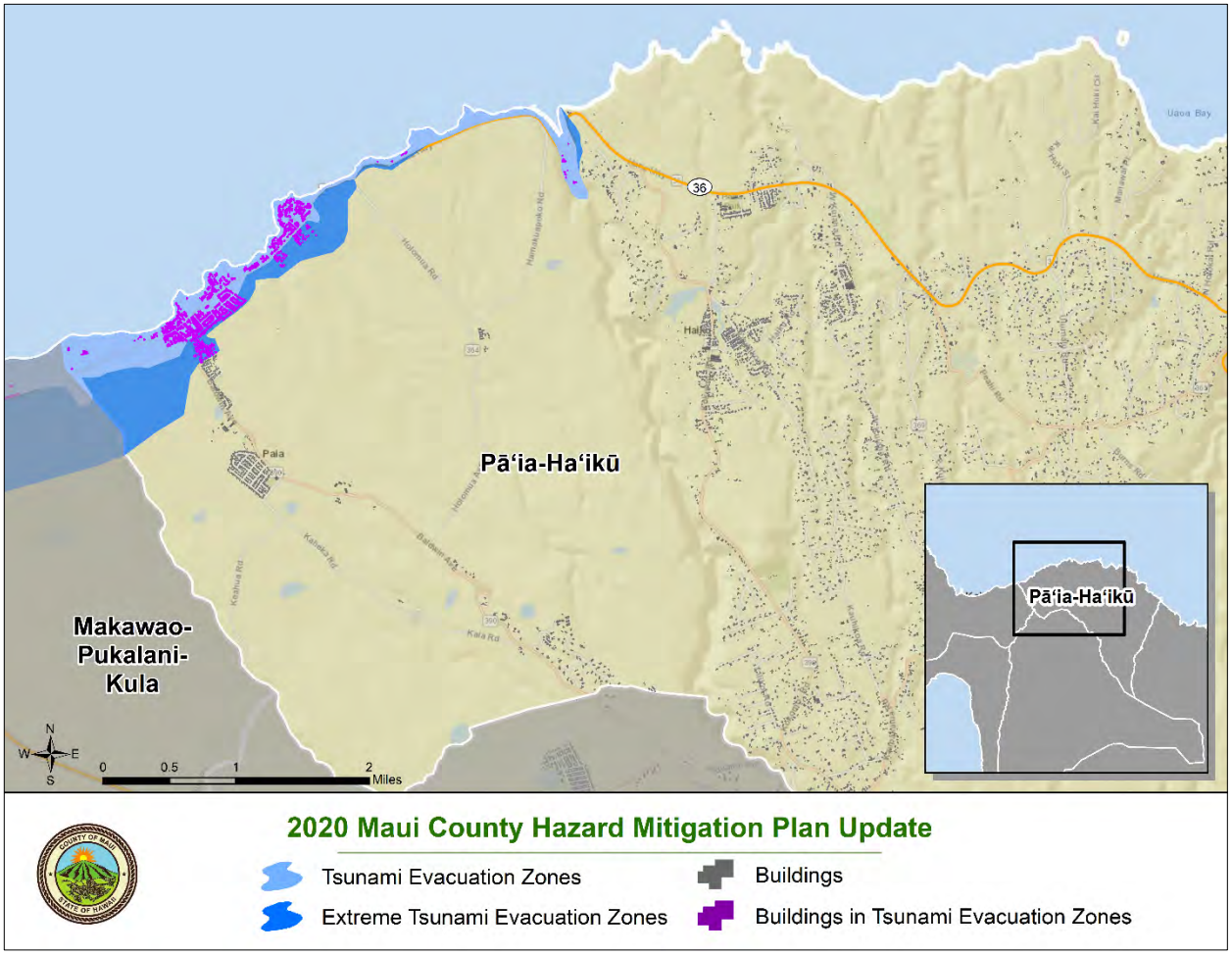

Figure 206. Buildings in Tsunami Evacuation Zones in the Pāʻia-Haʻikū Community Planning Area.

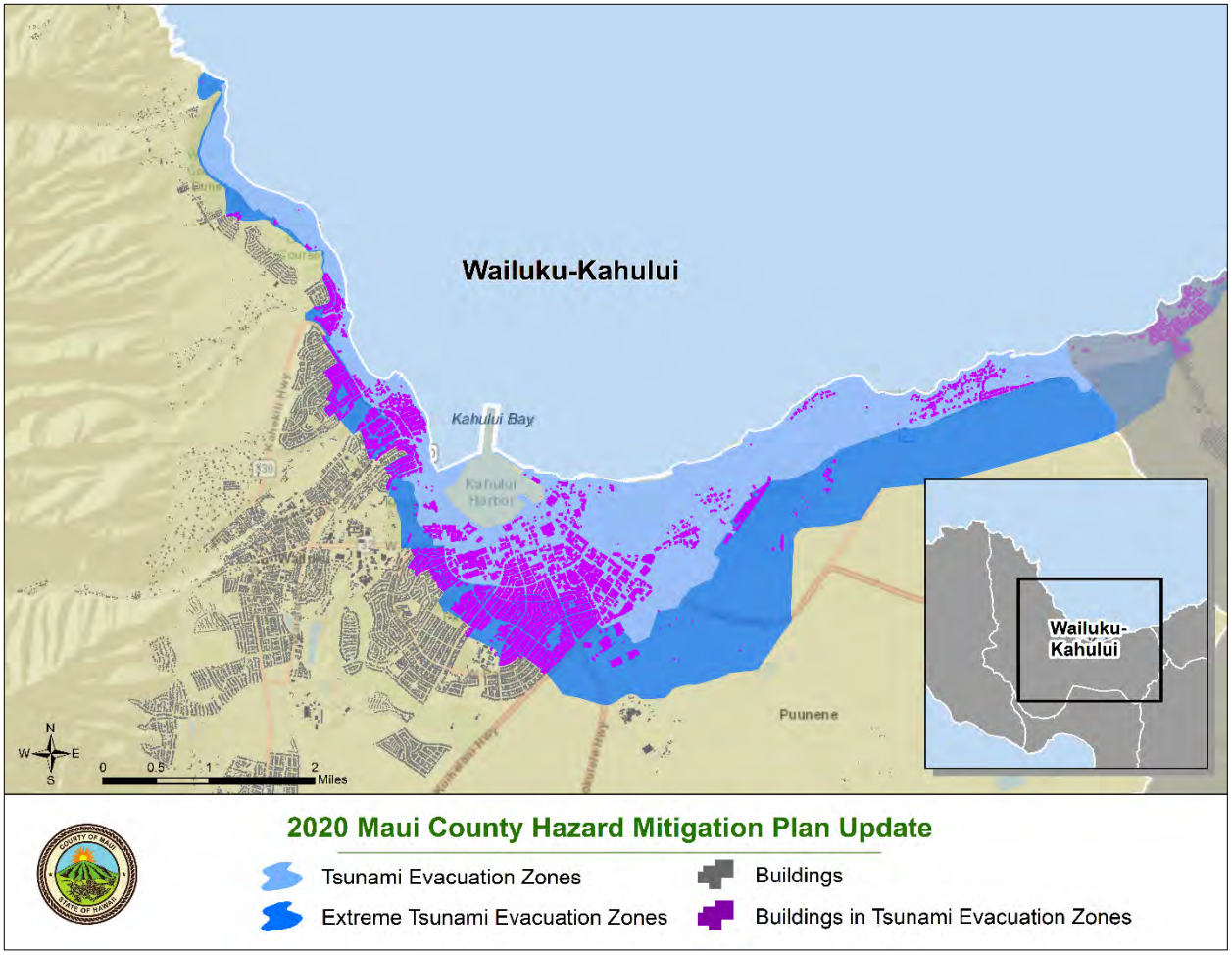

Figure 207. Buildings in Tsunami Evacuation Zones in the Wailuku-Kahului Community Planning Area.

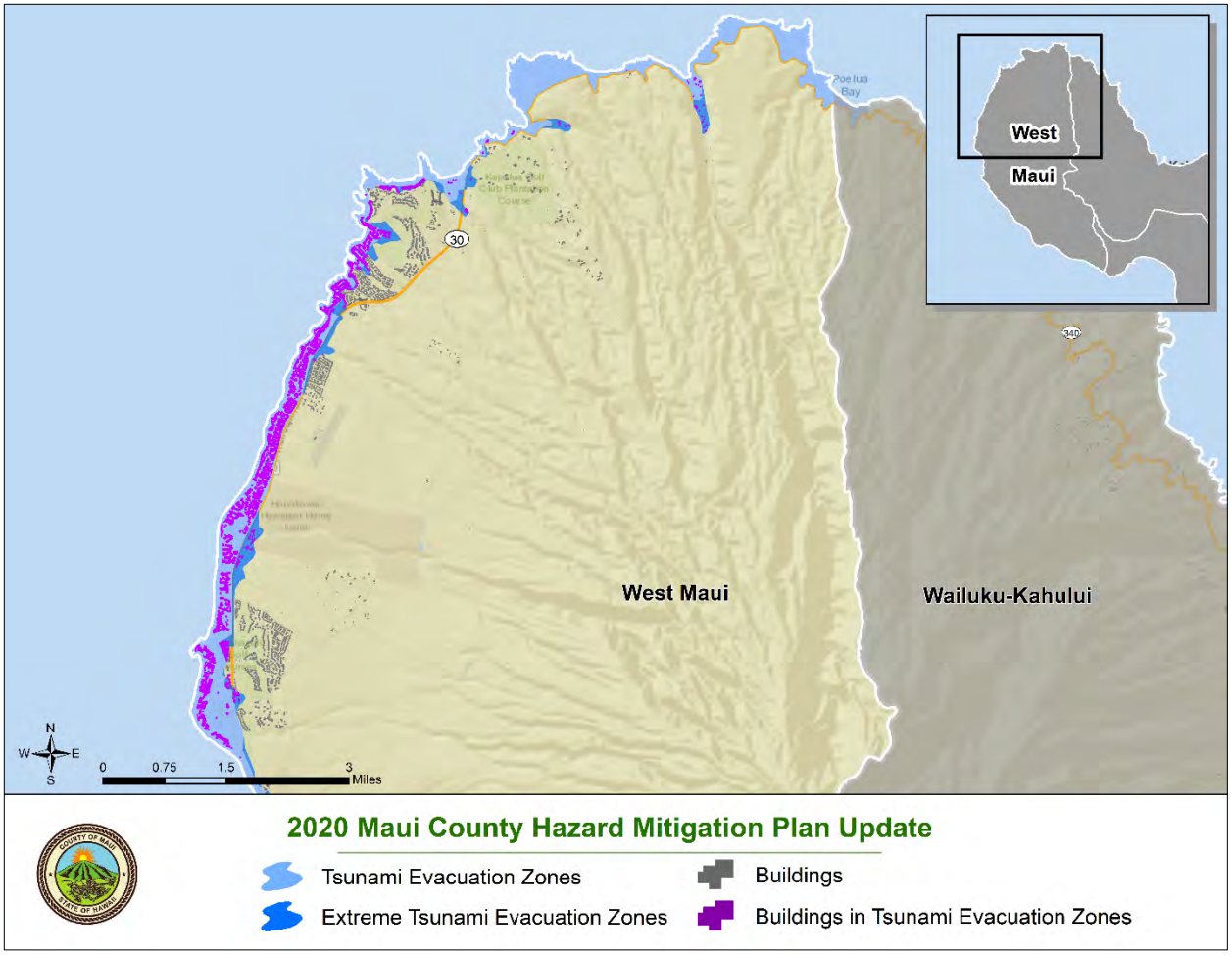

Figure 208. Buildings in Tsunami Evacuation Zones in the Northern West Maui Community Planning Area.

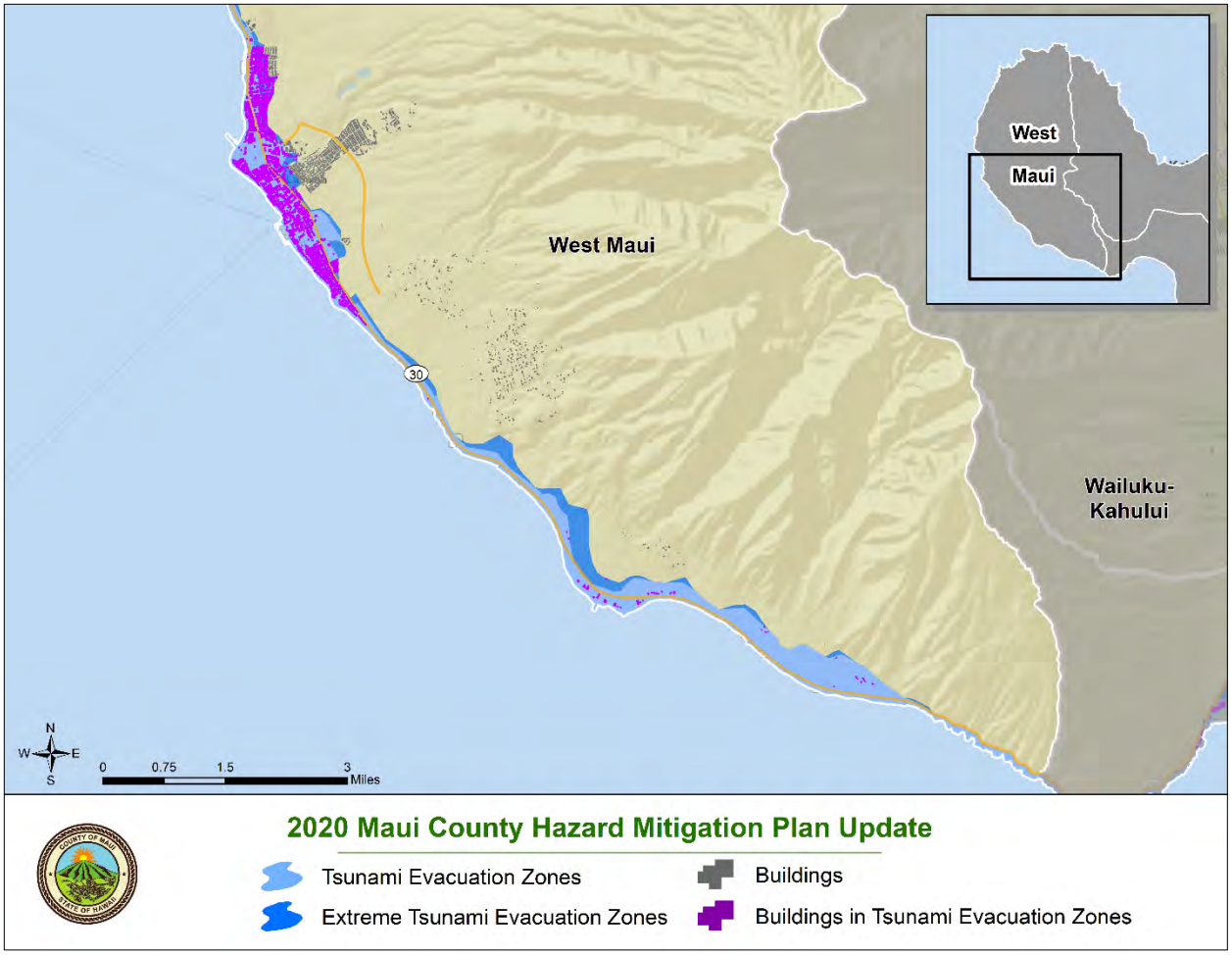

Figure 209. Buildings in Tsunami Evacuation Zones in the Southern West Maui Community Planning Area.

GIS analysis was used to determine number of critical facilities within tsunami evacuation zones. The table below presents the number of critical facilities within tsunami evacuation zones for each community planning area. Overall, there are 110 potentially at-risk critical facilities within Maui County tsunami evacuation zones.

Table 64. Potentially At-Risk Critical Facilities in Tsunami Evacuation Zones.

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Commercial Facilities	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	**2 (100%)**
Communications Facilities	0	0	0	0	1	N/A	0	N/A	**1 (13%)**
Emergency Services	1	3	0	0	5	1	4	2	**16 (43%)**

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Energy	N/A	N/A	N/A	N/A	0	N/A	2	N/A	**2 (40%)**
Food and Agriculture	0	0	N/A	N/A	N/A	N/A	0	N/A	**0 (0%)**
Government Facilities	N/A	N/A	N/A	N/A	2	N/A	1	N/A	**3 (21%)**
Healthcare and Public Health	0	3	0	0	2	0	4	5	**14 (29%)**
Mass care	1	2	0	0	5	1	2	4	**15 (20%)**
Transportation	N/A	N/A	0	N/A	1	N/A	14	1	**16 (59%)**
Water and Wastewater Systems	N/A	9	N/A	0	3	1	11	17	**41 (53%)**
TOTAL	**2 (14%)**	**17 (52%)**	**0 (0%)**	**0 (0%)**	**19 (60%)**	**3 (18%)**	**40 (38%)**	**29 (56%)**	**110 (37%)**

The figures below show critical facilities in Maui County tsunami evacuation zones by community planning area.

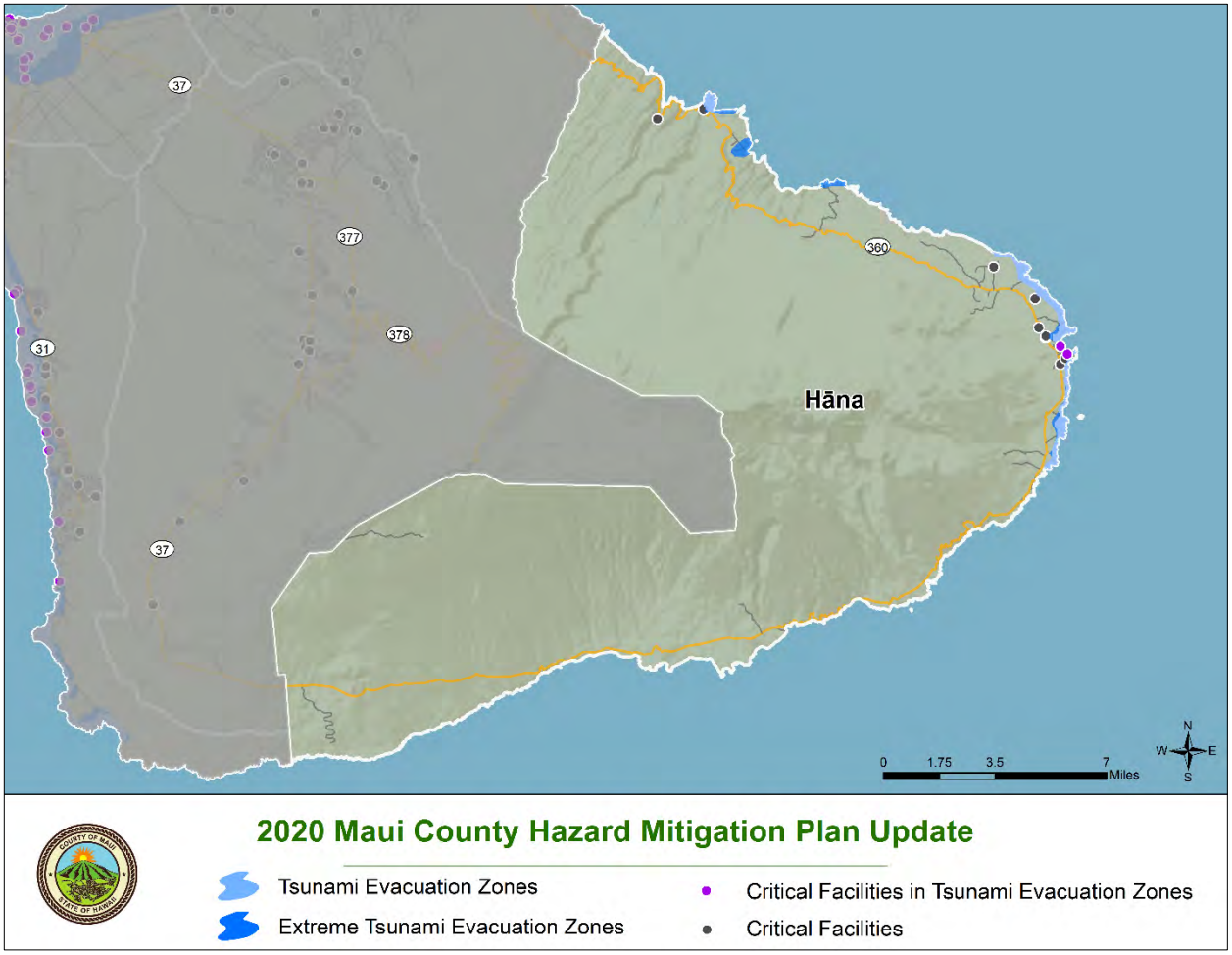

Figure 210. Critical Facilities in Tsunami Evacuation Zones in the Hāna Community Planning Area.

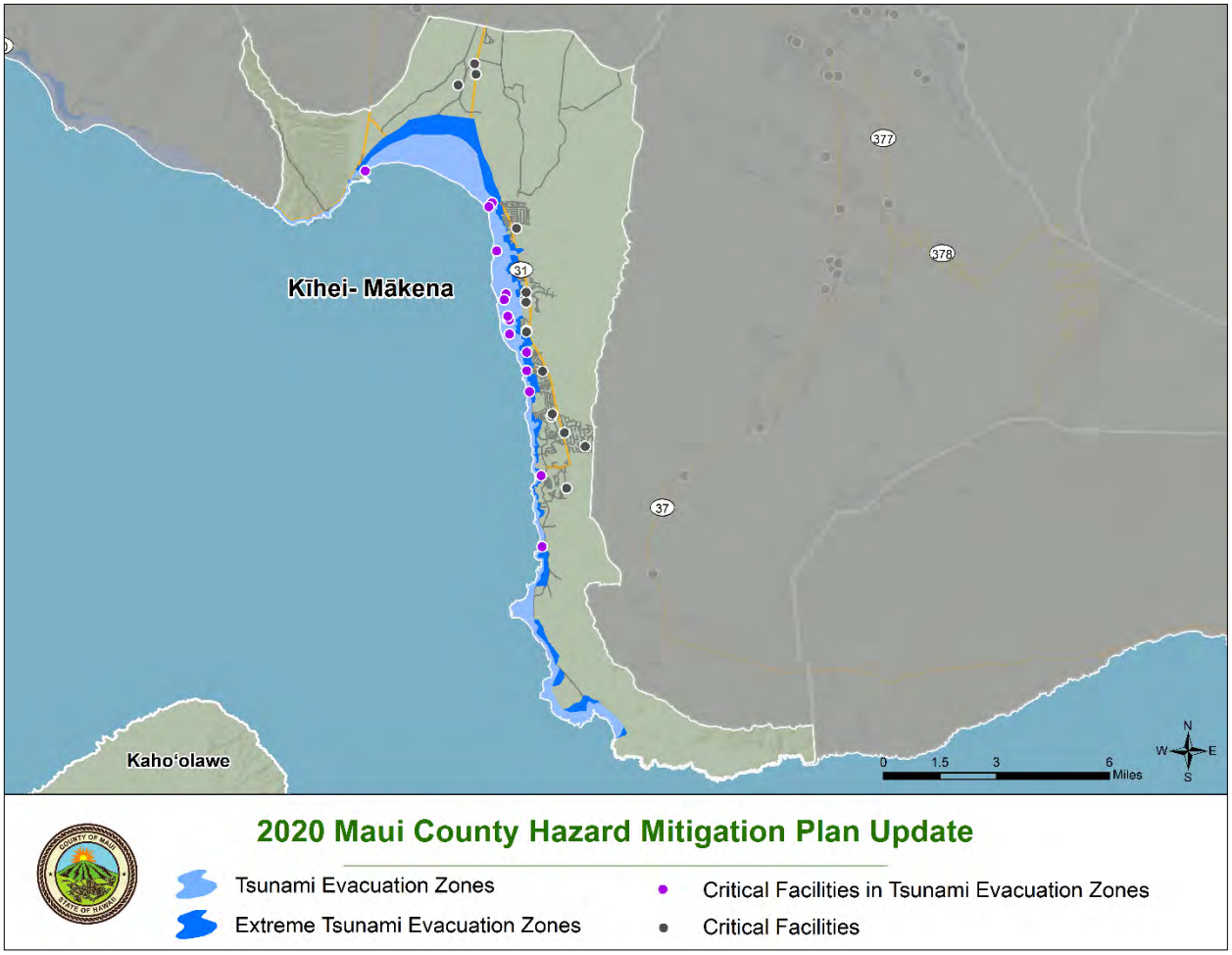

Figure 211.Critical Facilities in Tsunami Evacuation Zones in the Kīhei-Mākena Community Planning Area.

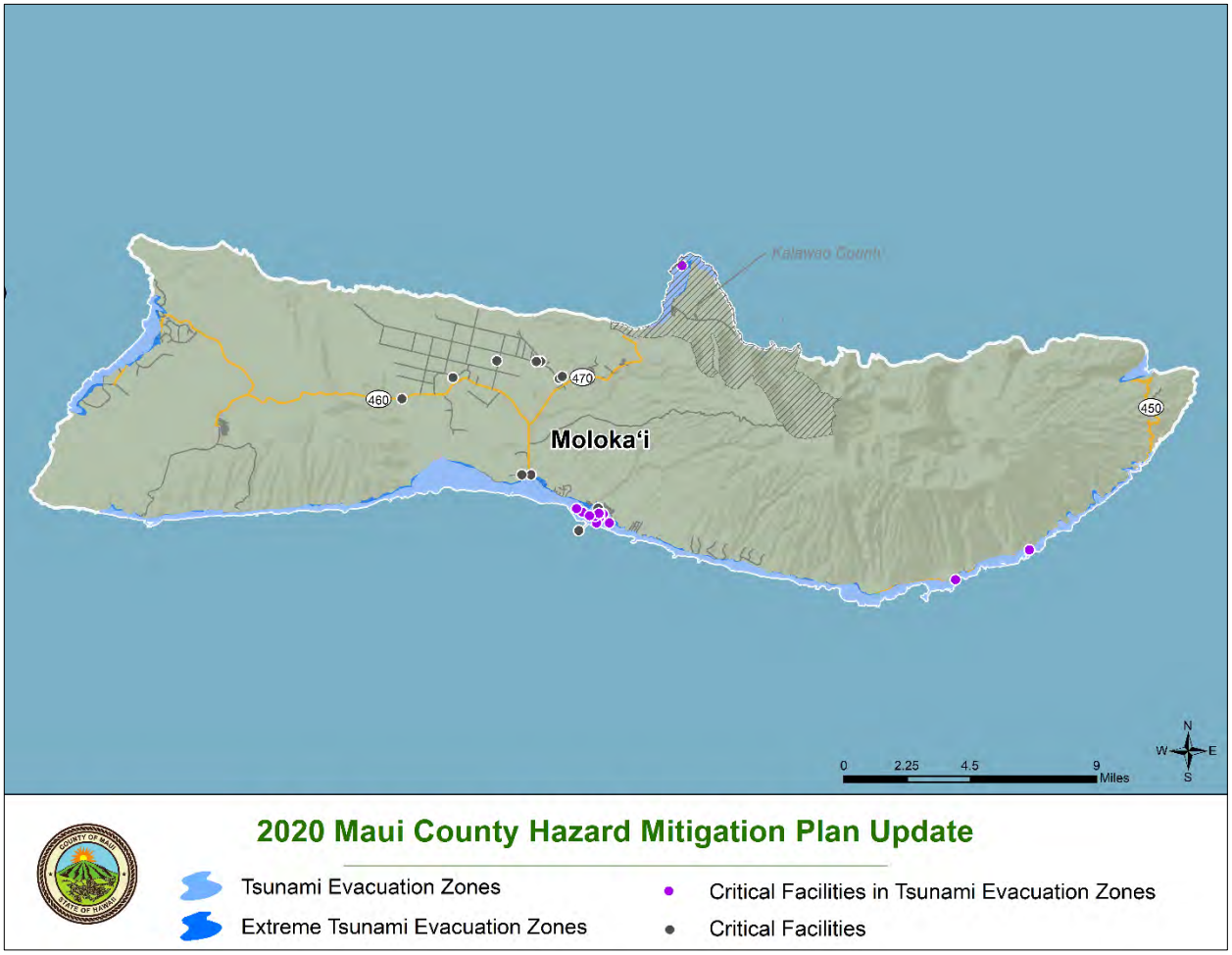

Figure 212. Critical Facilities in Tsunami Evacuation Zones in the Moloka'i Community Planning Area.

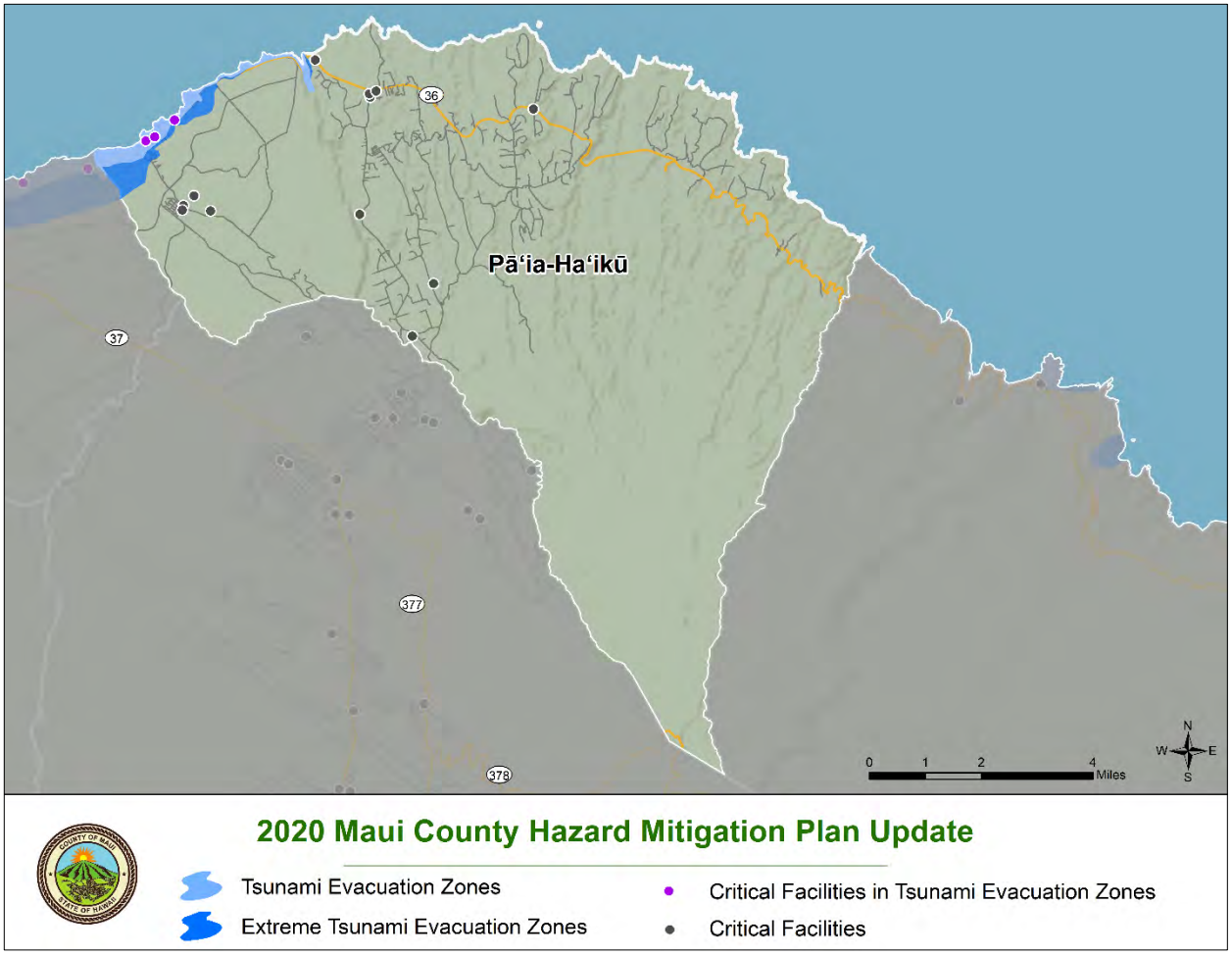

Figure 213. Critical Facilities in Tsunami Evacuation Zones in the Pāʻia-Haʻikū Community Planning Area.

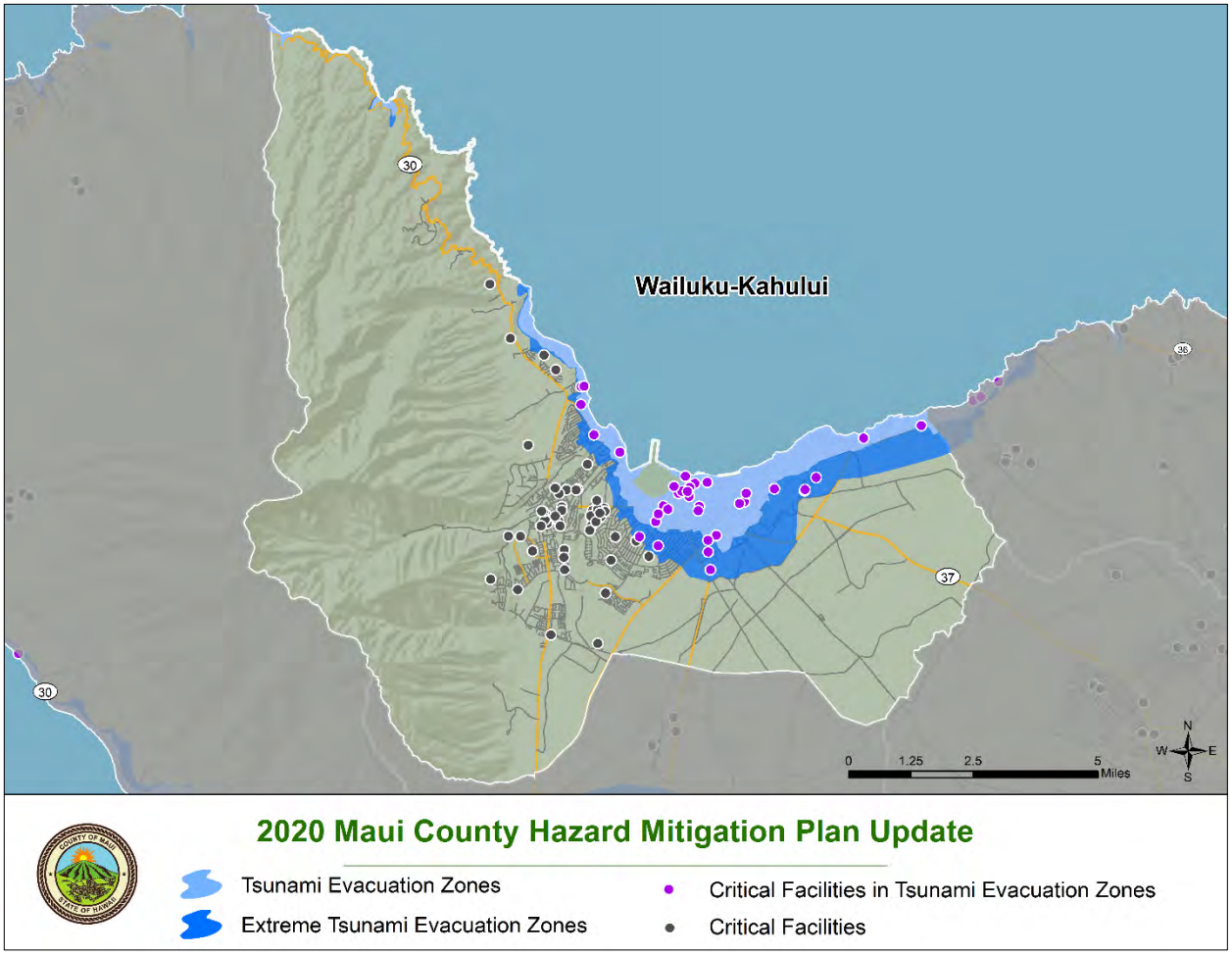

Figure 214. Critical Facilities in Tsunami Evacuation Zones in the Wailuku-Kahului Community Planning Area.

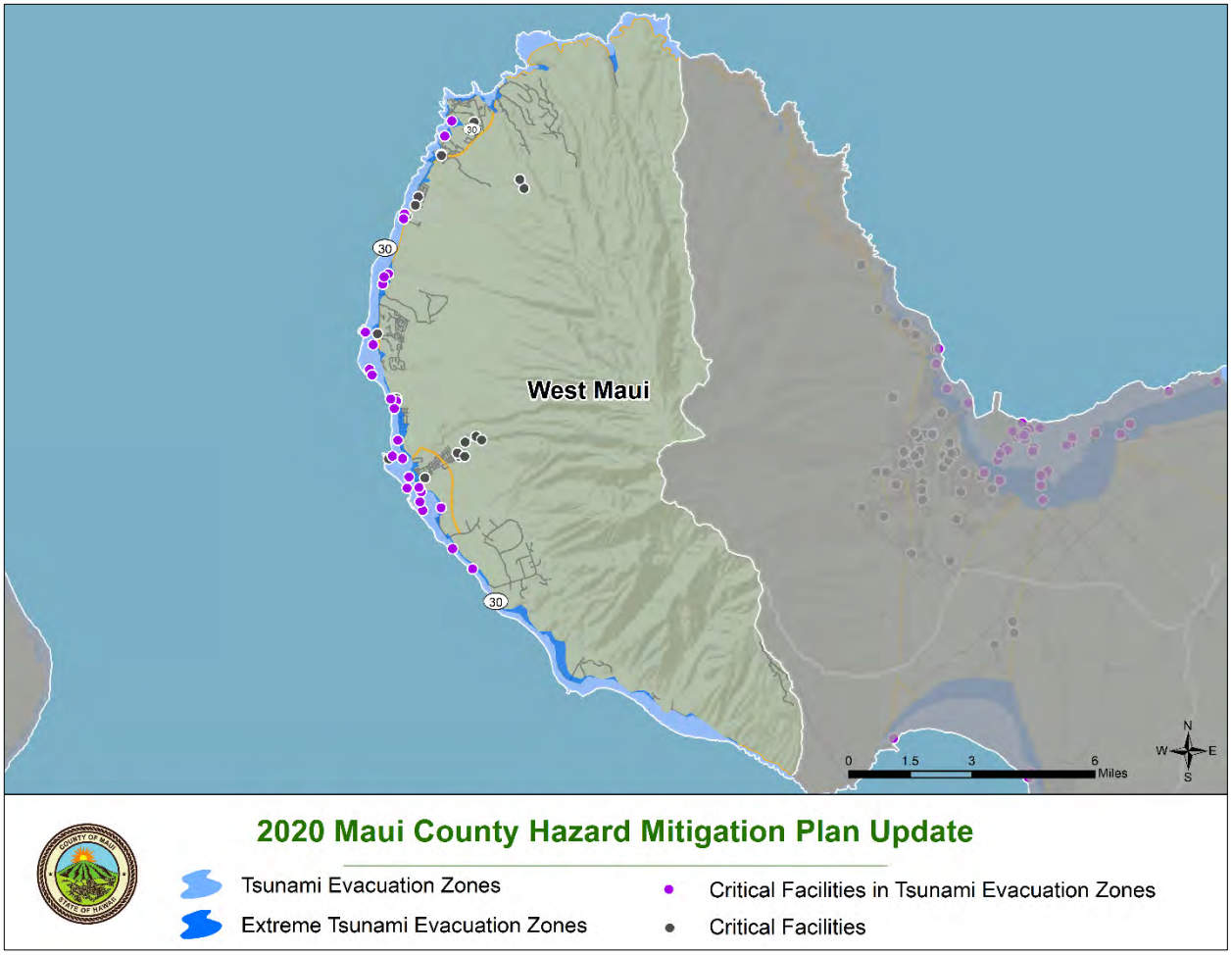

Figure 215. Critical Facilities in Tsunami Evacuation Zones in the West Maui Community Planning Area.

In addition to buildings and identified critical facilities, utility lines, roads, and bridges are vulnerable to the impact of tsunamis. When utility lines are damaged by tsunamis, functionality of water, sewer, gas, and electricity systems may be compromised. Because of their geographic extent, roads and utility lines can have a greater chance of being impacted by tsunami events. Further, if any section of a road or utility line is damaged or flooded by a tsunami, the entire system may be impacted. For instance, a tsunami that results in one area of a road or a bridge being impassible may block accessibility to other roads or locations until waters recede, or in the case of damage (e.g., undermining, scour, or washing out), until repairs can be completed.

Table 65 presents the number of bridges in each community planning area that are within a tsunami evacuation zones (normal and extreme). Figure 216 and Figure 217 present bridges within tsunami evacuation zones on the Islands of Maui and Molokaʻi. There are no NBI bridges on the Island of Lānaʻi.

Table 65. Number of NBI Bridges in Maui County Community Planning Areas in Tsunami Evacuation Zones.

Community Planning Area	Number of (NBI) Bridges
Hāna	0
Kīhei-Mākena	3
Lānaʻi	N/A
Makawao-Pukalani-Kula	N/A
Molokaʻi	16
Pāʻia-Haʻikū	1
Wailuku-Kahului	3
West Maui	10
MAUI COUNTY TOTAL	**33 (21%)**

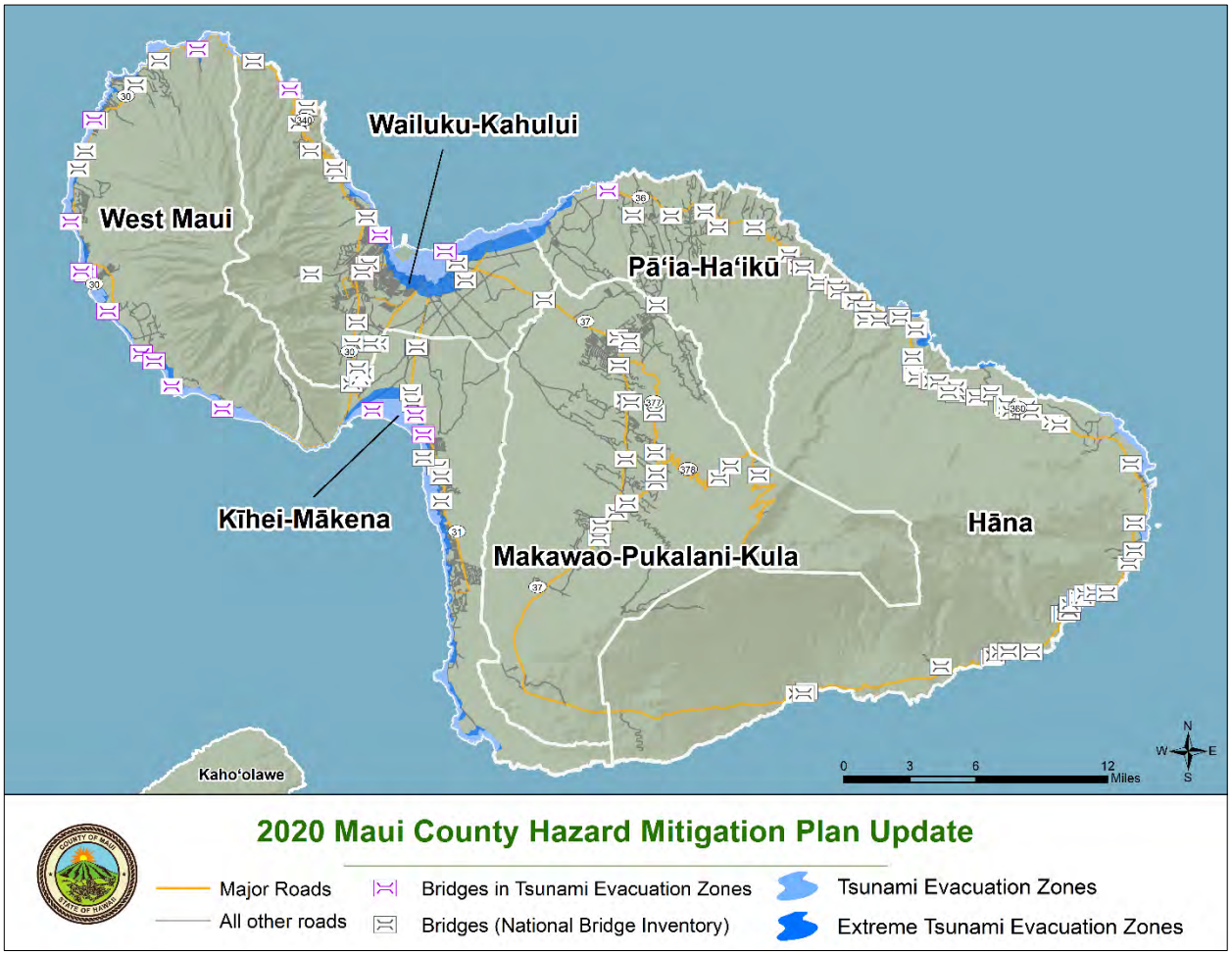

Figure 216. Bridges in Tsunami Evacuation Zones on Maui Island.

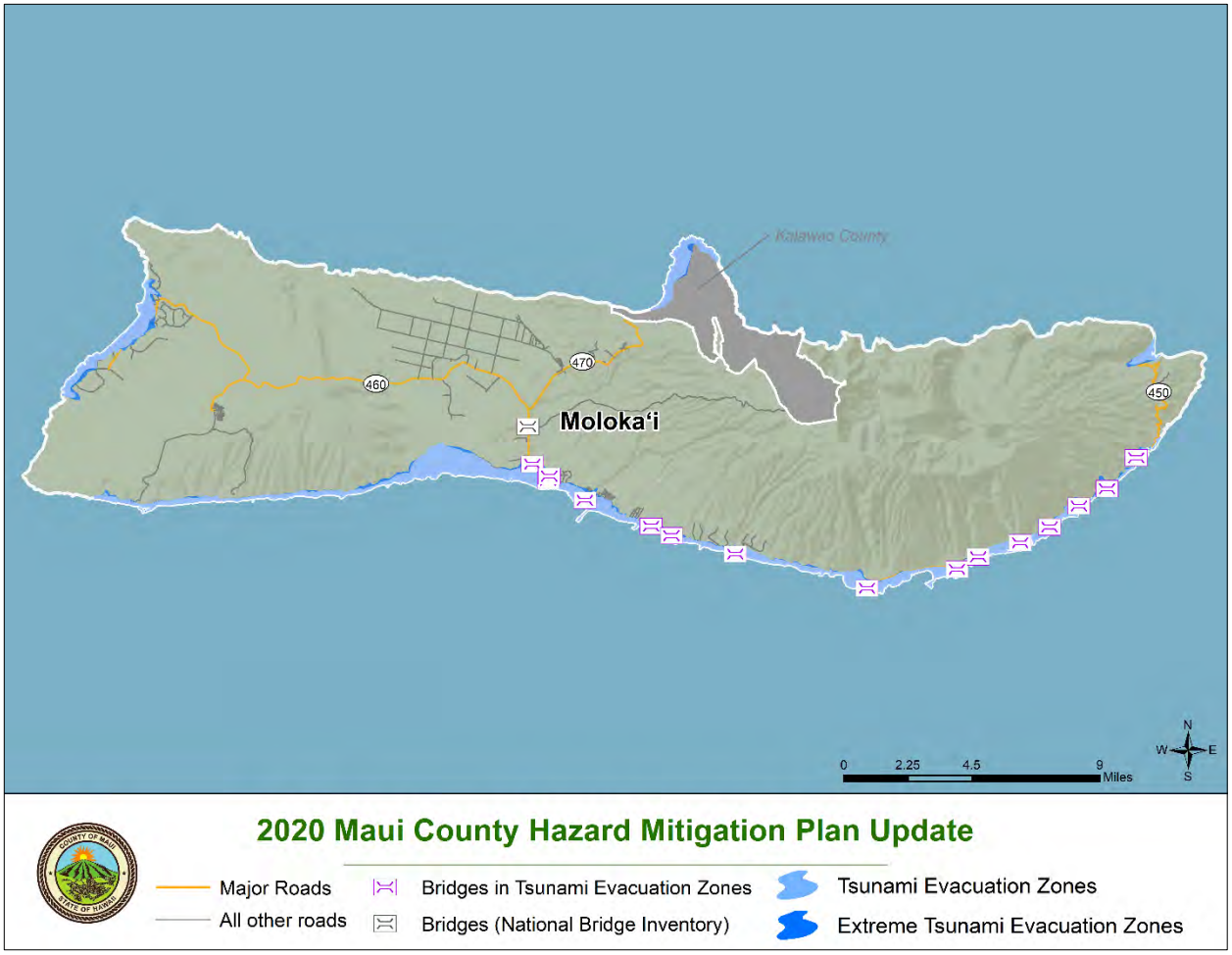

Figure 217. Bridges in Tsunami Evacuation Zones on Moloka'i Island.

Further, the maps below show roads, county-owned and others, within tsunami evacuation zones. Many roads may have a segment within a tsunami evacuation zone area rather than the entire road being within a risk area.

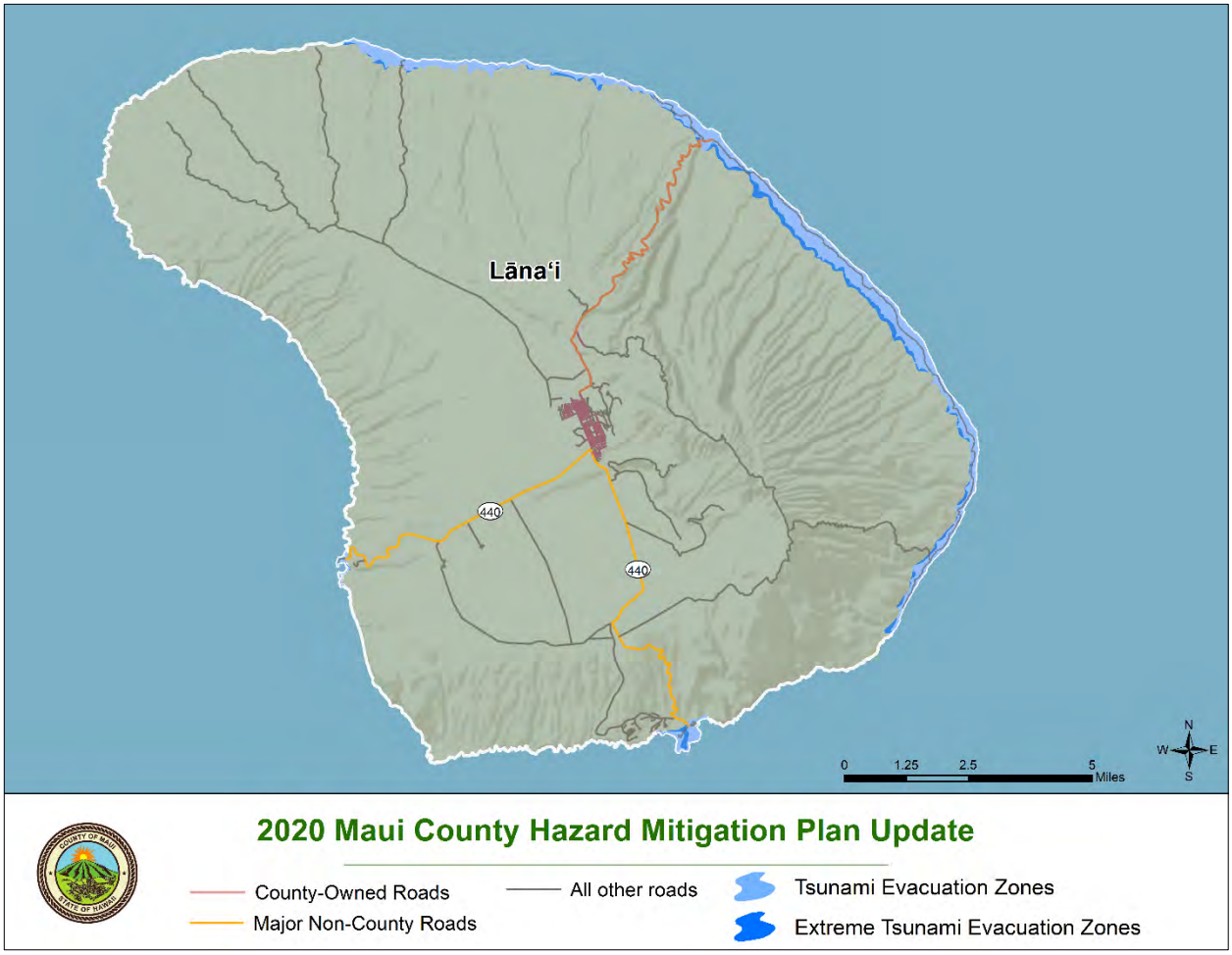

Figure 218. Roads and Tsunami Evacuation Zones on Lānaʻi Island.

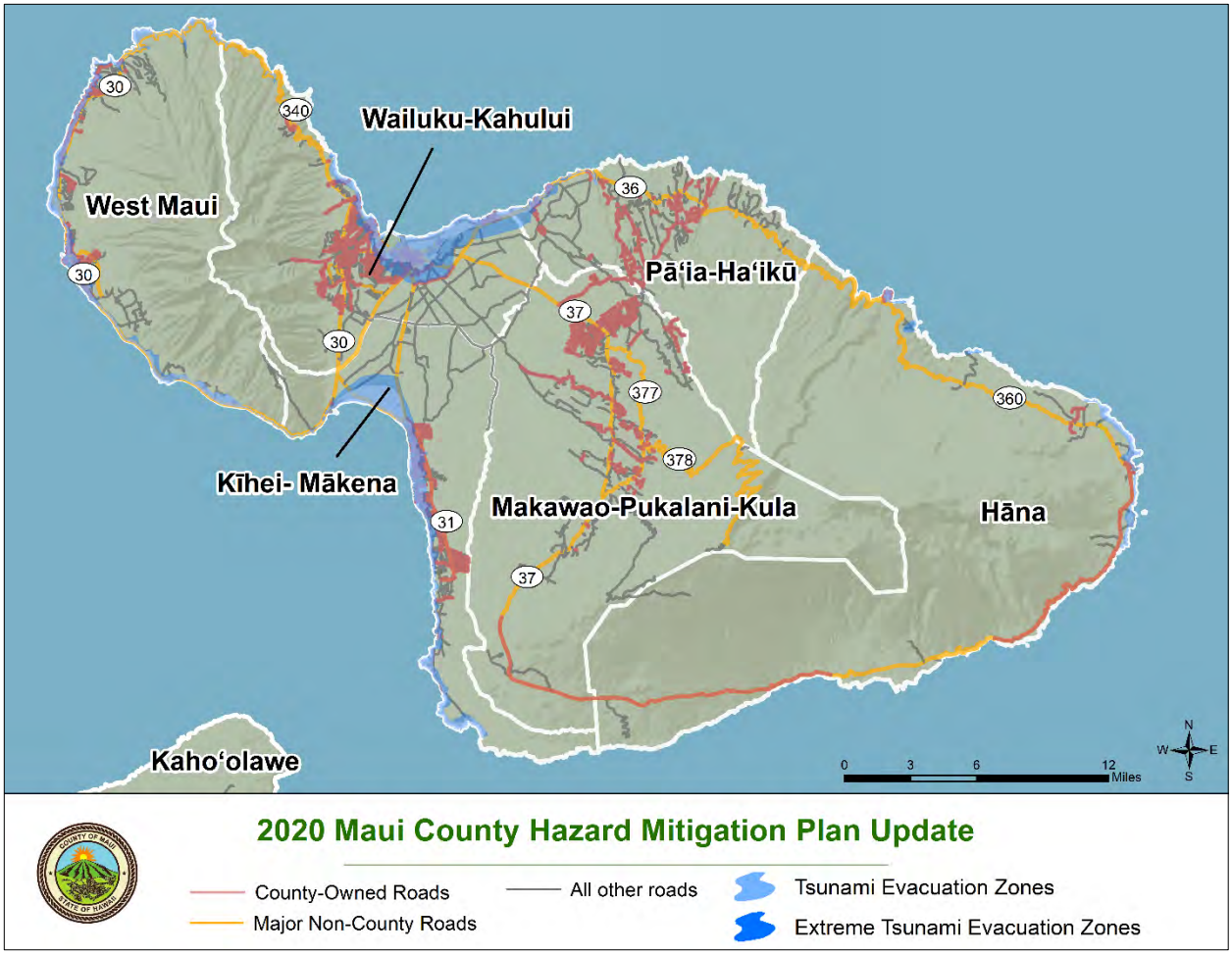

Figure 219. Roads and Tsunami Evacuation Zones on Maui Island.

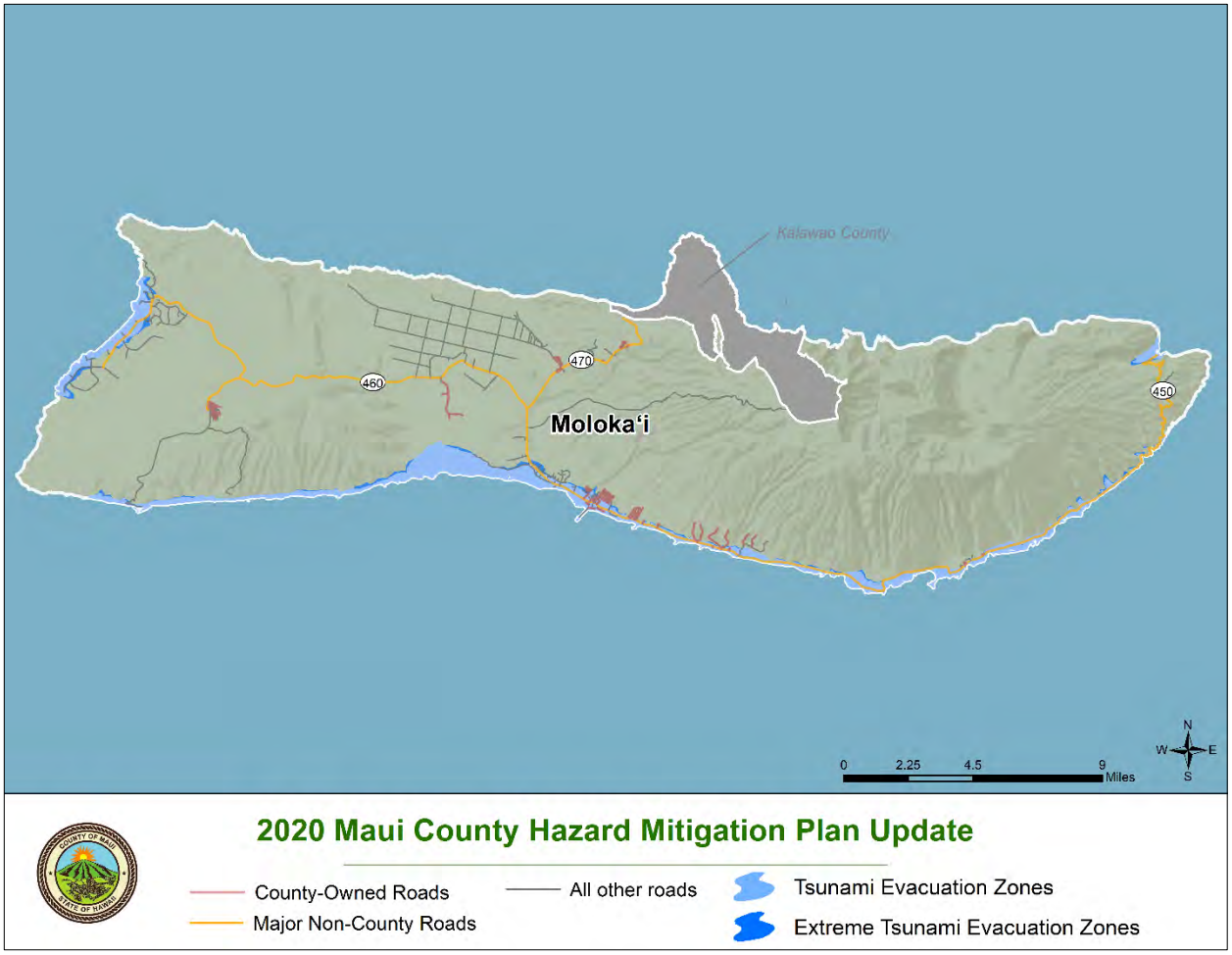

Figure 220. Roads and Tsunami Evacuation Zones on Moloka'i Island.

Life Safety, Health, Warning, and Evacuation Impacts

Tsunamis present serious risks to life safety. Cumulatively, tsunamis in the Hawaiian Islands have killed the largest number of people of all natural hazards affecting the state. Drowning is the most common cause of tsunami death. Powerful currents can turn floating debris into projectiles that can cause injuries, deaths, and property damage. Fires can also ignite from broken gas lines or ruptured tanks.[204]

An effective early warning system is essential for reducing loss of life and property during a tsunami. Tsunami and extreme tsunami evacuation zones have been modeled and are included in state and local evacuation plans. NOAA has two tsunami warning centers that are staffed 24 hours a day, 7 days a week. Their mission is to provide early tsunami warnings for potentially destructive tsunamis. The warning centers monitor for tsunamis and the earthquakes that may cause them, forecast tsunami impacts, issue tsunami messages, conduct public outreach, and coordinate with partners to continually

[204] International Tsunami Information Center (2020). What are tsunamis, and what causes them? Retrieved from http://itic.ioc-unesco.org/index.php?option=com_content&view=category&layout=blog&id=1004&Itemid=1004.

improve warning operations. The Pacific Tsunami Warning Center provides the official tsunami warnings for the State of Hawai‘i, including warnings, watches, advisories, information statements, seismic information statements, and warning cancellations.[205] These warnings are described below.[206]

A **Tsunami Warning** is issued when a potential tsunami with significant widespread inundation is imminent or expected. Generally, this means that the tsunami is expected to run up more than one meter above sea level. Warnings alert the public that widespread, dangerous coastal flooding accompanied by powerful currents is 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 to be taken by local officials may include the evacuation of low-lying coastal areas, and the repositioning of ships to deep waters when there is time to safely do so. Warnings may be updated, adjusted geographically, downgraded, or canceled. To provide the earliest possible alert, initial warnings are normally based only on seismic information. The warning includes an estimate of when the first tsunami wave will arrive.

A **Tsunami Advisory** is issued when the tsunami will be too small to require evacuation, but it is expected to be large enough to make beaches and near shore waters dangerous. Generally, this means that tsunami runup is expected to exceed 0.3 meters in some places but will not exceed 1.0 meter anywhere. A tsunami advisory means there is threat of a potential tsunami which may produce strong currents or waves dangerous to those in or near the water. 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 to be taken by local officials may include closing beaches, evacuating harbors and marinas, and the repositioning of ships to deep waters when there is time to safely do so. Advisories are normally updated to continue the advisory, expand/contract affected areas, upgrade to a warning, or cancel the advisory.

A **Tsunami Watch** is issued to alert emergency management officials and the public of a tsunami which may later impact the watch area. A tsunami watch will always be either upgraded to a warning or advisory—or canceled—based on updated information and analysis. Therefore, emergency management officials and the public should prepare to take action. Watches are normally issued based on seismic information before confirmation that a destructive tsunami has been generated. A tsunami watch is only issued if any potential tsunami is more than three hours away; if the potential tsunami will arrive within three hours a tsunami warning is issued instead.

A **Tsunami Information Statement** is issued to inform emergency management officials and the public that an earthquake has occurred, but there is no threat of a destructive tsunami in Hawai‘i. For earthquakes within the state, information statements are issued to prevent unnecessary evacuations as the earthquake may have been felt. An information statement may, in appropriate situations, caution

[205] NOAA/NWS (2020). *U.S. Tsunami Warning System*. Retrieved from https://www.tsunami.gov/.
[206] State of Hawai’i Hazard Mitigation Plan Update (2018). *Chapter 4.13 – Tsunami.*

about the possibility of minor wave activity. However, a watch, advisory or warning may be issued for the area, if necessary, after analysis and/or updated information becomes available.

Tsunami Warning Cancellation is the final product indicating the end of the damaging tsunami threat. A cancellation is usually issued after an evaluation of sea level data confirms that a destructive tsunami will not impact the warned area. In the event of a damaging tsunami, the cancellation is issued after coastal tide gauges show that waves have fallen below the danger level and no further damaging waves are expected.

Operational warning sirens for these warnings exist on the most densely populated coastal areas of all islands. In Maui County, when a tsunami warning is issued (for both urgent local tsunamis and distant-source tsunamis), a steady three-minute siren tone is the attention alert signal. When sirens are heard, residents and visitors are advised to tune into a local television or radio station for more information.[207]

In addition to using earthquake data as a tsunami indicator, NOAA, as part of the U.S. National Tsunami Hazard Mitigation Program, implemented the Deep-ocean Assessment and Reporting of Tsunami (DART) as a mechanism to detect and measure potential tsunamis using sea level data. Using actual wave data provide more accurate information regarding a tsunami's characteristics than earthquake data. DART systems consist of an anchored seafloor bottom pressure recorder (BPR) and a companion moored surface buoy for real-time communications. An acoustic link transmits data from the BPR on the seafloor to the surface buoy. The surface buoy then delivers data to the National Weather Service Telecommunications Gateway that then distributes the data in real-time to the Tsunami Warning Centers. The figure below presents the operation of the DART System.[208] Maui County participates in the NWS TsunamiReady program.

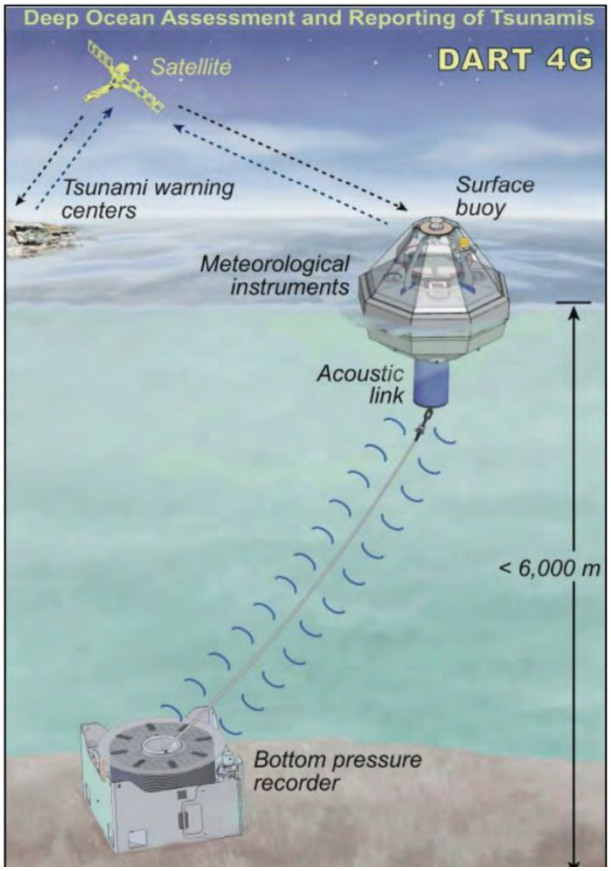

Figure 221. DART System.

[207] Maui County (2020). *Warning Procedures and Information*. Retrieved from https://www.mauicounty.gov/171/Warning-Procedures-and-Information.
[208] NOAA Center for Tsunami Research (2020). D*eep-Ocean Assessment and Reporting of Tsunami (DART)*. Retrieved from https://nctr.pmel.noaa.gov/Pdf/brochures/dart4G_Brochure.pdf.

Locally generated tsunami's have lower warning times than those sourced hundreds of miles away. Figure 222 shows estimated travel times for locally generated tsunamis. Some travel times are as little as 20 minutes for potentially impacted parts of Maui County. Visitors to the county not familiar with tsunami warnings or local tsunami evacuation routes may be at a risker risk to tsunami impacts.

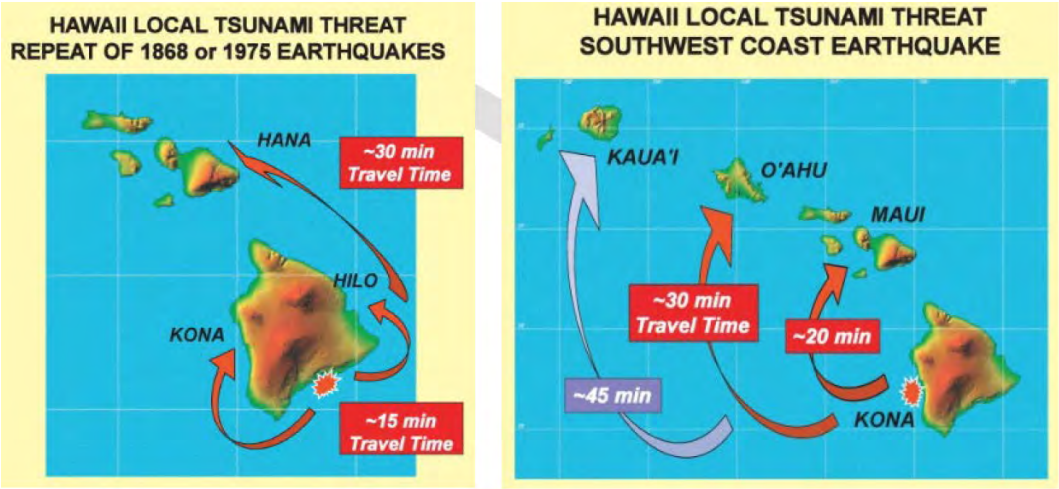

Figure 222. Estimated Travel Times for Locally Generated Tsunamis.[209]

Public Health Impacts

Public health impacts from tsunamis are similar to those of coastal flooding. Aside of direct threats to life and property, tsunamis cause result in the contamination of drinking water through saltwater intrusion, inundation of hazardous materials facilities, or inundation of wastewater treatment plants. Flood water may contain these hazardous materials and be dangerous to traverse. Further, flooded structures may quickly develop mold or wood rot, presenting serious health risks to inhabitants if not treated properly.

Impacts to Vulnerable Populations

A quarter to almost half of buildings in the Moloka'i, Wailuku-Kahului, West Maui, and Kīhei-Mākena Community Planning Areas are located within tsunami evacuation zones, therefore significant numbers of the population who live, work or go to school in these locations are potentially exposed to the tsunami hazard. Numerous visitor accommodations are also located in coastal areas of the Kīhei-Mākena and West Maui Community Planning Areas. The Moloka'i, Wailuku-Kahului, West Maui, and Kīhei-Mākena Community Planning Areas rank first, second, third, and sixth, respectively, for overall vulnerability.

While all populations within tsunami hazard zones are considered at-risk to tsunami impacts, certain populations within these areas may be more vulnerable than others due to socioeconomic characteristics, and especially those related to household composition, access to information and access

[209] 2018 State of Hawai'i Hazard Mitigation Plan

to lifelines. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are described below.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty with mobilizing and evacuating in a timely fashion if a tsunami warning is issued. Further, the deaf or hard of hearing may not hear audible hazard alerts such as tsunami sirens. Once evacuated, these populations will require additional services and care considerations in the response aftermath and during recovery. Special accommodations for these populations must be considered in disaster planning processes.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a natural disaster. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate preparedness actions such as stocking extra food and supplies, support recovery actions such as repairing of homes after a disaster, or fund mitigation actions that would protect their homes and property from future hazard impacts.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon urgent hazard warning information. Additionally, those who do not speak English well, may not comprehend hazard warning information to the extent that enables them to make timely decisions and take life-saving actions in the event of a tsunami.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living in housing built before 1950, and prior to the enactment of modern building codes, are more susceptible to damages and losses due to structural damage as a result of hazard impacts. Structures in coastal areas and built prior to the enactment of setback regulations could suffer greater damages from a tsunami due to their proximity to the ocean. In addition, higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences as a result of hazard exposure.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges during a tsunami evacuation, and have difficulty accessing needed supplies and services before, during and after an event. Fewer evacuation options are available in areas with lower road densities. Furthermore, tsunami impacts can damage or destroy transportation infrastructure, hampering relief efforts and potentially isolating remote communities for extended periods. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Moloka‘i households also do not have access to a vehicle.

Economic Impacts

Tsunamis can have wide-reaching economic impacts. Direct economic impacts may result from destroyed buildings and infrastructure, including power utility poles and lines, potable water and wastewater facilities, and roadways. The force of tsunami waves may destroy piers, breakwaters, and seawalls. Ships, marinas, and fishing fleets may be battered, sunk, moored, or stranded, impacting the fishing and tourism industries. Business interruptions can occur, and damages or changes to impacted beaches may impact tourism for periods long after the tsunami. Further, the county may attract less tourists after a tsunami, as there may be a perceived risk to visiting.

Climate Change Impacts

While climate change may not have known impacts om tsunami sources (earthquakes, landslides, and volcanoes), climate change may make Maui County more susceptible to tsunami impacts. Increased sea levels associated with climate change could mean tsunamis can reach farther inland. Further, warming ocean trends are known to cause coral bleaching episodes. Coral reefs provide protection against tsunamis by forming an offshore barrier that works to dissipate wave energy.

Volcanic Hazards

Description

A volcano is an opening in earth’s crust through which molten rock, called magma, and gases escape to the surface. Volcanoes form in three different types of tectonic settings: 1) subduction zone volcanoes

are the most violent and destructive, and form where one tectonic plate is subducted under another; 2) rift volcanoes are the most common and form where two tectonic plates are spreading apart; and 3) hot spot are volcanic centers that are typically 60-120 miles across. Mount St. Helens, a Washington volcano famous for its eruption in 1980, is a subduction zone volcano, whereas the infamous Yellowstone Caldera is a hot spot.[210]

Volcanoes can be active, dormant, or extinct. Active volcanoes are erupting or have erupted in recorded history. Dormant volcanoes are not currently erupting but are expected to erupt again in the future. Lastly, extinct volcanoes have not erupted in recorded history and are not expected to erupt in future. As shown in Figure 223, active volcanoes pose a variety of natural hazards:

- **Lava flows, domes, and dome collapses**: Lava flowing across the ground rarely threatens human life, as it typically moves at a slow rate and follows a predictable path. Alternatively, sluggish, partially solidified lava may push up at the vent during an effusive eruption, creating a lava dome. A growing lava dome may become so steep that it collapses, violently releasing pyroclastic flows potentially as hazardous as those produced during explosive eruptions.

- **Pyroclastic flows**: a pyroclastic flow is a ground-hugging debris flow of hot ash, pumice, rock fragments, and volcanic gas that can rush down the side of a volcano at a speed of 60 miles per hour or more. Temperatures in pyroclastic flows can be over 930 degrees Fahrenheit and are capable of burning and carbonizing wood. Distances pyroclastic flows can travel are dependent upon the surrounding topography and the volume of magma released.

- **Lahars**: Lahars are another type of debris flow in which volcanic particles mix with water. Lahars are formed when pyroclastic flows enter rivers or creek systems, when they flow over snow and ice, or when heavy rain fall on loose volcanic debris. Lahars can travel as quickly as 100 miles per hour and travel as far as 190 miles. Lahar can also transition into normal floodwaters as they become diluted downstream.[211]

- **Volcanic Ash and Tephra Fall**: Explosive eruptions blast fragments and gas into the air with tremendous force. The finest particles (ash) billow upward, forming an eruption column that can attain stratospheric heights in minutes. Tephra (volcanic ash and larger rock fragments), carried by the prevailing winds, is an aviation hazard and may remain suspended for hundreds of miles before settling to the ground as tephra fall. Generally, tephra gain size and thickness of accumulations decreases with distance from the eruption.

- **Volcanic Gas or Fog (Vog):** During an eruption, noxious gases, such as water vapor, carbon dioxide, sulfur dioxide, hydrogen sulfide, carbon monoxide, and chlorine, can be released into the surrounding area. These gases can mix with atmospheric moisture to produce volcanic smog

[210] Volcanoes. (2017). Oregon State University. Retrieved October 31, 2017 from http://volcano.oregonstate.edu/volcanoes-0.

[211] Fisher, R. (1997). Hazardous Volcanic Events. Retrieved October 31, 2017 from http://volcanology.geol.ucsb.edu/hazards.htm.

(vog) and acid rain. Vog poses a health hazard, as it can result in respiratory illnesses, contaminated water, and crop damages. In rare cases deaths and injuries can result gases released as part of an eruption. Perhaps the most tragic incident to occur in recent history is that in 1986 at Lake Nyos, Cameroon, in which over 1,700 people died from lack of oxygen when large amounts of carbon dioxide spilled out of Lake Nyos and flowed down to a nearby village. Further, when molten lava flows into the ocean, it creates localized air pollution known as laze (combination of the words lava and haze). This is a type of gas plume that results in hazy and noxious conditions downwind of an ocean entry. It forms through a series of chemical reactions as hot lava boils seawater. The plume is a mixture of hydrochloric acid gas (HCl), steam, and tiny volcanic gas particles. The entry point area and downwind should be avoided by humans, as laze can cause skin and eye irritation, and breathing difficulties.[212] Laze was formed in the most recent eruption of Kilauea in 2018.

[212] USGS (2017). *Volcanic gas hazards from Kilauea volcano*. Retrieved from https://volcanoes.usgs.gov/observatories/hvo/hvo_gas.html.

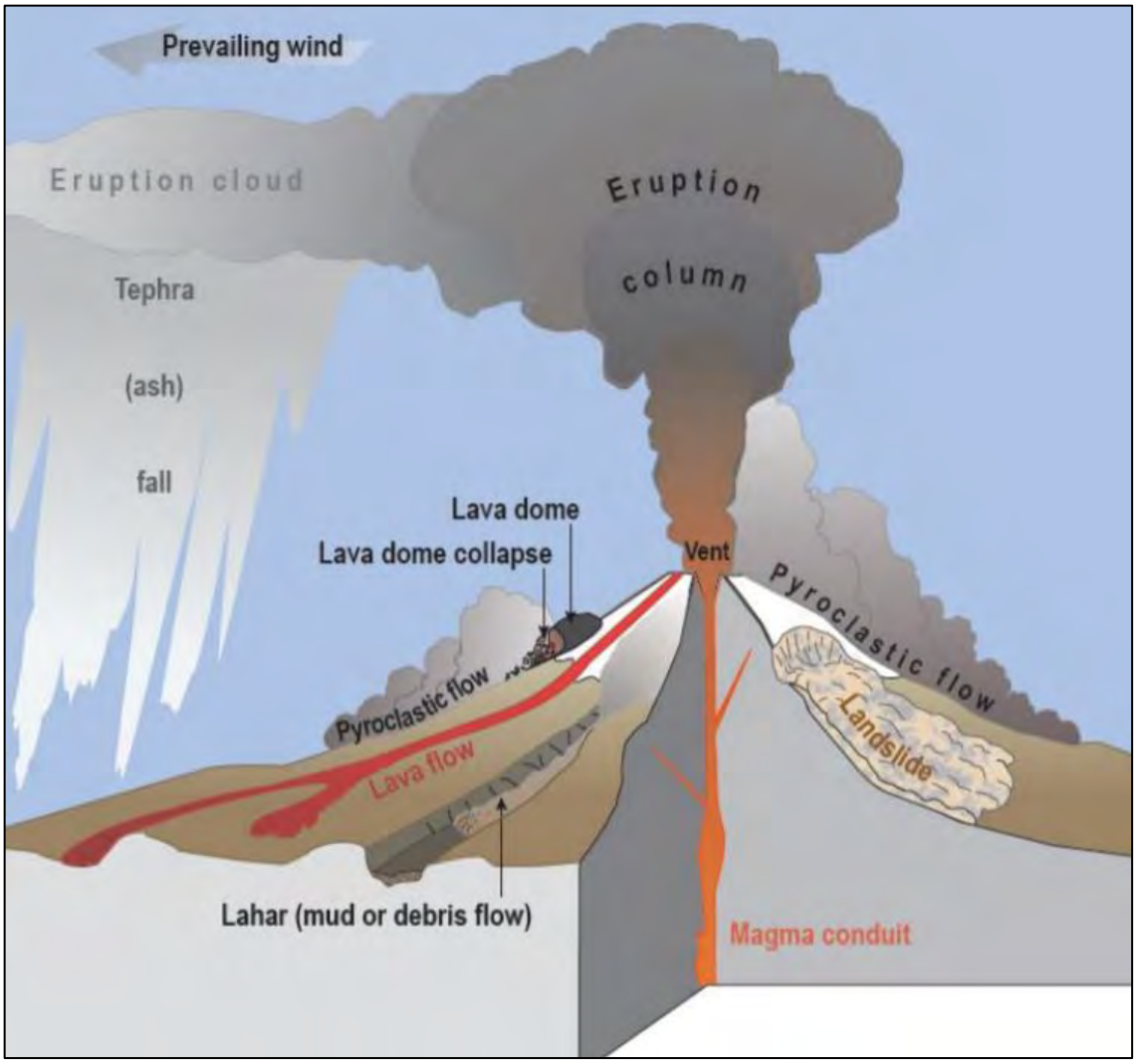

Figure 223. Volcanos and Associated Hazards.[213]

Predicting exactly when a volcano will erupt is impossible, but with constant monitoring, geologists are becoming more accurate in recognizing signs of eruption. It is not possible to stop a volcano from erupting, but mitigation and preparedness can locate people and infrastructure out of harm's way and allow for adequate warning and evacuation procedures in the event of an eruption.

Volcanoes in Hawai'i are shield volcanoes. Shield volcanoes develop as lava flows form gently sloping, shield-like mountains. Shield volcanoes are the largest volcanoes on earth. Examples of shield volcanoes are Maunaloa in Hawai'i County and Haleakalā in Maui County. Hawai'i's volcanic activity is distinct from that occurring at continental margins (e.g. Mt. Shasta, Mt. St. Helens) in that volcanoes in Hawai'i produce more fluid basalt magmas, which are typically less explosive. Basalt lava flows are characterized by two morphologies, known around the world by their Hawaiian names, `a`ā and pāhoehoe. Eruptions

[213] Madera County Hazard Mitigation Plan Update (2017). Madera County, CA. Retrieved from https://www.maderacounty.com/home/showdocument?id=362.

from shield volcanoes are not typically explosive unless water has entered the system's vent. The understanding of the eruptive process, including explosive activity, is incomplete as subject-matter experts have been able to observe and record only a small fraction of Hawaiian volcano life cycles. Shield volcanoes erupt almost exclusively at their summits or along rift zones.[214] The figure below shows the composition of a shield volcano.

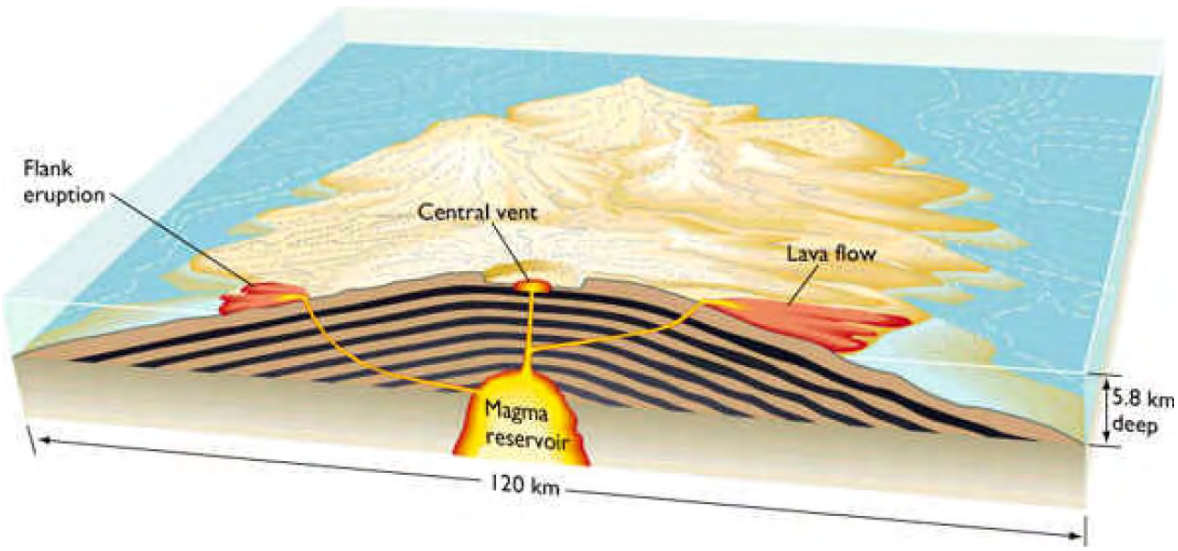

Figure 224. Composition of a Shield Volcano.[215]

Location

Maui County is at risk to two different types of volcanic hazards – lava flows and vog. Lava flows pose a risk only to the Island of Maui, from a possible eruption of Haleakalā. Haleakalā is a shield volcano, with a moderate threat level designation from USGS.

On the Island of Hawai'i, lava-flow hazards are rated on a scale of one through nine, with one being the zone of highest hazard and nine being the zone of lowest hazard. For example, the summits and rift zones of Kilauea and Maunaloa volcanoes are rated Hazard Zone 1. Using this same scale, preliminary estimates of lava-flow hazard zones on Maui were made in 1983 by the U.S. Geological Survey. In 2006, researchers suggested an adjustment of the zones in relation to Haleakalā due to the Maui volcano's considerably smaller size than the active volcanoes located on the Island of Hawai'i. As a result, these researchers suggested that Maui Zone 1 is roughly equivalent to Hawai'i Island Zone 3, Maui Zone 2 is roughly equivalent to Hawai'i Island Zone 4, and Maui Zone 3 is roughly equivalent to Hawai'i Island Zone 6. In other words, no place on Maui has volcanic hazards equivalent to Lava-Flow Hazard Zones 1

[214] State of Hawai'i Hazard Mitigation Plan Update (2018). *Chapter 4.14: Volcanic Hazards (Lava Flow and Vog).*
[215] State of Hawai'i Hazard Mitigation Plan Update (2018). *Chapter 4.14: Volcanic Hazards (Lava Flow and Vog), Figure 4.14-1.*

and 2 on Hawai'i Island.[216] The figure below shows the current lava flow hazard zones on Maui developed in 2006, with the original zones inset.[217]

According to the 2018 State of Hawai'i Hazard Mitigation Plan Update, approximately 212 square miles (18%) of Maui County are within Lava Flow Hazard Zones 1 through 4.

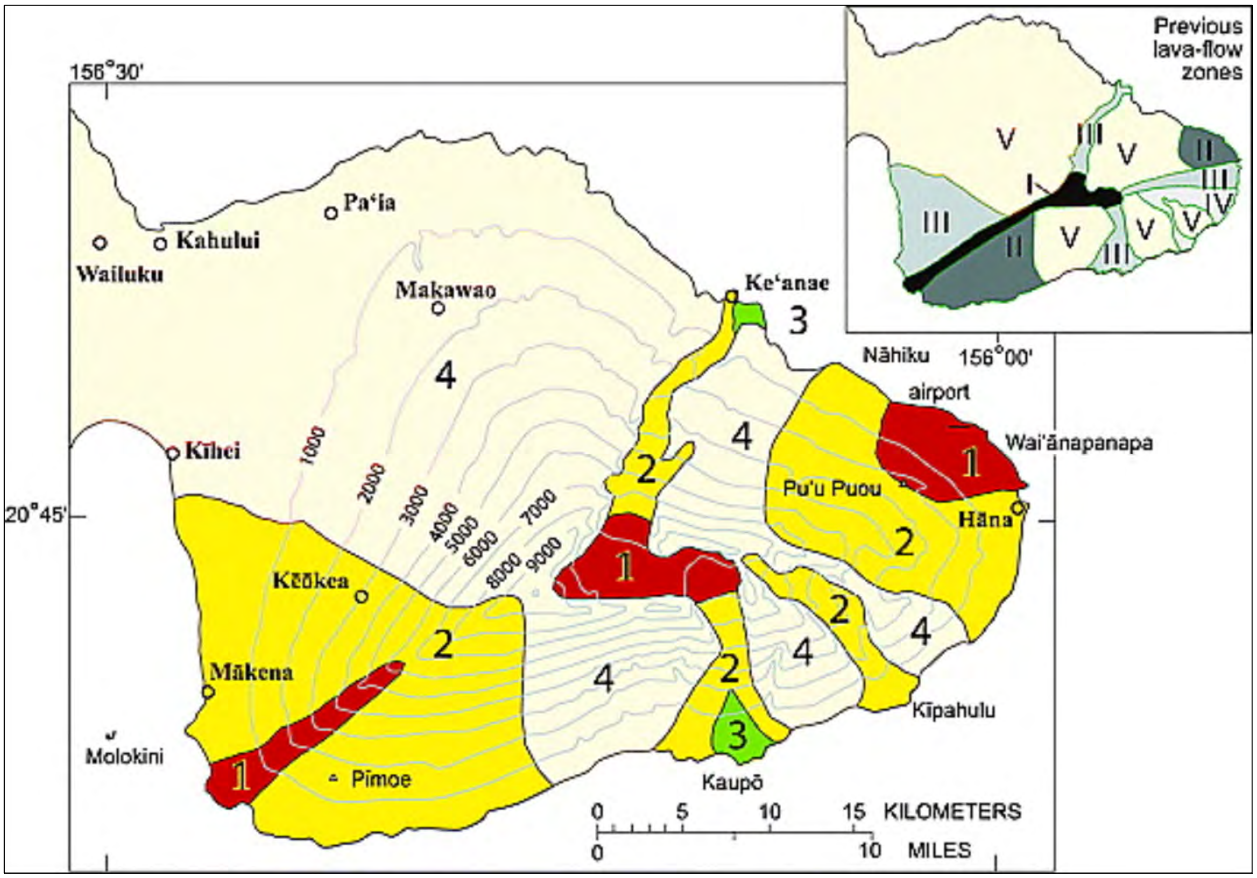

Figure 225. Lava Flow Hazard Zones on the Island of Maui.

The second volcanic hazard, vog, has the potential to impact the entire county. In the Hawaiian Archipelago, potential sources of vog are Haleakalā on the Island of Maui, Maunaloa and Hualalai on the Island of Hawai'i, and the active Kilauea volcano, also on the Island of Hawai'i. Of these volcanoes, only Kilauea has had an eruption in the last 200 years.

Kilauea's most recent eruption initiated in 1983 and continues to the present day. From Kilauea, vog typically originates at the Halemaumau vent (at the volcano's summit), the Puu Oo vent (at the volcano's upper east rift zone), and the ocean entry plume (along the shoreline of Puna District). The concentrations of sulfur dioxide gas in vog are typically greater near Kilauea. Sulfur dioxide levels are

[216] Maui County Hazard Mitigation Plan Update (2015). *Chapter 17: Volcanic Hazards: Lava Flow and VOG.*
[217] USGS. *Map of lava-flow hazard zones, Maui Island, Hawai'i.* Retrieved from https://www.usgs.gov/media/images/map-lava-flow-hazard-zones-maui-island-hawai-i.

lessened further away or upwind from the vents. While vog typically impacts the Island of Hawaiʻi, during episodes of Kona storms or non-trade wind conditions, vog can be transferred further north towards the Maui County. Because of Maui Island's unique topography, vog is funneled through the central valley between Haleakalā volcano and the West Maui Mountains. Therefore, the effects of vog are not limited to the island's southern coast in Kīhei-Mākena but can extend as far as the agricultural areas of central and upcountry Maui and the densely populated areas of Wailuku and Kahului on the island's northern shore. Episodes of vog on the islands of Lānaʻi and Molokaʻi are less common because these islands are further away from the sources on the Island of Hawaiʻi. Lānaʻi and Molokaʻi are also shielded from wind-blown vog by the mountains on Maui Island.[218]

Previous Occurrences

Haleakalā has erupted approximately 10 times over the last 1,000 years, with the most recent eruption around 1790 on the volcano's south flank. At the time of the eruption, this area of the island was not populated.

More recently, vog episodes have impacted Maui County from eruptions of neighboring Hawai'i island. Significant vog occurrences in Maui County have included the following:

- **April 25, 2008**—According to The Maui News, the Island of Maui District Health Office issued an advisory for the residents of the Island of Maui due to vog originating from Kilauea's summit vent. The advisory urged individuals with respiratory conditions to take precautions. The Hawaiian Volcano Observatory reported that a few days before the advisory for the Island of Maui went in effect, sulfur dioxide levels around the observatory topped 1 ppm for a period of 2 hours.
- **January 2015**—Maui County experienced obscured views and potentially hazardous vog conditions. A surface ridge sitting over the islands changed the typical trade wind weather pattern, forcing winds to come up from the south, instead, bringing along vog from Hawai'i island's Kilauea Volcano up as far as Kauai. The vog was so thick, that a kayaker became disoriented while trying to paddle from Maui to Hawai'i island and had to be rescued by the Coast Guard 19 miles northeast of Kohala.
- **May 2018** – In May 2018 and new eruption at Kilauea began, lasting through August 2018. Maui County experienced potentially hazardous vog conditions associated with this eruption.

Extent

As Haleakalā has not erupted since the late 18th century, when the area around the volcano was not inhabited, determining the extent of a lava flow event in Maui County is difficult. Lava flows can destroy homes, business, roadways, and other infrastructure within lava flow hazard zones. The extent of volcanic eruptions can be measured the Volcanic Explosivity Index (VEI), a numeric scale that measures

[218] Maui County Hazard Mitigation Plan Update (2015). *Chapter 17: Volcanic Hazards: Lava Flow and VOG.*

relative explosivity of historic eruptions.[219] The VEI scale ranges from 0 for non-explosive eruptions and 8 for the largest eruptions in history (e.g. the Yellowstone Caldera eruption 600,000 years ago). While no previous eruptions of Haleakalā have been scored using the VEI, shield volcanoes are generally considered non-eruptive. Therefore, an eruption of Haleakala would most likely receive a low VEI score, such as 0 or 1.

The extent of the hazard posed by volcanic gases and vog depends on the amount of magma being erupted and the concentration of gas in that magma. The Hawai'i Department of Health has developed an index reflecting the hazardous levels of sulfur dioxide, a common noxious gas present in vog. These color-coded categories are presented in Figure 226. Based on past events and information from the International Volcanic Health Hazard Network, the most severe vog conditions expected for Maui County is the orange, indicating that sulfur dioxide levels are unhealthy for sensitive groups, such as the elderly, very young, or those with respiratory illnesses.[220]

[219] USGS. *Volcano Hazards Program Glossary – VEI*. Retrieved from https://volcanoes.usgs.gov/vsc/glossary/vei.html#:~:text=Volcanic%20Explosivity%20Index%20(VEI)%20is,to%20determine%20the%20explosivity%20value..

[220] International Volcanic Health Hazard Network. *Real-time and historic air quality data*. Retrieved from https://vog.ivhhn.org/current-air-quality.

SO_2 Conc. (ppm)[1]	Color Code & Air Quality Condition	Air Quality Description	Recommended Action/Activity[2]		
			Sensitive Groups[3]	People Experiencing Health Effects[3]	Everyone Else
0 – 0.10	Green (Good)	Considered satisfactory & poses little or no risk	Highly sensitive individuals may be affected at these levels		Potential health effects not expected
0.11-0.20	Yellow (Moderate)	Acceptable, however, may be moderate health concern for small number of people	Be aware that levels are slightly elevated	If you experience breathing difficulties, such as chest tightness or wheezing, stop activities, use a rescue inhaler and find a place to sit down and rest.	Potential health effects not expected, however actions to reduce exposure to vog may be useful
0.21–1.00	Orange (Unhealthy for Sensitive Groups)	Members in sensitive groups, including healthy individuals with mild asthma, may experience health effects. They may be affected at lower levels than general public. Toward the upper end of this range, most asthmatics who are active outdoors are likely to experience some breathing difficulties. General public not expected to be affected in this range.	Avoid outdoor activities that cause heavy breathing or breathing through the mouth[4]	If you experience breathing difficulties, such as chest tightness or wheezing, stop activities, use a rescue inhaler and find a place to sit down and rest.	Potential health effects not expected, however actions to reduce exposure to vog may be useful
1.01–3.00	Red (Unhealthy)	Everyone may begin to experience health effects. Members of sensitive groups may experience more serious health effects.	Avoid outdoor activities & remain indoors	Consider leaving the area	Avoid outdoor activities that cause heavy breathing or breathing through the mouth[4]
3.01–5.00	Purple (Very Unhealthy)	Triggers health alert, meaning everyone may experience more serious health effects.	Avoid outdoor activities & remain indoors	Leave the area & seek medical help	Avoid outdoor activities & remain indoors
> 5.01	Maroon (Hazardous)	Triggers health warnings of emergency conditions. Entire population is more likely to be affected.	Avoid outdoor activities & remain indoors. Leave the area if directed by Civil Defense	Leave the area & seek medical help	Avoid outdoor activities & remain indoors. Leave the area if directed by Civil Defense

Figure 226. Short-term Sulfur Dioxide Advisory Levels.[221]

Probability

Based on past events, Maui experiences a lava flow event from an eruption at Haleakalā every few hundred years. However, the county typically experiences a vog event due to eruptions on the Island of Hawaiʻi every few years. Within Maui County, certain community planning areas are more likely to experience volcanic hazards than others due to potential lava flow trajectories or wind patterns that bring vog from the Island of Hawaiʻi to Maui County. The table below presents volcanic hazard probabilities for each community planning area.

Table 66. Volcanic Hazard Probabilities for Maui County Community Planning Areas.

Community Planning Area	Landslide Probability
Hāna	Likely (10% to 90% annual chance)
Kīhei-Mākena	Likely (10% to 90% annual chance)
Lānaʻi	Possible (1% to 10% annual chance)
Makawao-Pukalani-Kula	Likely (10% to 90% annual chance)
Molokaʻi	Possible (1% to 10% annual chance)

[221] Hawai'i Department of Health. *DOH Guidance on Short-term Sulfur Dioxide (SO2) Advisory Levels.* Retrieved from http://www.hiso2index.info/assets/FinalSO2Exposurelevels.pdf.

Community Planning Area	Landslide Probability
Pāʻia-Haʻikū	Likely (10% to 90% annual chance)
Wailuku-Kahului	Likely (10% to 90% annual chance)
West Maui	Possible (1% to 10% annual chance)

Vulnerability

All of Maui County is vulnerable to volcanic hazards from vog. While lava flows are slow-moving, they destroy essentially everything in their path. Therefore, all current and future buildings, infrastructure, critical facilities, and populations within lava flow hazard zones (Figure 225) are considered at risk to lava flow.

Building Impacts (including Critical Facilities)

All buildings and infrastructure (including critical facilities) within lava flow hazard zones are considered at risk. This includes the Pāʻia-Haʻikū, Makawao-Pukalani-Kula, and Hāna community planning areas, as well as the eastern portions of the Kīhei-Mākena and Wailuku-Kahului community planning areas.
All buildings and infrastructure in Maui County are also considered at risk to vog. While most vog impacts are on human health, vog can impact buildings and infrastructure through corrosion. Acid aerosols increase corrosion to any exposed metal along the path of the downwind vog plume, including fencing, waterlines, water tanks, farm equipment, and exposed steel structures (i.e. transmission towers, bridges). Even in relatively dry downwind areas, severe corrosion will generate significant economic losses. Dew formation drives corrosion rather than infrequent rainfall; during the evening hours, as the dew point temperature is approached, acid aerosols will form an extremely corrosive film on metallic surfaces. With daily replenishment of fresh acid from vog, and nightly condensation of moisture it is reasonable to anticipate substantially more rapid deterioration of exposed metal surfaces than would occur in similar environments not exposed to vog.[222]

Life Safety, Health, Warning, and Evacuation Impacts

It can be assumed that all existing and future populations are at risk to volcanic hazards. Injuries and fatalities are possible people within lava flow trajectories due able not able to evacuate in time. Further, vog can have significant impacts on health and life safety, especially for populations considered to have increased vulnerability.

Sulfur dioxide is irritating to the eyes, nose, throat and respiratory tract. Short-term exposure to elevated levels of sulfur dioxide may cause inflammation and irritation, resulting in burning of the eyes, coughing, difficulty in breathing and a feeling of chest tightness. In terms of exposure to vog, sensitive populations include young children and individuals with preexisting respiratory conditions, such as asthma, emphysema, bronchitis, and chronic lung or heart disease. Individuals who belong to these sensitive populations may respond to very low levels of sulfur dioxide in the air. Prolonged or repeated exposure to higher levels may increase susceptibility to vog impacts.

[222] Maui County Hazard Mitigation Plan Update (2015). *Chapter 17: Volcanic Hazards: Lava Flow and VOG.*

Other common symptoms of vog exposure include the following:[223]

- Headaches;
- Breathing difficulties;
- Increased susceptibility to respiratory ailments;
- Watery eyes; and,
- Sore throat.

The USGS maintains five volcano observatories charged with monitoring and researching active volcanoes within the United States. The Hawaiian Volcano Observatory monitors volcanoes in Hawai'i. Since 1790, Haleakalā has settled into a pattern of dormancy. However, Haleakalā is still monitored by the USGS for the possibility of further large-scale events. As a result of this monitoring, it is likely, although not definite, that warning time ranging from hours to weeks would be available for any event likely to impact Maui County.

The Hawai'i Department of Health provides ambient air quality data and short-term sulfur dioxide advisories. These advisories are issued based on the color codes described in Figure 226. Further, private sites such as *AirNow* provide real-time air particle monitoring data.[224]

In the event Haleakalā erupts, an entire or partial evacuation of households and businesses within lava hazard zones will likely occur. During vog events, it may be necessary for certain populations, especially those considered sensitive to vog impacts, to shelter indoors or evacuate an area.

Public Health Impacts
Volcanic hazard-induced public health impacts are described above.

Impacts to Vulnerable Populations
Based on available hazard information, all populations within Maui County may be exposed to vog. In addition, populations living within the Pāʻia-Haʻikū, Makawao-Pukalani-Kula, and Hāna Community Planning Areas, as well as the eastern portions of the Kīhei-Mākena and Wailuku-Kahului Community Planning Areas may be exposed to lava flow hazards. As lava flows permanently alter the landscape and destroy everything in their path, complete property loss is likely, presenting hardships to all affected but especially those with socioeconomic limitations. Lava flows may also cause interruptions to services upon which populations rely, such as electricity and communications, and damage infrastructure such as roadways, which can inhibit evacuation or access to health care.

Vog causes irritation to mucous membranes and is particularly harmful to those with pre-existing respiratory conditions. Populations without access to health insurance may delay seeking critical medical treatment.

[223] Maui County Hazard Mitigation Plan Update (2015). *Chapter 17: Volcanic Hazards: Lava Flow and VOG.*
[224] International Volcanic Health Hazard Network (2020). *Real-Time & Historic Air Quality Data.* Retrieved from https://vog.ivhhn.org/current-air-quality.

Populations exhibiting constraints related to all subcomponents of vulnerability: household composition, socioeconomic status, access to information, housing characteristics and access to lifelines are susceptible to negative consequences as a result of volcanic hazards. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are described below.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty with mobilizing and evacuating or taking protective action in a timely fashion as a result of volcanic eruption. Populations with chronic medical or respiratory conditions, such as the elderly, may be particularly affected by vog conditions. If evacuated, dependent populations will require additional services and care considerations in the response aftermath and during recovery. Special accommodations for these populations must be considered in disaster planning processes. Elders, as they are more likely to have that are.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to prepare for, or recover from a natural disaster. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate preparedness or recovery actions. Insuring properties against losses from volcanic eruption can be cost prohibitive, and the permanent loss of homes and property due to lava flow would further set back populations with financial constraints.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152).

Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon urgent hazard warning information. Additionally, those who do not speak English well, may not comprehend hazard warning information to the extent that enables them to make timely decisions and take life-saving actions.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living in housing built before 1950, and prior to the enactment of modern building codes, are more susceptible to impacts from volcanic hazards in that they may be located within hazard zones, or lack modern air conditioning and filtration systems. In addition, higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences as a result of hazard exposure.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges during an evacuation, and have difficulty accessing needed supplies and services before, during and after a hazard event. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Moloka‘i households also do not have access to a vehicle.

Economic Impacts
Economic impacts from volcanic hazards could include loss of buildings or infrastructure associated with lava flows. Other impacts from both lava flows and vog episodes include business interruptions and potential impacts to tourism.

Climate Change Impacts
Climate change does not have any known impacts on the frequency or intensity of volcanic hazards in Maui County. It is possible that changes in trade wind patterns could impact vog events. Further, greenhouse gases released during volcanic eruptions are likely to contribute to climate change.

Wildfire

Description

A wildfire is any fire occurring in a wildland area (i.e. grassland, forest, brush land) except for fire under prescription.[225] Wildfires are part of the natural management of forest ecosystems but may also be caused by human factors.

Nationally, over 80% of forest fires are started by negligent human behavior such as smoking in wooded areas or improperly extinguishing campfires. The second most common cause for wildfire is lightning. In the planning area, lightning is not common, but wildfires are more frequent in drier, leeward locations.

225 Prescription burning, or “controlled burn,” undertaken by land management agencies is the process of igniting fires under selected conditions, in accordance with strict parameters.

There are three classes of wildland fires: surface fire, ground fire, and crown fire. A surface fire is the most common of these three classes and burns along the floor of a forest, moving slowly and killing or damaging trees. A ground fire (muck fire) is usually started by lightning or human carelessness and burns on or below the forest floor. Crown fires spread rapidly by wind and move quickly by jumping along the tops of trees. Wildland fires are usually signaled by dense smoke that fills the area for miles around. In the planning area, brush fires are known to jump from place to place due to patches of vegetation and winds.

Wildfire probability depends on local weather conditions, outdoor activities such as camping, debris burning, and construction, and the degree of public cooperation with fire prevention measures. Drought conditions and other natural hazards (such as tornadoes, hurricanes, etc.) increase the probability of wildfires by producing fuel in both urban and rural settings. Cyclical climate events, such as El Niño-La Niña, can also have a dramatic effect on the risk of wildfires. In Hawai'i, more fires are typically seen during El Niño years, when conditions are typically warmer and drier. In Hawai'i, non-native, fire-prone grasses and shrubs fuel wildfires.

Many individual homes, subdivisions, resorts, recreational areas, organizational camps, businesses and industries are located within high wildfire hazard areas. Further, the increasing demand for outdoor recreation places more people in wildland areas during holidays, weekends, and vacation periods. Unfortunately, wildland residents and visitors are rarely educated or prepared for wildfire events that can sweep through the brush or timber and destroy property.

Wildfires can result in severe economic losses as well. Businesses that depend on timber, such as paper mills and lumber companies, experience losses that are often passed along to consumers through higher prices, and sometimes jobs are lost. The high cost of responding to and recovering from wildfires can deplete fiscal resources and increase insurance rates. The economic impact of wildfires can also be felt in the tourism industry if roads and tourist attractions are closed due to health and safety concerns.

Location

Vegetated areas and steep slopes, which as conducive to wildfires, characterize much of Maui County. Wildfires are more common in leeward areas of the county rather than windward, as the trade winds bring moisture to windward areas. In order to best portray the potential for fire locations, the Hawai'i Department of Land and Natural Resources (DLNR) Wildfire Risk Area data was consulted. This data maps at-risk Wildland-Urban Interface Communities on the major Hawaiian Islands. The Wildland Urban Interface (WUI) is the area where urban development meets vegetated, wildfire prone undeveloped lands. The University of Wisconsin Spatial Analysis for Conservation and Sustainability (SILVIS) Lab produces Wildland Urban Interface data for the nation. This data was used by Hawai'i DLNR to categorize communities into low, medium, and high risk wildfire areas.

The SILVIS Lab defines the Wildland-Urban Interface (WUI):[226]

> WUI is composed of both interface and intermix communities. In both interface and intermix communities, housing must meet or exceed a minimum density of one structure per 40 acres (16 ha). Intermix communities are places where housing and vegetation intermingle. In intermix, wildland vegetation is continuous, more than 50 percent vegetation, in areas with more than 1 house per 16 ha. Interface communities are areas with housing in the vicinity of contiguous vegetation. Interface areas have more than 1 house per 40 acres, have less than 50 percent vegetation, and are within 1.5 mi of an area (made up of one or more contiguous Census blocks) over 1,325 acres (500 ha) that is more than 75 percent vegetated. The minimum size limit ensures that areas surrounding small urban parks are not classified as interface WUI.

The figure below shows the wildfire risk areas for Maui County.

[226] Radeloff, V.C., R.B. Hammer, S.I Stewart, J.S. Fried, S.S. Holcomb, and J.F. McKeefry. 2005. The Wildland Urban Interface in the United States. Ecological Applications 15: 799-805. Retrieved from http://silvis.forest.wisc.edu/maps/wui

Figure 227. Hawai'i DLNR Division of Forestry and Wildlife Wildfire Risk Areas in Maui County.

Another method for determining potential wildfire locations is by - wildfire ignition density. Wildfire ignition density maps are derived from location of past wildfires. The Pacific Fire Exchange out of the University of Hawai'i at Manoa, which developed the wildfire ignition density data, describes these maps:[227]

The Hawai'i ignition density maps are based on an ignition density "surface" that indicates the number of ignitions per square mile per year across Hawai'i state. Ignition points came from the Hawai'i State Wildfire History, a data set compiled, and quality controlled by the Hawai'i Wildfire Management Organization. This data set provides the location, date of occurrence, and area burned for over 11,000

[227] Trauernicht, C. and Lucas, M. (2016). *Wildfire Ignition Density Maps for Hawai'i.* Pacific Fire Exchange, University of Hawai'i at Manoa. Retrieved from https://static1.squarespace.com/static/54825edae4b0426dc2c78f10/t/57e9d6d337c58137fc4bc004/1474942687486/WildfireIgnitionDensitiesForHawai'i.pdf.

wildfire incidents reported by the National Park Service, the Hawai'i Division of Forestry and Wildlife, and all four County Fire Departments from 2000 through 2012.

The figure below shows wildfire ignition density for Maui County.

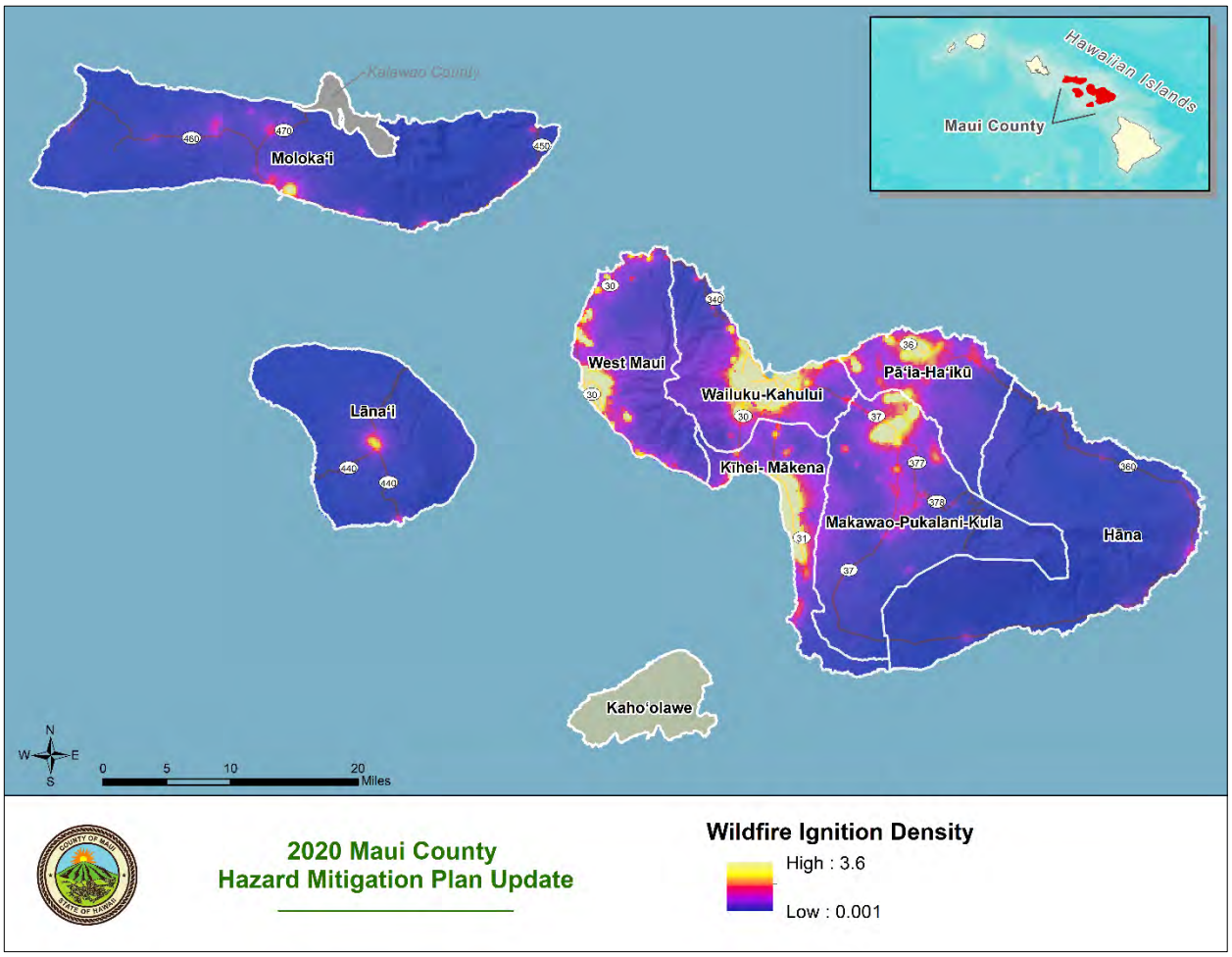

Figure 228. Wildfire Ignition Density for Maui County.

Previous Occurrences

Data on historic wildfires was collected from Pacific Wildfire Exchange. Pacific Wildfire Exchange provides data on historic wildfire perimeters occurring between 1999 and 2019. During this 20-year period, 80 fires occurred within Maui County, including five in the Hāna community planning area, 14 in Kīhei-Mākena, 11 in Makawao-Pukalani-Kula, nine in Moloka'i, 12 in Wailuku-Kahului, and 28 in West Maui. There were no wildfires recorded on the Island of Lāna'i. Further, nine fires were recorded on the uninhabited Island of Kahoolawe. Several fires spanned multiple planning areas. These fire perimeters are shown in the figure below. Table 67 presents details for these historic wildfire events.

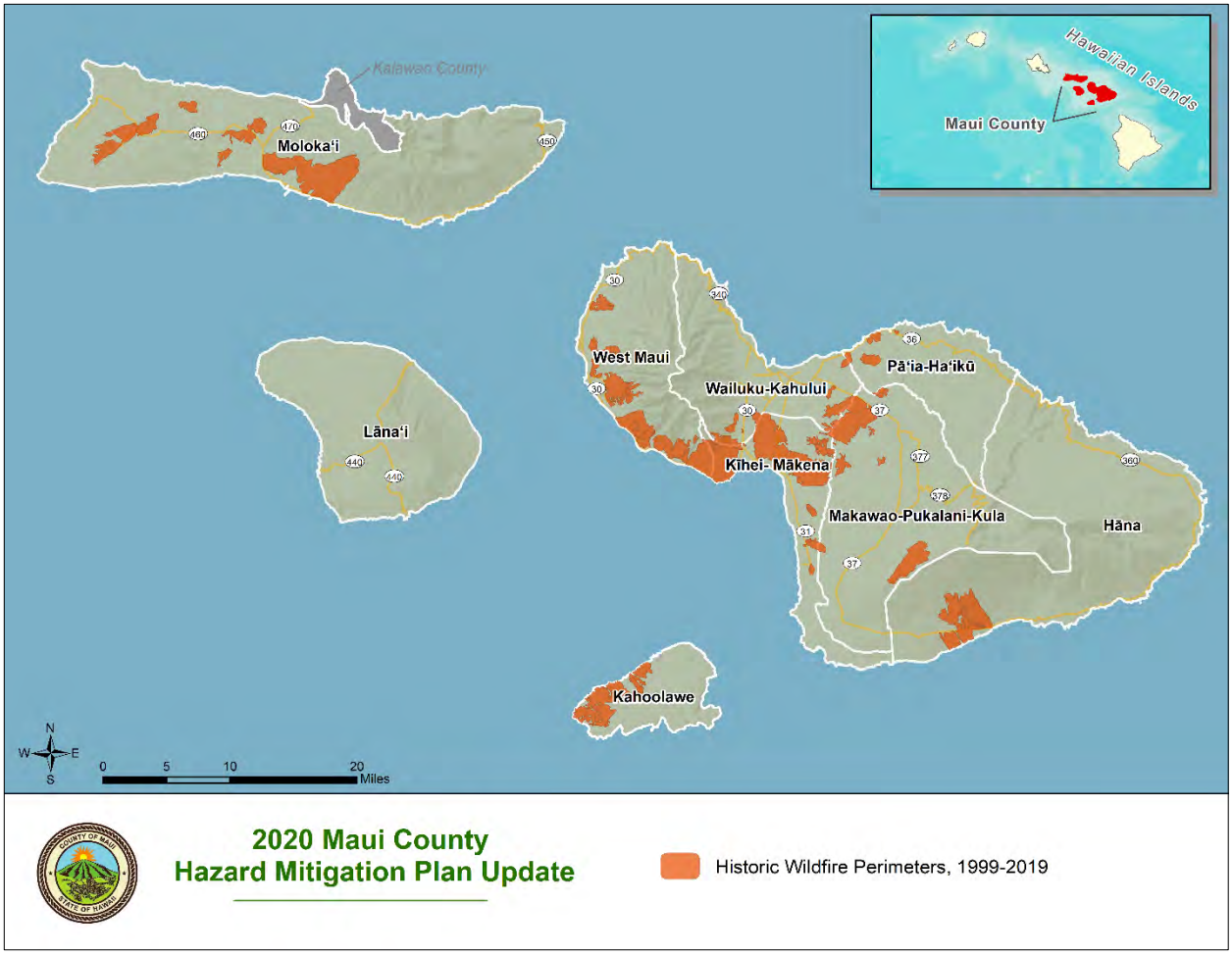

Figure 229. Wildfires in Maui County, 1999-2019 (Pacific Fire Exchange).

Table 67. Wildfires in Maui County, 1999-2019 (Pacific Fire Exchange).

Year	Size (acres)	Community Planning Area(s)	Fire Name
2002	232	West Maui	N/A
2003	359	Moloka‘i	N/A
2003	2,661	Hāna	N/A
2003	2,241	Moloka‘i	N/A
2003	467	Moloka‘i	N/A
2003	1,506	Moloka‘i	N/A
2003	340	Wailuku-Kahului	N/A
2004	122	Makawao-Pukalani-Kula	N/A
2005	100	West Maui	N/A
2005	82	West Maui	N/A
2005	97	West Maui	N/A

Year	Size (acres)	Community Planning Area(s)	Fire Name
2005	73	West Maui	N/A
2006	236	West Maui	N/A
2006	4,383	Kīhei-Mākena, West Maui	N/A
2006	2,771	Hāna	N/A
2007	2,379	Makawao-Pukalani-Kula	N/A
2007	1,141	West Maui	N/A
2007	203	West Maui	N/A
2007	940	Molokaʻi	N/A
2007	2,551	West Maui	Olowalu
2007	323	West Maui	N/A
2008	26	Molokaʻi	N/A
2008	22	Molokaʻi	N/A
2008	464	Makawao-Pukalani-Kula, Kīhei Mākena	N/A
2009	8,358	Molokaʻi	Kaunakakai
2010	635	West Maui	KOAI
2010	4,810	Wailuku-Kahului, Kīhei-Mākena, West Maui	N/A
2010	90	West Maui	N/A
1999	150	West Maui	Ukumehame
2001	212	West Maui	Olowalu
2002	130	Kahoolawe	Kahoolawe
2003	46	Kahoolawe	Kahoolawe
2003	562	Kahoolawe	Kahoolawe North Coast
2003	1,101	Kahoolawe	Kahoolawe NW Coast 1
2003	931	Kahoolawe	Kahoolawe NW Coast 2
2003	899	Kahoolawe	Kahoolawe Connecting West
2003	465	Kahoolawe	Kahoolawe Skinny North
2003	880	Kahoolawe	Kahoolawe NW
2003	154	Kahoolawe	Kahoolawe NW
2012	118	Molokaʻi	Hoomalu Drive
2014	237	Pāʻia-Haʻikū	Holomua Road at Sugar Cane Field
2015	378	Makawao-Pukalani-Kula	Ikea Place at Koea Place
2015	277	West Maui	Puukolii Fire 2015
2015	73	Hāna	Kahikinui Fire
2016	203	West Maui	Honoapiilani Highway
2016	4,547	Hāna	Kahikinui Fire
2016	86	Makawao-Pukalani-Kula	Haliimaile Road
2016	75	Makawao-Pukalani-Kula	Akalani Loop

Year	Size (acres)	Community Planning Area(s)	Fire Name
2016	100	Pāʻia-Haʻikū	Holomua Road
2016	3,756	Wailuku-Kahului, Kīhei-Mākena, West Maui	Māʻalaea Nui Fire
2016	1,415	West Maui	Ukumehame (Olowalu) Fire
2016	529	Makawao-Pukalani-Kula	Pulehu Road
2016	197	Makawao-Pukalani-Kula, Kīhei Mākena, Pāʻia-Haʻikū	Haliimaile Road
2017	175	Wailuku-Kahului	Kahului Fire
2017	107	Kīhei-Mākena	Pulehu Fire 1
2017	160	Kīhei-Mākena	Pulehu Fire 2
2017	170	Makawao-Pukalani-Kula, Kīhei-Mākena	Pulehu Fire 3
2017	39	Pāʻia-Haʻikū	Haʻikū Road
2018	7	West Maui	Ukumehame Fire
2018	1,672	Makawao-Pukalani-Kula, Wailuku-Kahului	Pukalani Fire
2018	294	West Maui	Kaanapali Fire
2018	2,215	West Maui	Lahaina Fire
2018	72	West Maui	Māʻalaea Fire
2018	341	West Maui	Olowalu Fire
2019	192	West Maui	Olowalu Fire
2019	147	Kīhei-Mākena	Wailea Fire
2019	4	Wailuku-Kahului	Kahului Fire
2019	173	Wailuku-Kahului	Puunene Fire
2019	7,908	Wailuku-Kahului, Kīhei-Mākena	Waiko Road Fire
2019	61	Kīhei-Mākena	South Kīhei Fire
2019	3,249	Kīhei-Mākena	Pukalani Fire 1
2019	580	Kīhei-Mākena	Pukalani Fire 2
2019	237	Kīhei-Mākena	Kīhei Fire
2019	14	Wailuku-Kahului	Honoapiilani Highway
2019	328	Wailuku-Kahului	Pāʻia Fire
2019	109	Wailuku-Kahului	Kahului Fire
2019	4,801	Kīhei-Mākena, West Maui	Māʻalaea Fire
2019	732	West Maui	Kahana Ridge Fire
2019	215	Hāna	Kahikinui Fire
2019	566	Pāʻia-Haʻikū	Pāʻia Fire 2

Extent

Wildfire extent can be determined by size, such as area burned. The largest fire to burn in Maui County between 1999 and 2019 was the Kaunakakai Fire in 2009 that burned over 8,358 acres on the Island of Molokaʻi. Larger, more damaging fires are possible.

Probability of Future Events

Wildfire events will continue to be an ongoing occurrence in Maui County. The likelihood of wildfires increases during drought cycles and abnormally dry conditions. Dry, windy conditions with an accumulation of vegetative fuel can create conditions for a fire that spreads quickly. Wildfires could become more frequent in the future as drought conditions become more frequent and more intense with climate change.

Fire data indicated 80 wildfires directly impacted Maui County between 1999 and 2019. This results in approximately four fires every year occurring within the county overall. However, not all of Maui County's community planning areas have the same likelihood of experiencing wildfires. The table below shows the annual probability for the wildfire hazard for each community planning area.

Table 68. Wildfire Probabilities for Maui County Community Planning Areas.

Community Planning Area	Landslide Probability
Hāna	Likely (10% to 90% annual chance)
Kīhei-Mākena	Likely (10% to 90% annual chance)
Lānaʻi	Possible (1% to 10% annual chance)
Makawao-Pukalani-Kula	Likely (10% to 90% annual chance)
Molokaʻi	Likely (10% to 90% annual chance)
Pāʻia-Haʻikū	Likely (10% to 90% annual chance)
Wailuku-Kahului	Likely (10% to 90% annual chance)
West Maui	Highly Likely (greater than 90% annual chance)

Vulnerability

It is assumed that all current and future buildings, critical facilities, and populations in Maui County are at risk to wildfire. Maui County is located in a tropical climate with dry leeward areas. Most of the county is highly vegetated. Some areas of the county have steep slopes, which are particularly vulnerable to wildfires, especially leeward slopes which do not receive moisture brought by trade winds.

Burned areas are subject to increased erosion resulting in the siltation of creeks, streams, and rivers. This can result in channel aggradation (wider, slower channels). Steeps slopes are also destabilized due to the burning of vegetation. Burned areas, combined with heavy rain, present a serious risk of landsliding and rockfalls.

Building and Infrastructure Impacts (including Critical Facilities)
All current and future buildings and infrastructure (including critical facilities) in Maui County are considered at risk to wildfire. Fires can cause significant damage to buildings, including critical facilities, ranging from smoke and water damage to total loss. Certain structures may be more vulnerable than others. Buildings that are not up to the Hawai'i State Building Code may be more vulnerable to wildfires. Building material and landscaping around the buildings can also impact vulnerability. For example, wood shakes can ignite quickly due to embers. Pine needles may also catch roofs on fire if there are blowing embers in the area. The vegetation around a structure can also impact risk. Keeping a buffer area (defensible space) between the vegetation and structure can decrease risk. In addition, there are proactive landscaping schemes that can be used in fire-prone areas such as avoiding pine straw and mulch.

Some, areas within the county are more susceptible to wildfires than others. Hawai'i DLNR has mapped wildfire risk areas. GIS analysis was used to determine buildings and infrastructure within these areas, using Hawai'i DLNR data, building footprints, critical facilities data, and parcel data from county tax assessor records.

For buildings, the determination of assessed value at-risk (exposure) was calculated by summing the total assessed building values for building footprints that were confirmed to be located within or partially within an identified wildfire risk area (low, medium, or high). The number of parcels, building footprints, and their associated value are presented by community planning district in Table 69. This is an approximate analysis for planning purposes. This analysis does not account for building elevations or other protections.

Table 69. Potentially At-Risk Parcels, Buildings, and Improvement Value in Wildfire Risk Areas.

Fire Risk Areas	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Hāna								
High	0	0%	0	0%	$0	$0	$0	0%
Medium	7	0%	30	2%	$154,548	$77,274	$231,822	0%
Low	1,562	75%	1,512	77%	$179,838,276	$89,919,127	$269,757,403	82%
TOTAL	**1,569**	76%	**1,542**	**79%**	**$179,992,824**	**$89,996,401**	**$269,989,225**	82%
Kīhei-Mākena								
High	17,520	96%	8,416	97%	$10,840,409,251	$5,420,204,626	$16,260,613,877	96%
Medium	2	0%	0	0%	$0	$0	$0	0%
Low	1	0%	0	0%	$0	$0	$0	0%
TOTAL	**17,523**	96%	**8,416**	**97%**	**$10,840,409,251**	**$5,420,204,626**	**$16,260,613,877**	96%
Lānaʻi								
High	0	0%	0	0%	$0	$0	$0	0%
Medium	167	11%	128	7%	$364,881,867	$182,440,940	$547,322,807	52%
Low	1,183	81%	1,593	88%	$314,800,825	$157,400,418	$472,201,243	45%

Fire Risk Areas	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
TOTAL	**1,350**	92%	**1,721**	**95%**	**$679,682,692**	**$339,841,358**	**$1,019,524,050**	98%
Makawao-Pukalani-Kula								
High	9	0%	0	0%	$0	$0	$0	0%
Medium	1,433	15%	2,030	16%	$556,132,245	$278,066,141	$834,198,386	20%
Low	7,307	76%	9,923	77%	$2,003,783,856	$1,001,891,947	$3,005,675,803	72%
TOTAL	**8,749**	91%	**11,953**	**92%**	**$2,559,916,101**	**$1,279,958,088**	**$3,839,874,189**	92%
Molokaʻi								
High	3,718	61%	1,796	72%	$650,688,900	$325,344,450	$976,033,350	80%
Medium	1,440	24%	340	14%	$87,039,700	$43,519,850	$130,559,550	11%
Low	510	8%	312	12%	$55,048,600	$27,524,300	$82,572,900	7%
TOTAL	**5,668**	93%	**2,448**	**97%**	**$792,777,200**	**$396,388,600**	**$1,189,165,800**	98%
Pāʻia-Haʻikū								
High	0	0%	0	0%	$0	$0	$0	0%
Medium	3	0%	0	0%	$0	$0	$0	0%
Low	5,100	97%	7,165	97%	$1,280,756,670	$640,378,319	$1,921,134,989	95%
TOTAL	**5,103**	97%	**7,165**	**97%**	**$1,280,756,670**	**$640,378,319**	**$1,921,134,989**	95%
Wailuku-Kahului								
High	10,906	61%	10,581	62%	$3,624,252,949	$1,812,126,454	$5,436,379,403	62%
Medium	2,898	16%	2,928	17%	$699,989,291	$349,994,647	$1,049,983,938	12%
Low	898	5%	781	5%	$428,299,321	$214,149,661	$642,448,982	7%
TOTAL	**14,702**	81%	**14,290**	**84%**	**$4,752,541,561**	**$2,376,270,762**	**$7,128,812,323**	82%
West Maui								
High	12,242	68%	4,396	68%	$8,694,429,875	$4,347,214,956	$13,041,644,831	67%
Medium	5,018	28%	1,626	25%	$3,428,351,073	$1,714,175,540	$5,142,526,613	27%
Low	0	0%	0	0%	$0	$0	$0	0%
TOTAL	**17,260**	95%	**6,022**	**93%**	**$12,122,780,948**	**$6,061,390,496**	**$18,184,171,444**	94%
MAUI COUNTY TOTAL								
High	**44,395**	**56%**	**25,189**	**43%**	**$23,809,780,975**	**$11,904,890,488**	**$35,714,671,463**	**66%**
Medium	**10,968**	**14%**	**7,082**	**12%**	**$5,136,548,724**	**$2,568,274,362**	**$7,704,823,086**	**14%**
Low	**16,561**	**21%**	**21,286**	**36%**	**$4,262,527,548**	**$2,131,263,774**	**$6,393,791,322**	**12%**
TOTAL	**71,924**	**91%**	**53,557**	**91%**	**$33,208,857,247**	**$16,604,428,624**	**$49,813,285,871**	**93%**

All community planning areas have some vulnerability to wildfire risk areas in terms of building exposure. The data in the table above indicates that buildings and associated value in several community planning areas have greater vulnerability to wildfire than others. Kīhei-Mākena has the greatest proportion of its buildings within high wildfire risk areas, at 97%. Wailuku-Kahului has the greatest overall number of buildings in high wildfire risk areas, at 10,581. In all, 46,392 (79%) buildings in Maui County are within wildfire risk areas (low, medium or high), with an estimated value (structure and content) of approximately $49.8 billion (92%). It should be noted that value refers to improvement

value, which is not synonymous with insured or replacement value. The figures below show buildings within wildfire risk areas in each community planning area.

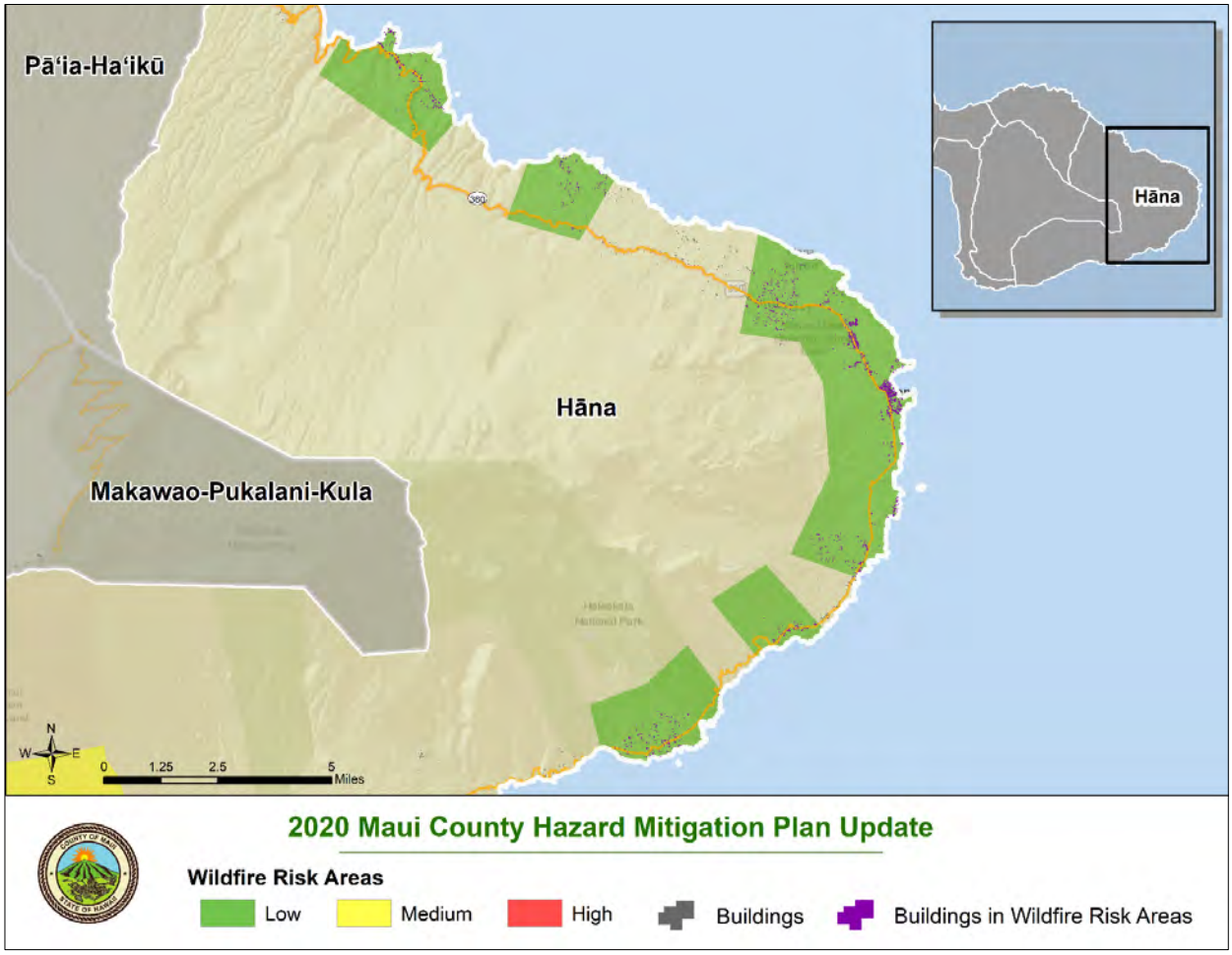

Figure 230. Buildings in Wildfire Risk Areas in the Eastern Hāna Community Planning Area.

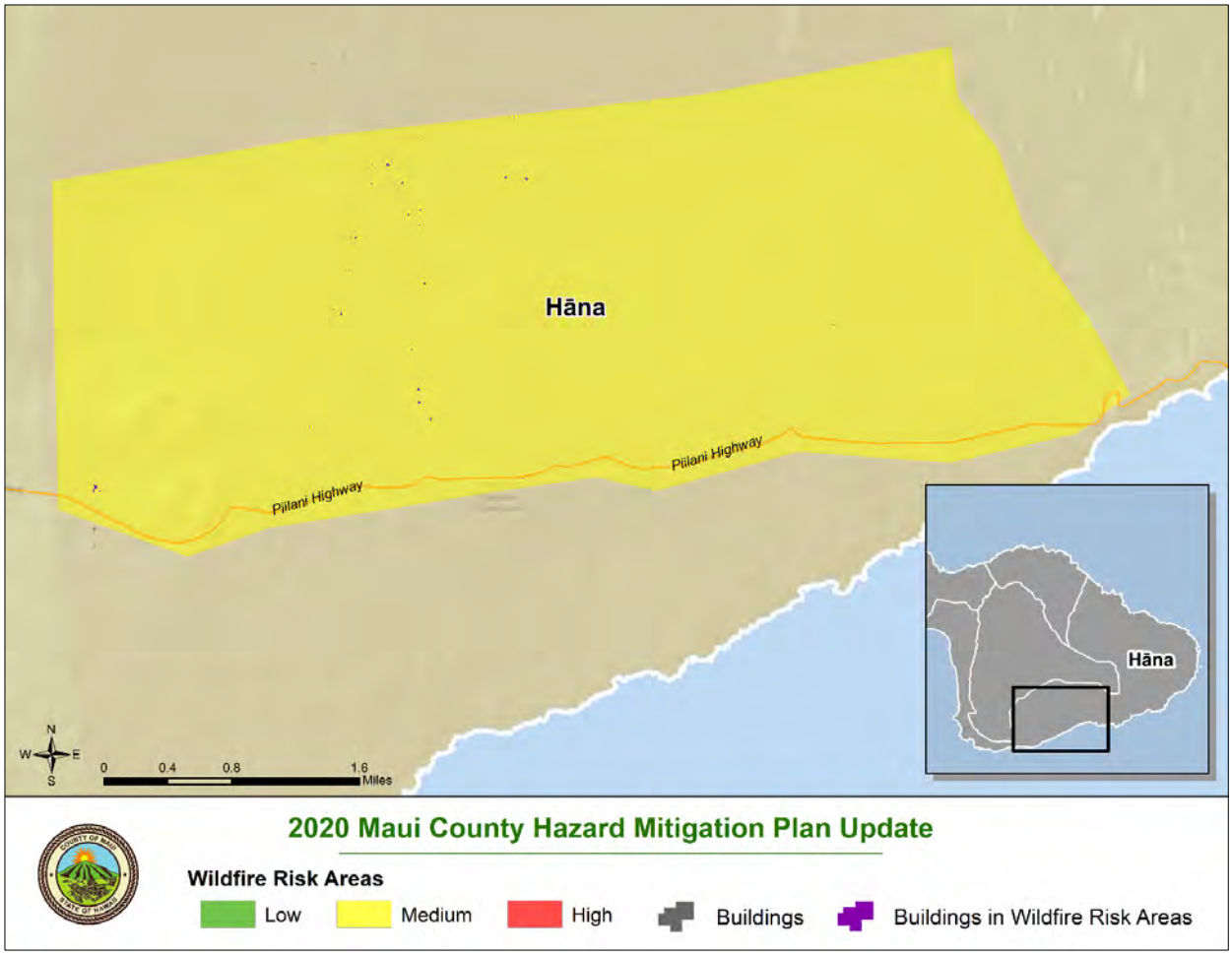

Figure 231. Buildings in Wildfire Risk Areas in the Southern Hāna Community Planning Area.

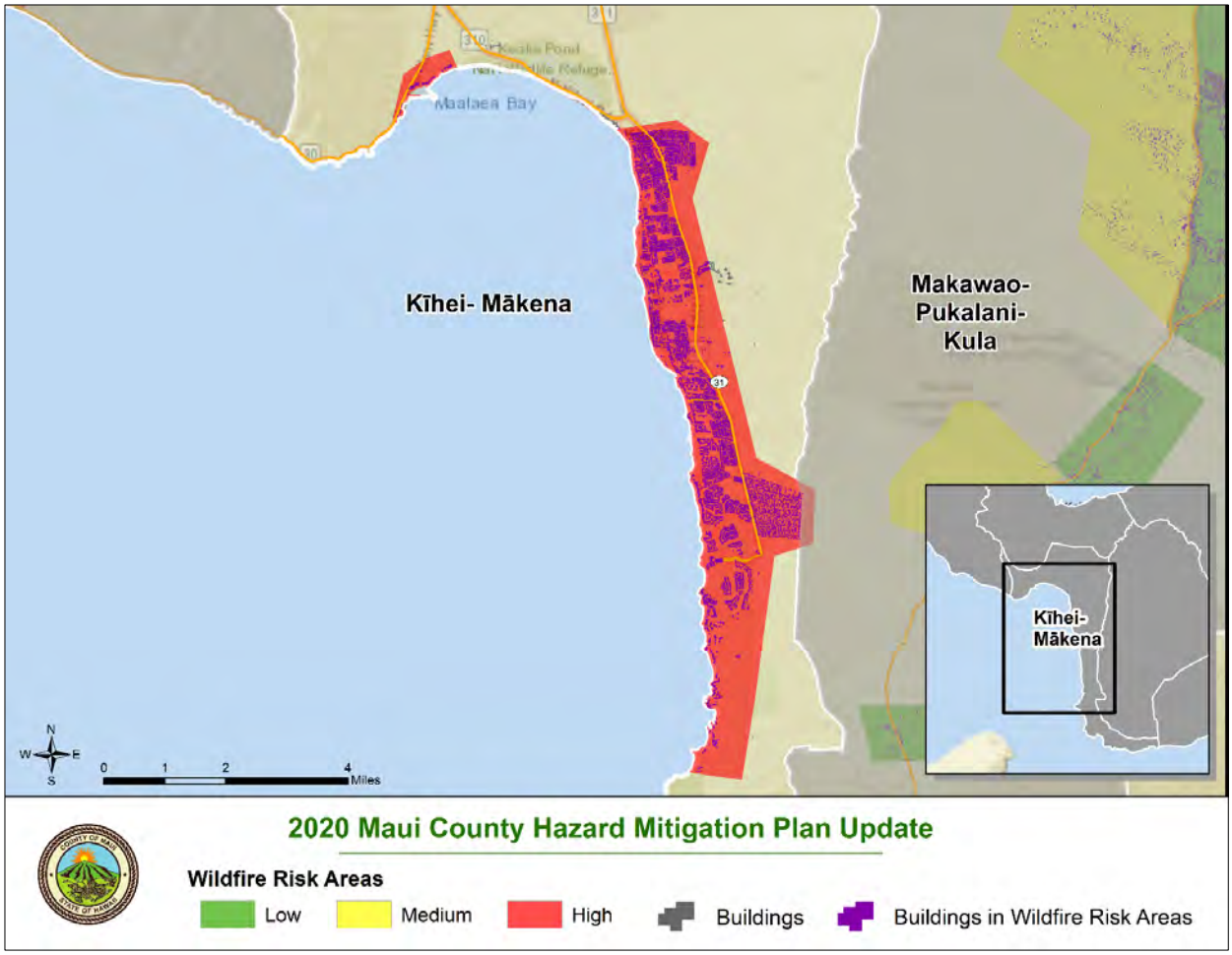

Figure 232. Buildings in Wildfire Risk Areas in the Kīhei-Mākena Community Planning Area.

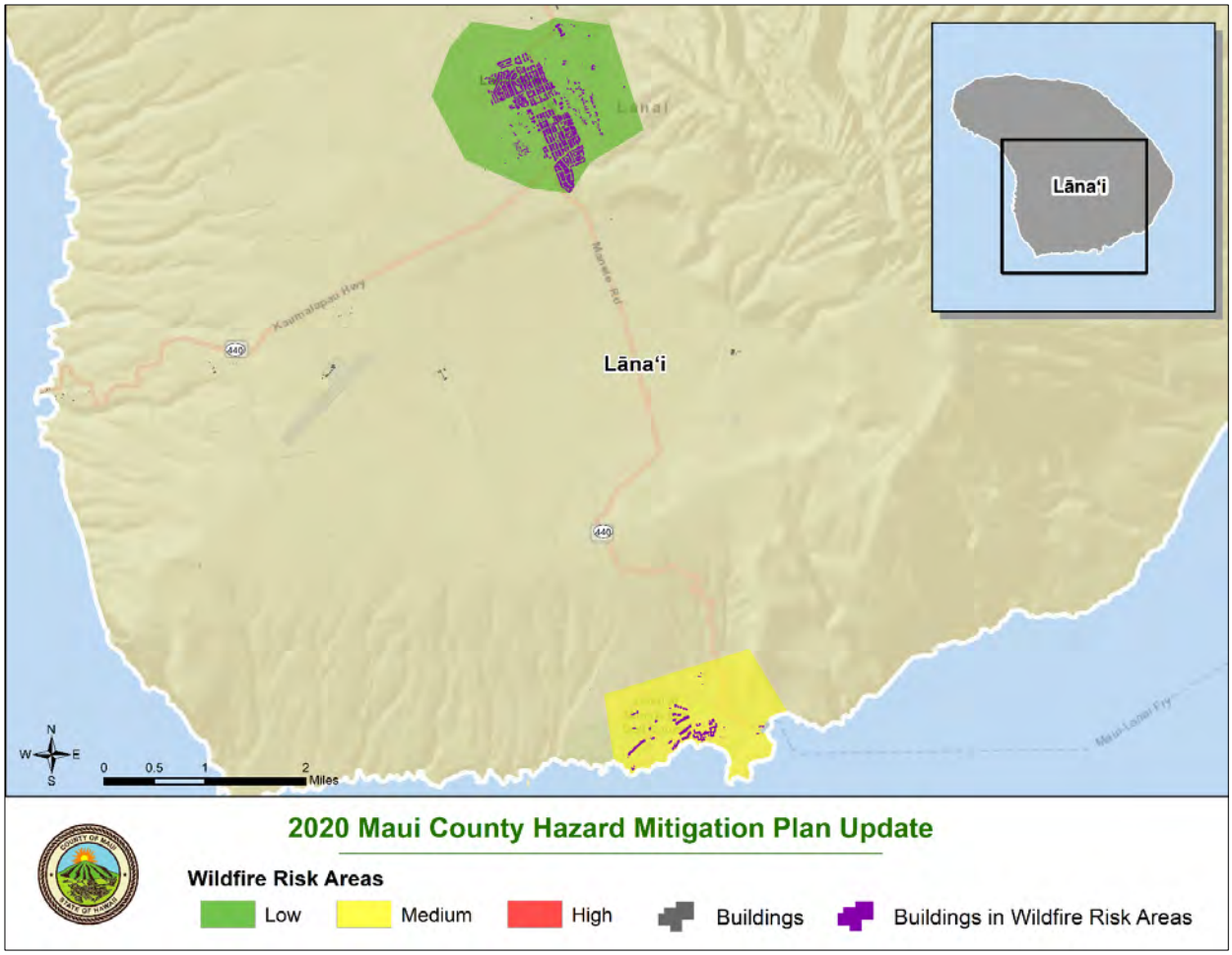

Figure 233. Buildings in Wildfire Risk Areas in the Lānaʻi Community Planning Area.

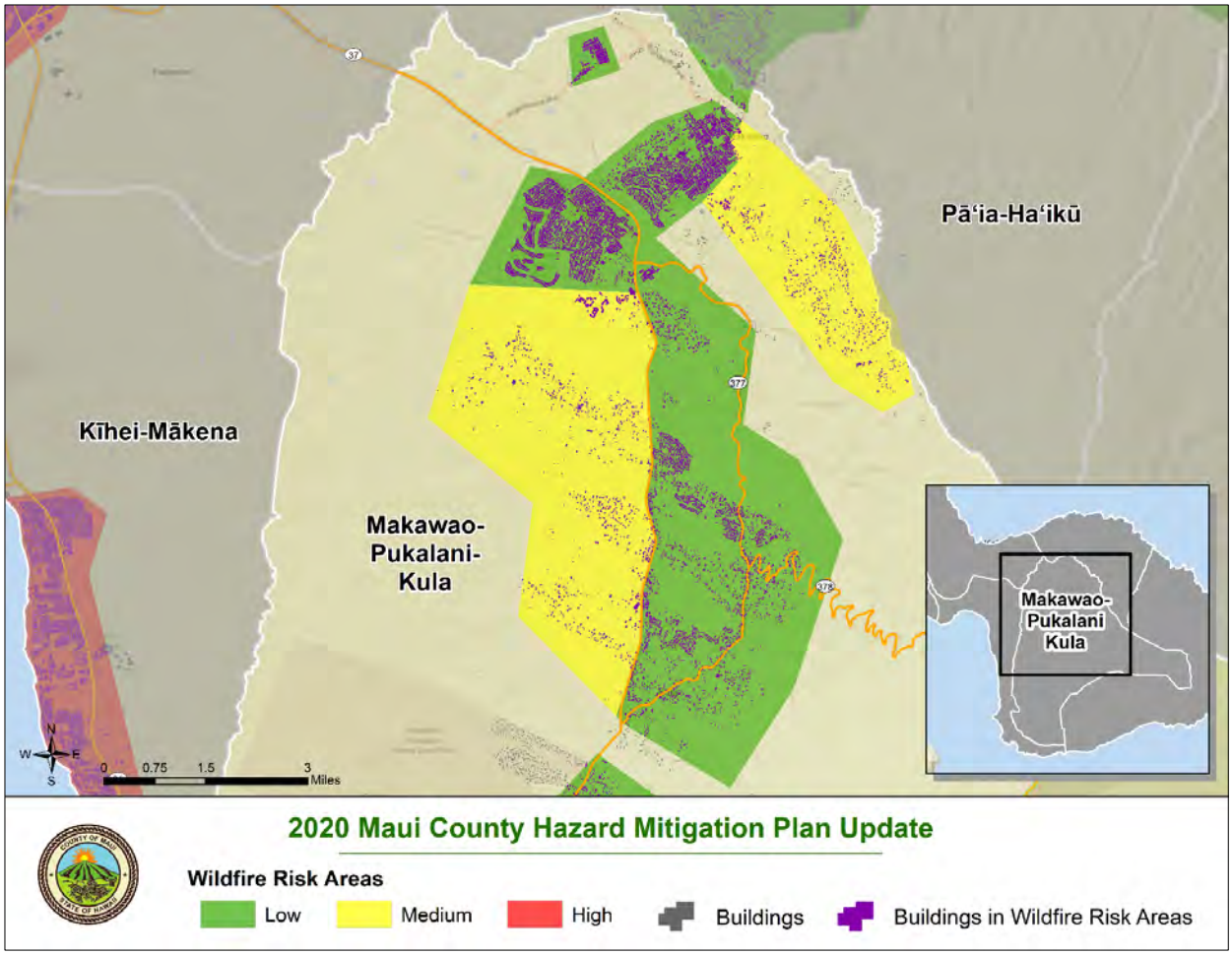

Figure 234. Buildings in Wildfire Risk Areas in Northern Makawao-Pukalani Kula Community Planning Area.

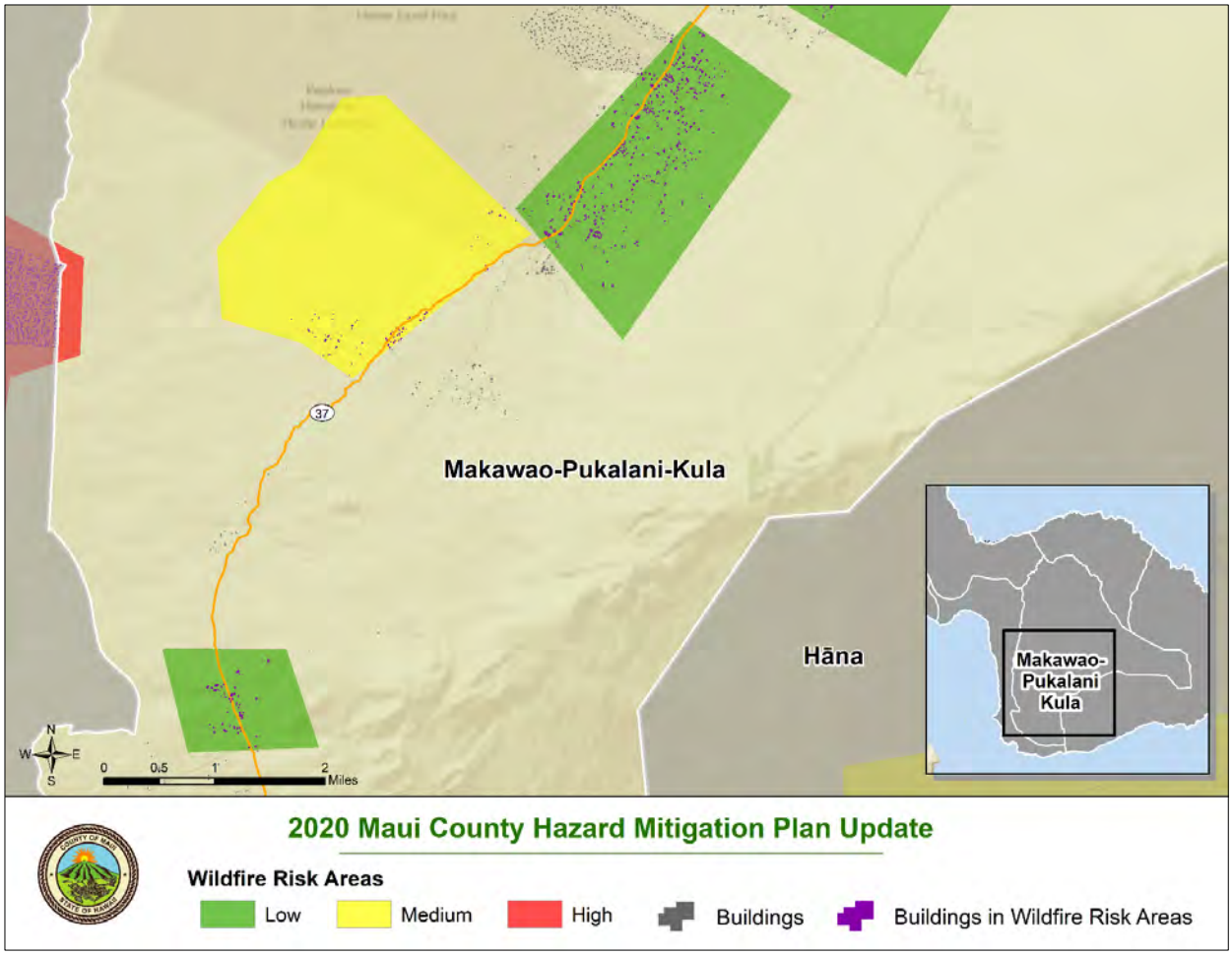

Figure 235. Buildings in Wildfire Risk Areas in the Southern Makawao-Pukalani-Kula Community Planning Area.

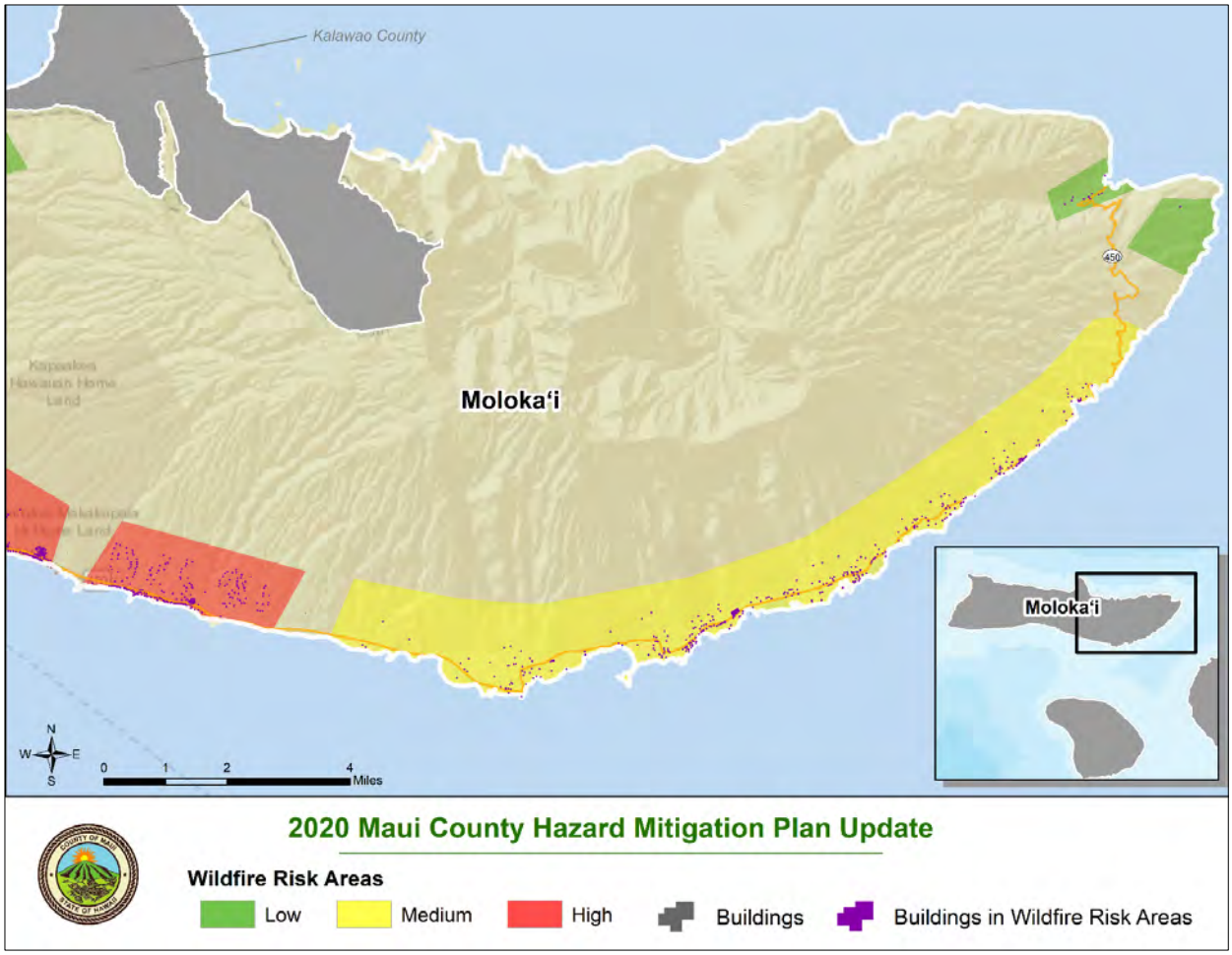

Figure 236. Buildings in Wildfire Risk Areas in the Eastern Moloka'i Community Planning Area.

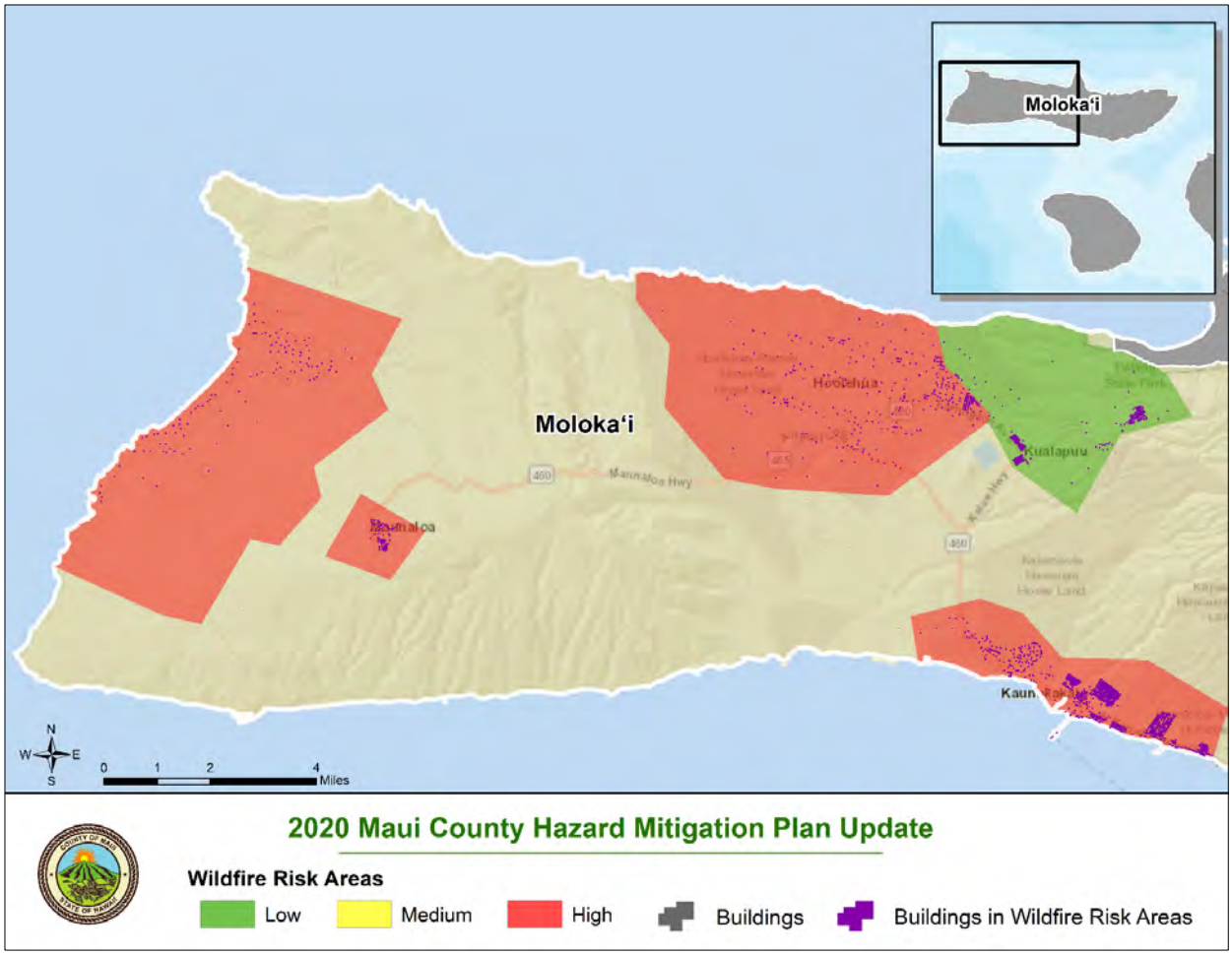

Figure 237. Buildings in Wildfire Risk Areas in the Western Moloka'i Community Planning Area.

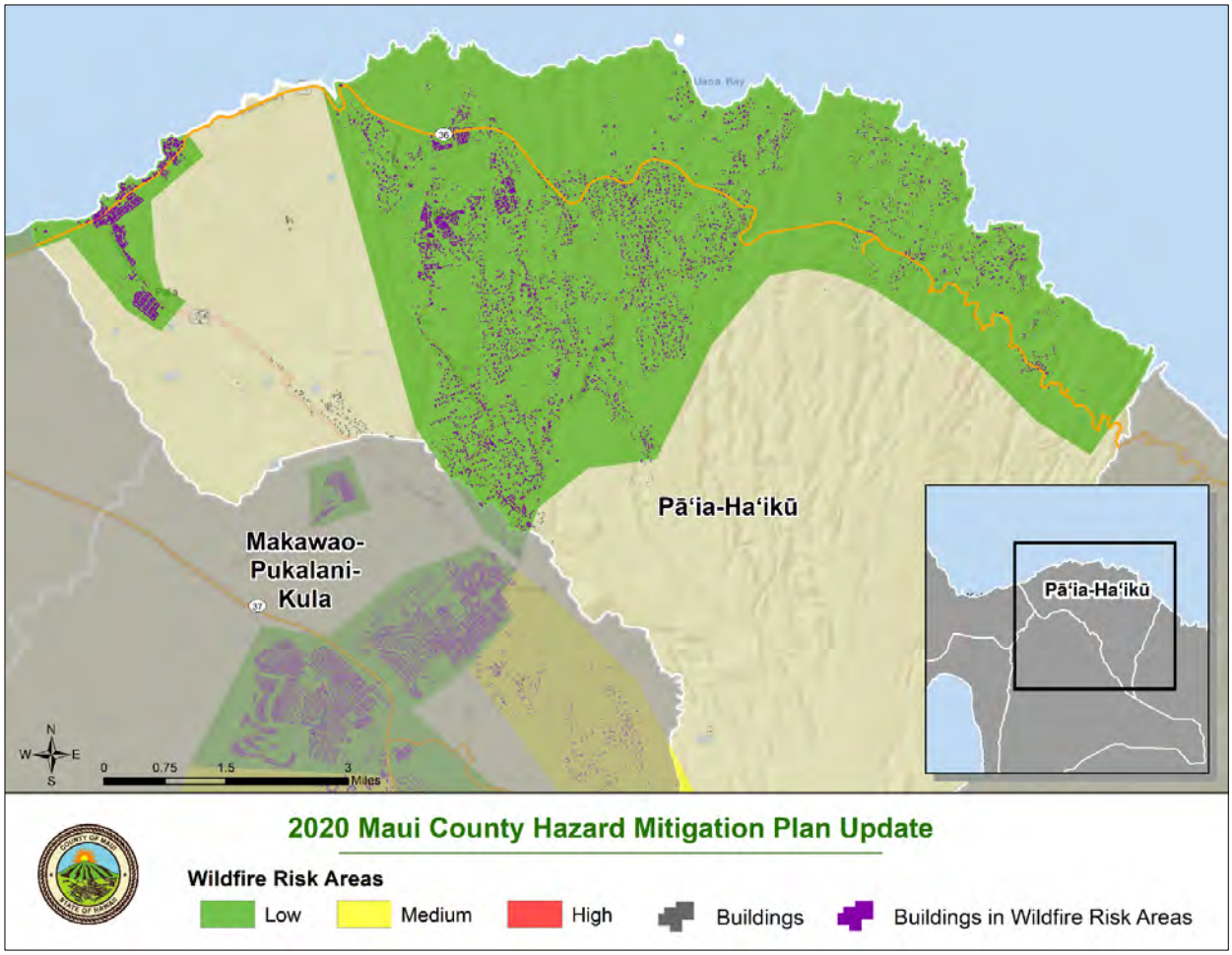

Figure 238. Buildings in Wildfire Risk Areas in the Pāʻia-Haʻikū Community Planning Area.

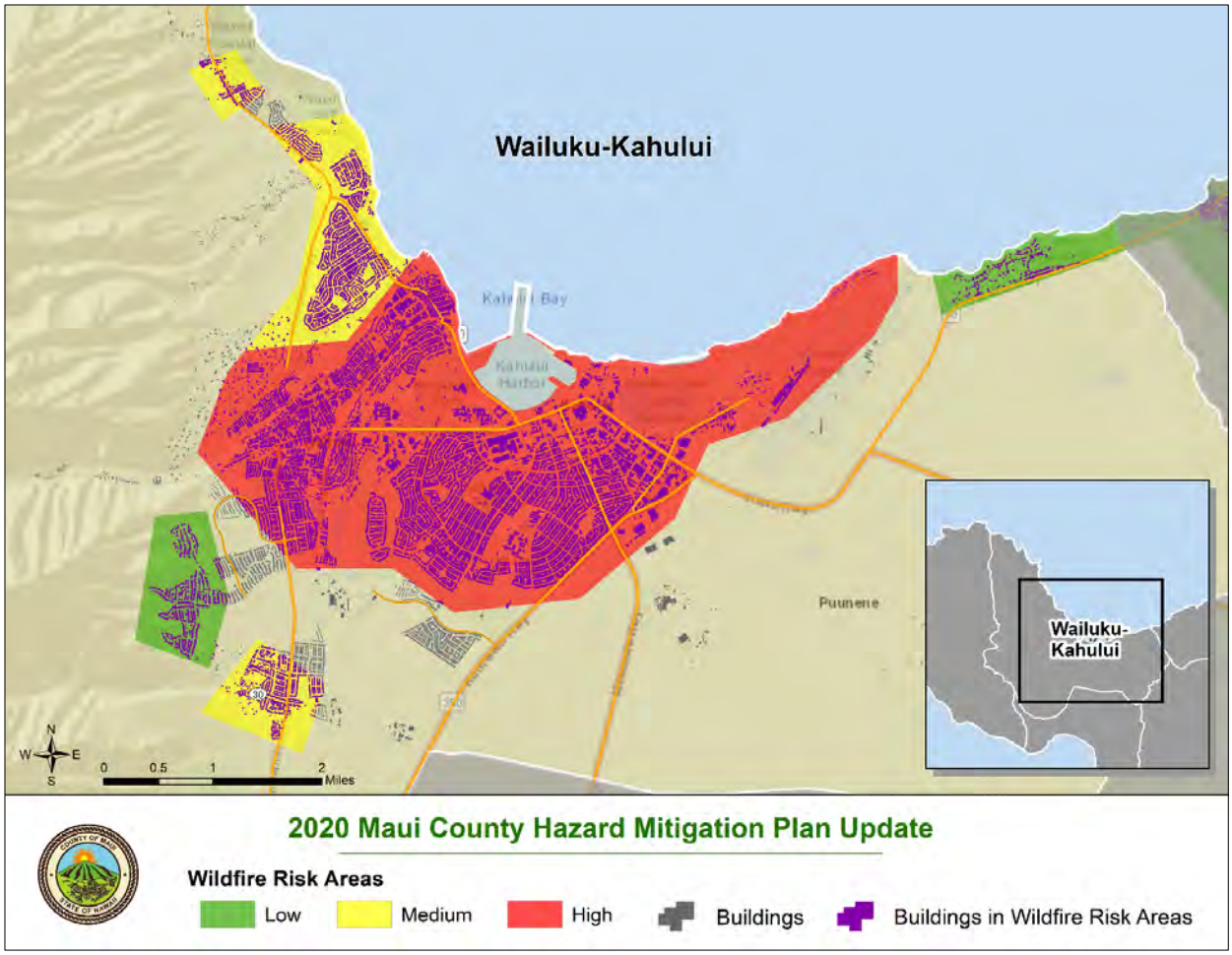

Figure 239. Buildings in Wildfire Risk Areas in the Wailuku-Kahului Community Planning Area.

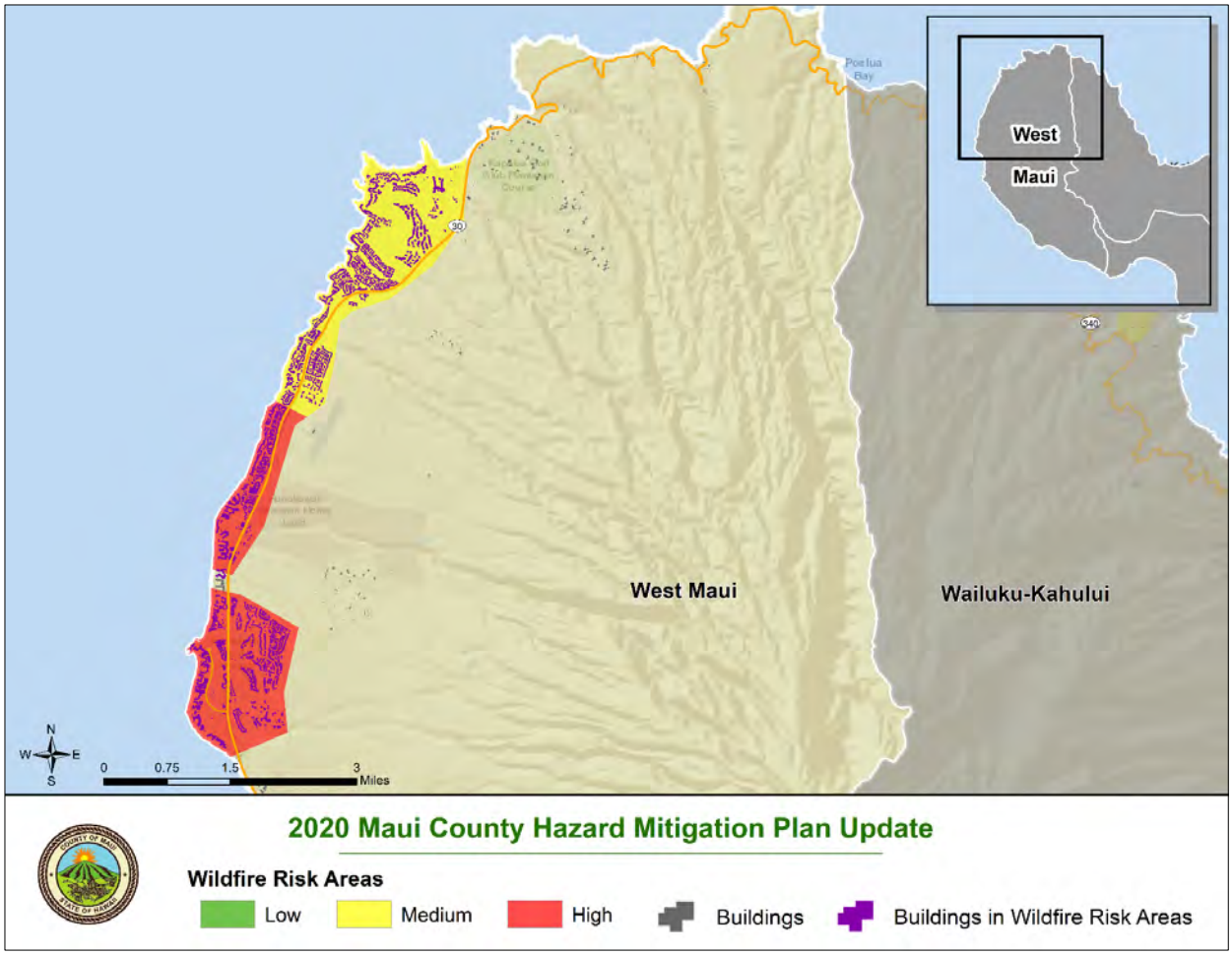

Figure 240. Buildings in Wildfire Risk Areas in the Northern West Maui Planning Area.

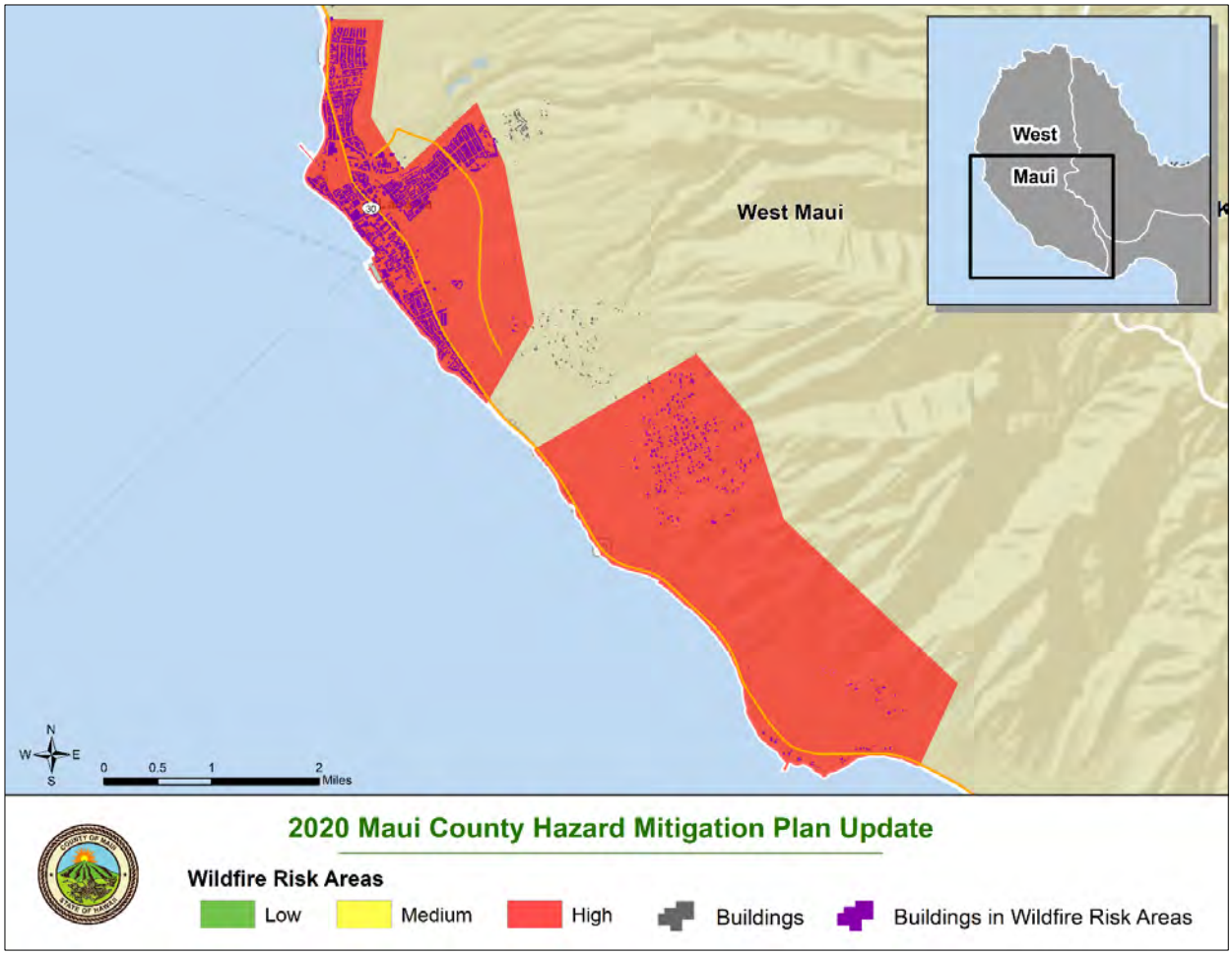

Figure 241. Buildings in Wildfire Risk Areas in Southern West Maui Community Planning Area.

GIS analysis was used to determine number of critical facilities within wildfire risk areas. The table below presents the number of critical facilities within wildfire risk areas for each community planning area. Overall, there are 248 potentially at-risk critical facilities within Maui County wildfire risk areas.

Table 70. Potentially At-Risk Critical Facilities in Wildfire Risk Areas.

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Commercial Facilities	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	**2 (100%)**
Communications Facilities	N/A	N/A	N/A	1	1	N/A	1	N/A	**3 (38%)**
Emergency Services	3	5	3	3	6	3	7	3	**33 (89%)**
Energy	2	N/A	N/A	N/A	1	N/A	2	N/A	**5 (100%)**
Food and Agriculture	1	1	N/A	N/A	N/A	N/A	1	N/A	**3 (100%)**
Government Facilities	N/A	N/A	N/A	N/A	2	N/A	12	N/A	**14 (100%)**
Healthcare and Public Health	1	3	4	1	3	2	26	5	**45 (94%)**
Mass care	3	7	5	12	10	5	15	7	**64 (85%)**
Transportation	1	N/A	1	N/A	3	N/A	12	4	**21 (78%)**
Water and Wastewater Systems	N/A	13	N/A	6	3	3	15	18	**58 (75%)**
TOTAL	**11 (79%)**	**29 (88%)**	**13 (81%)**	**23 (85%)**	**29 (91%)**	**13 (81%)**	**93 (88%)**	**37 (71%)**	**248 (84%)**

The figures below show critical facilities in Maui County wildfire risk areas by community planning district.

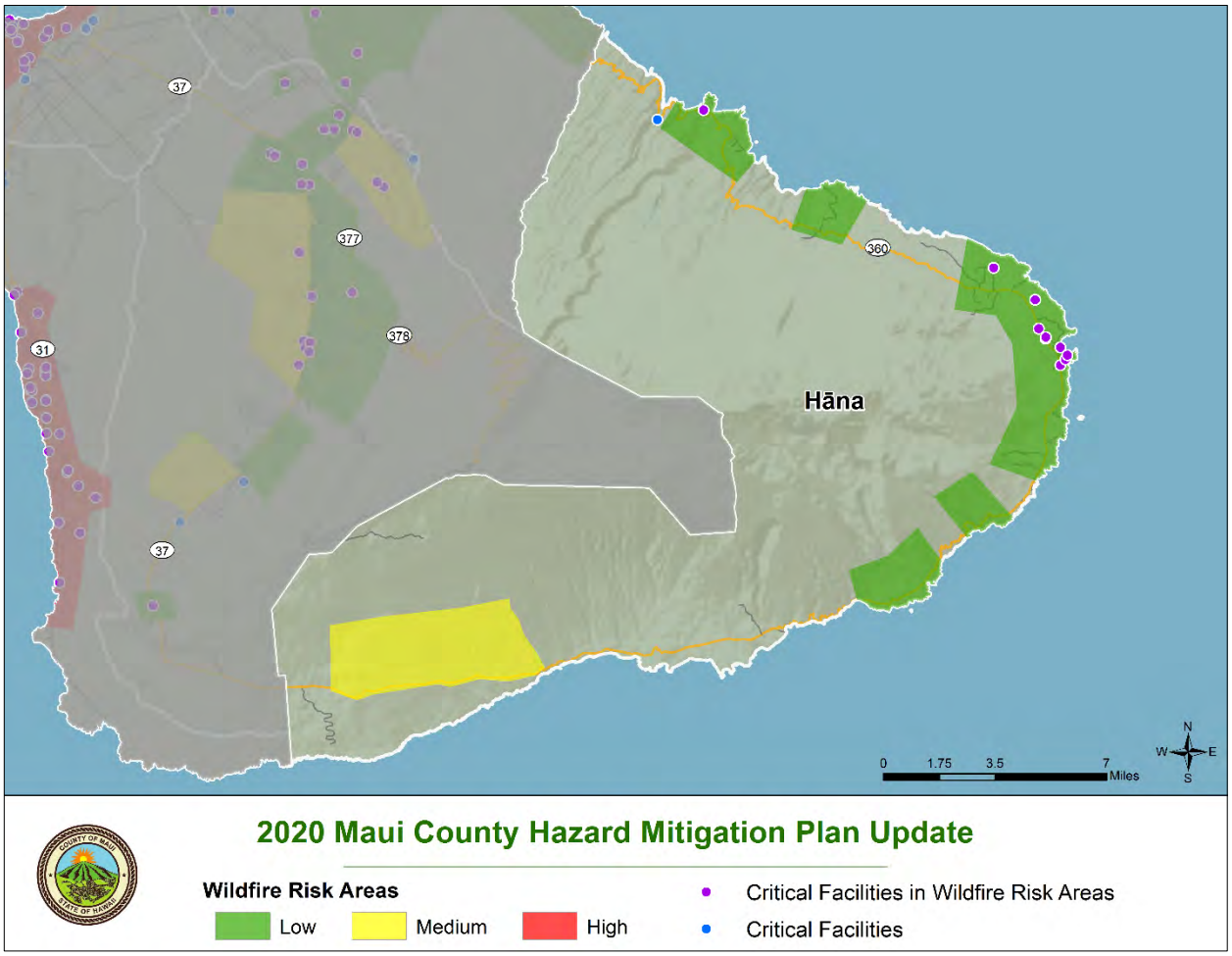

Figure 242. Critical Facilities in Wildfire Risk Areas in the Hāna Community Planning Area.

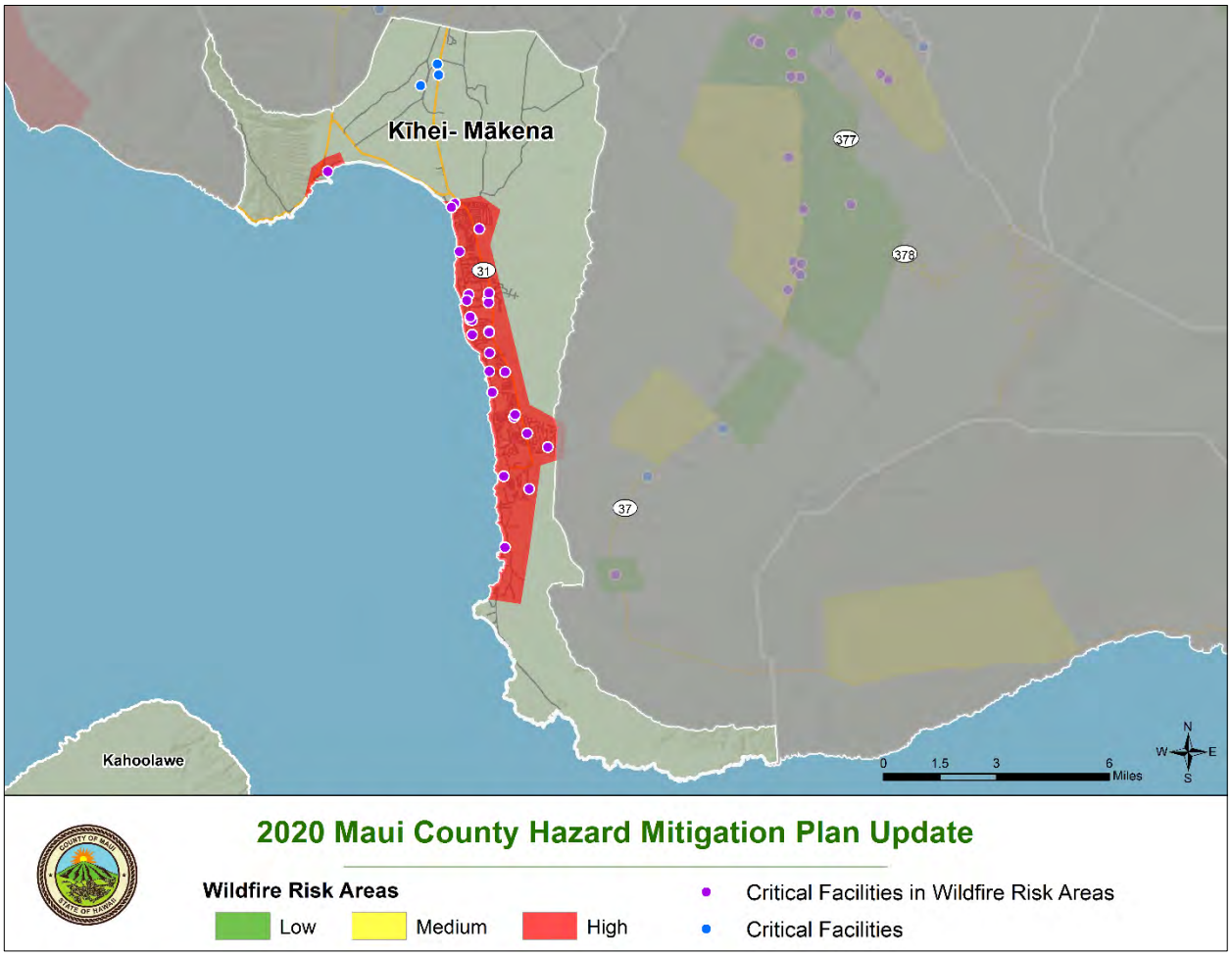

Figure 243. Critical Facilities in Wildfire Risk Areas in the Kīhei-Mākena Community Planning Area.

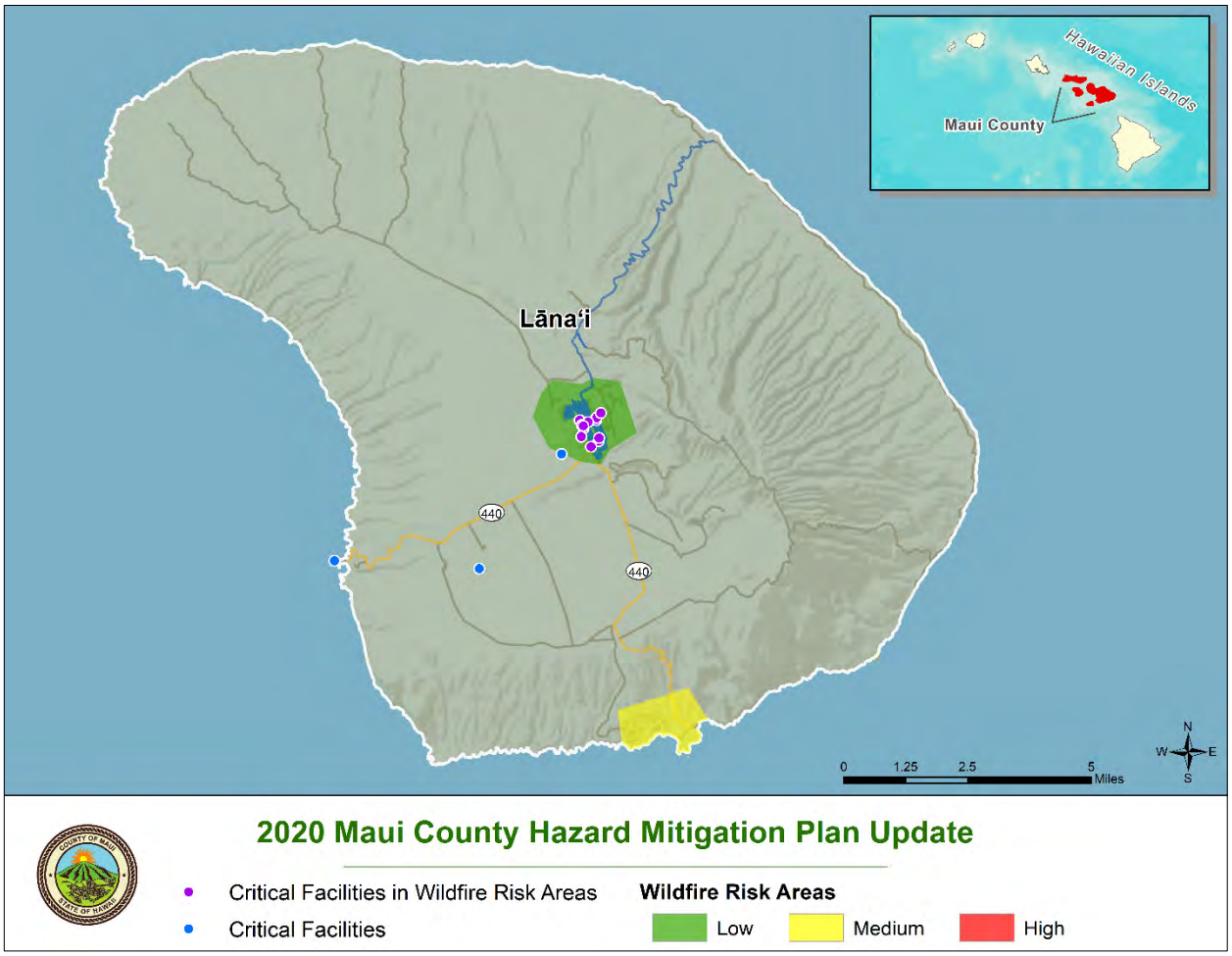

Figure 244. Critical Facilities in Wildfire Risk Areas in the Lānaʻi Community Planning Area.

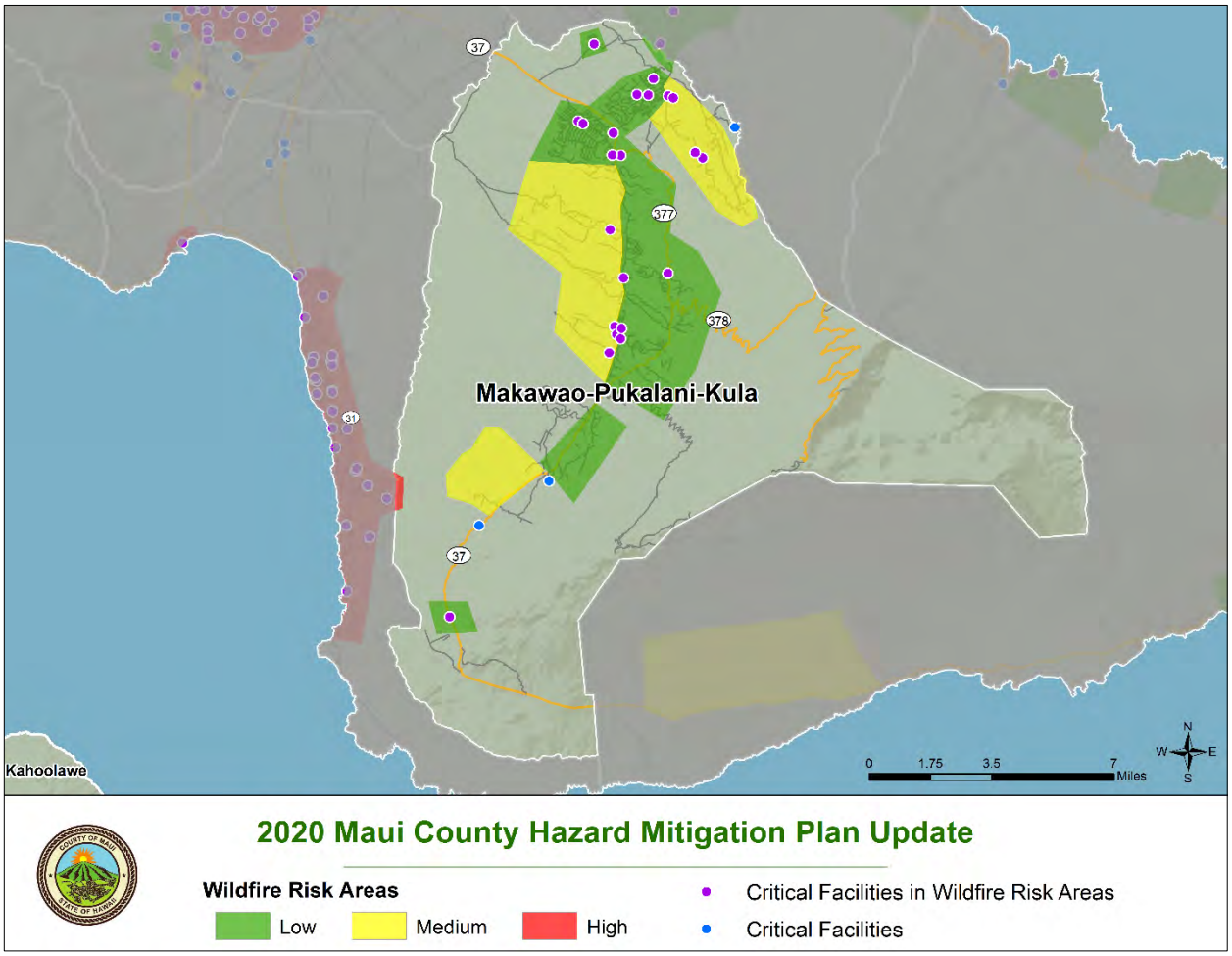

Figure 245. Critical Facilities in Wildfire Risk Areas in the Makawao-Pukalani-Kula Community Planning. Area

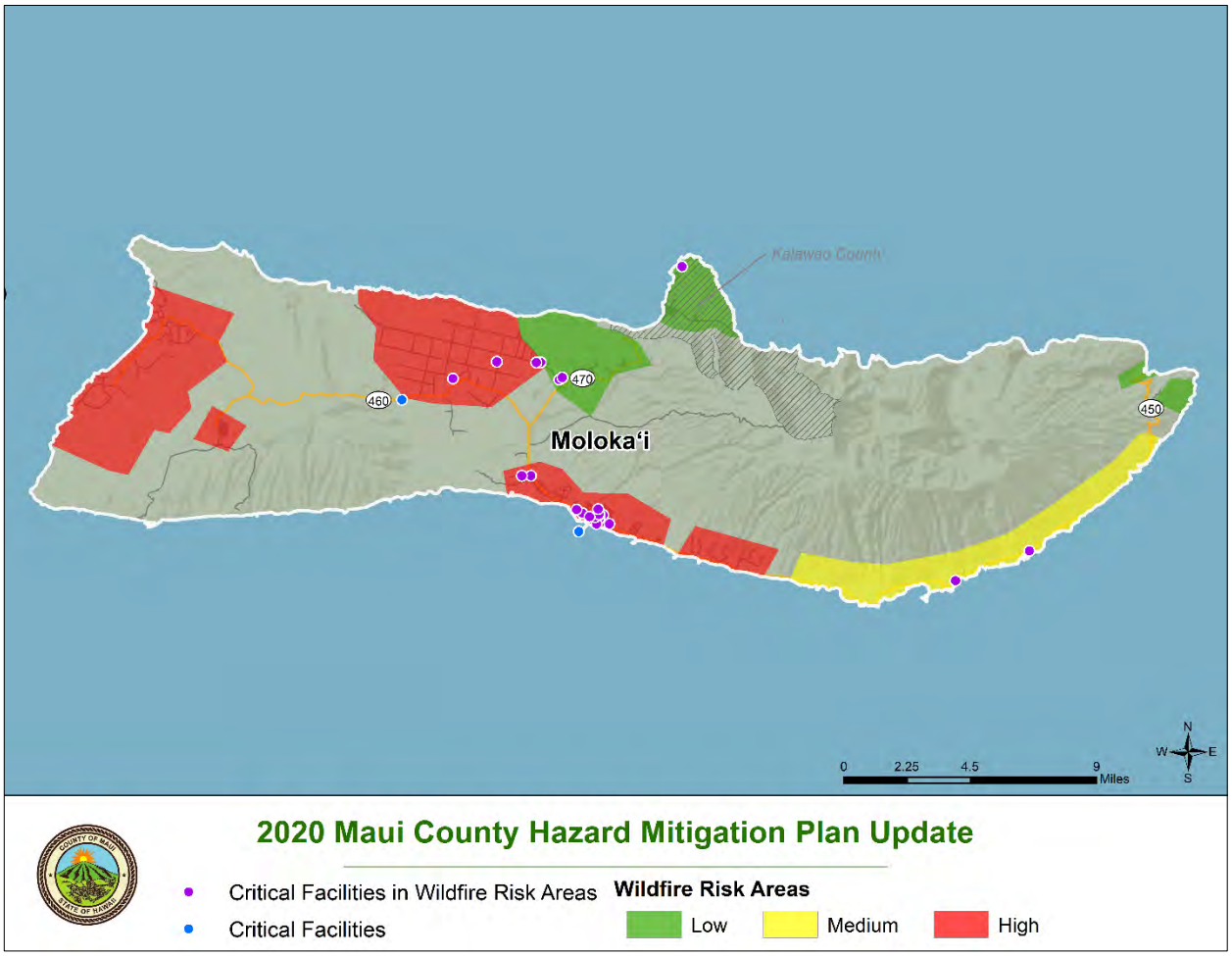

Figure 246. Critical Facilities in Wildfire Risk Areas in the Moloka'i Community Planning Area.

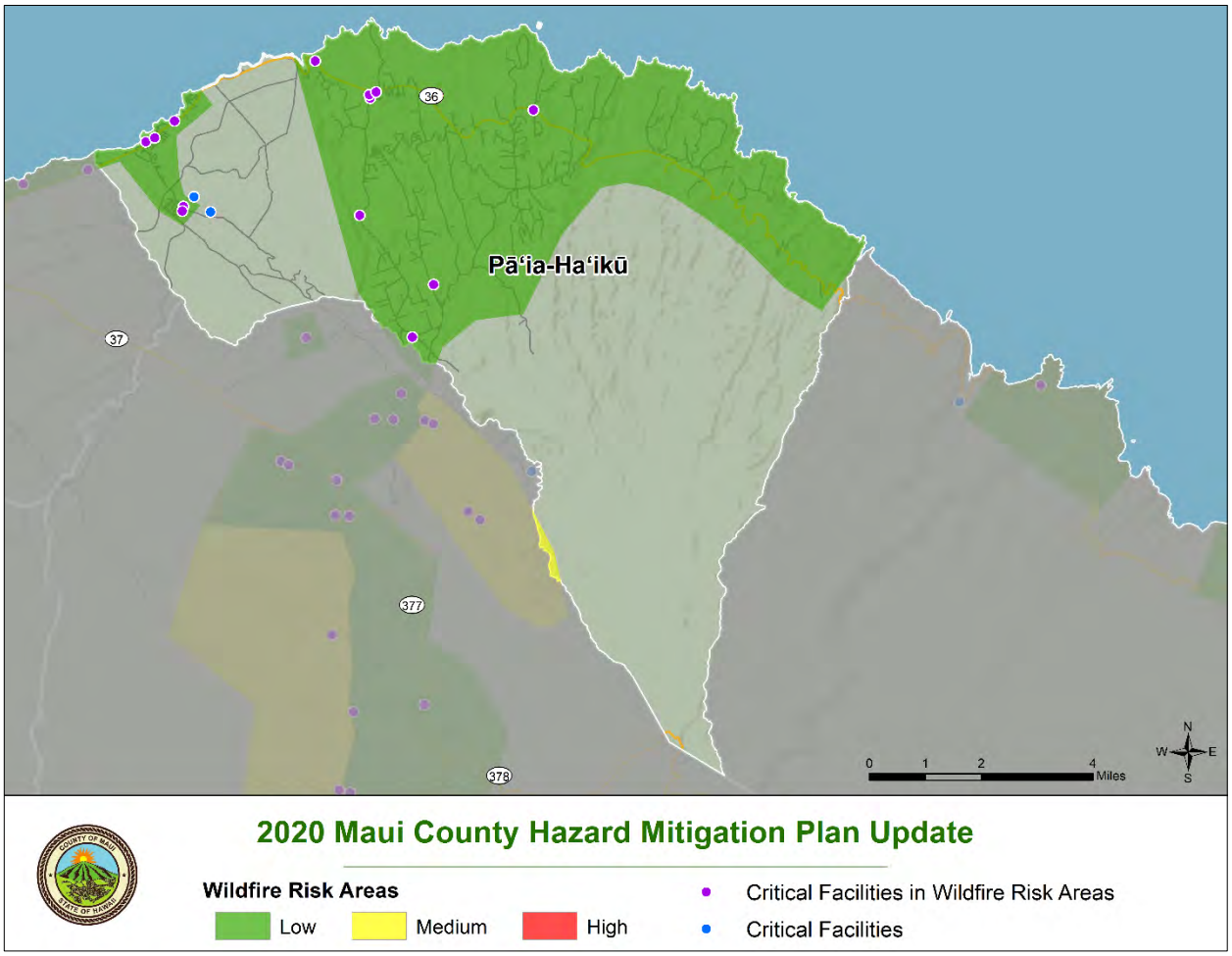

Figure 247. Critical Facilities in Wildfire Risk Areas in the Pāʻia-Haʻikū Community Planning Area.

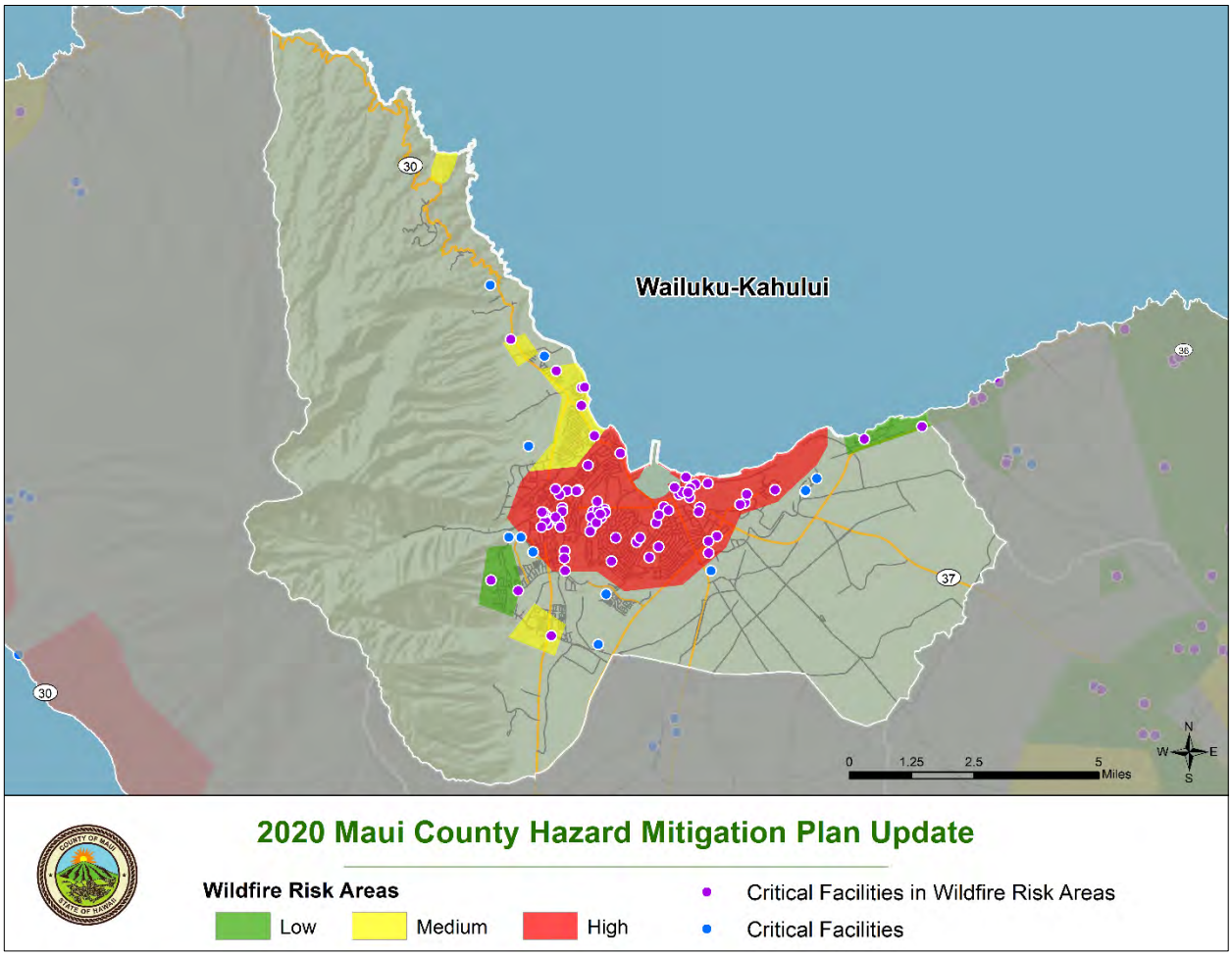

Figure 248. Critical Facilities in Wildfire Risk Areas in the Wailuku-Kahului Community Planning Area.

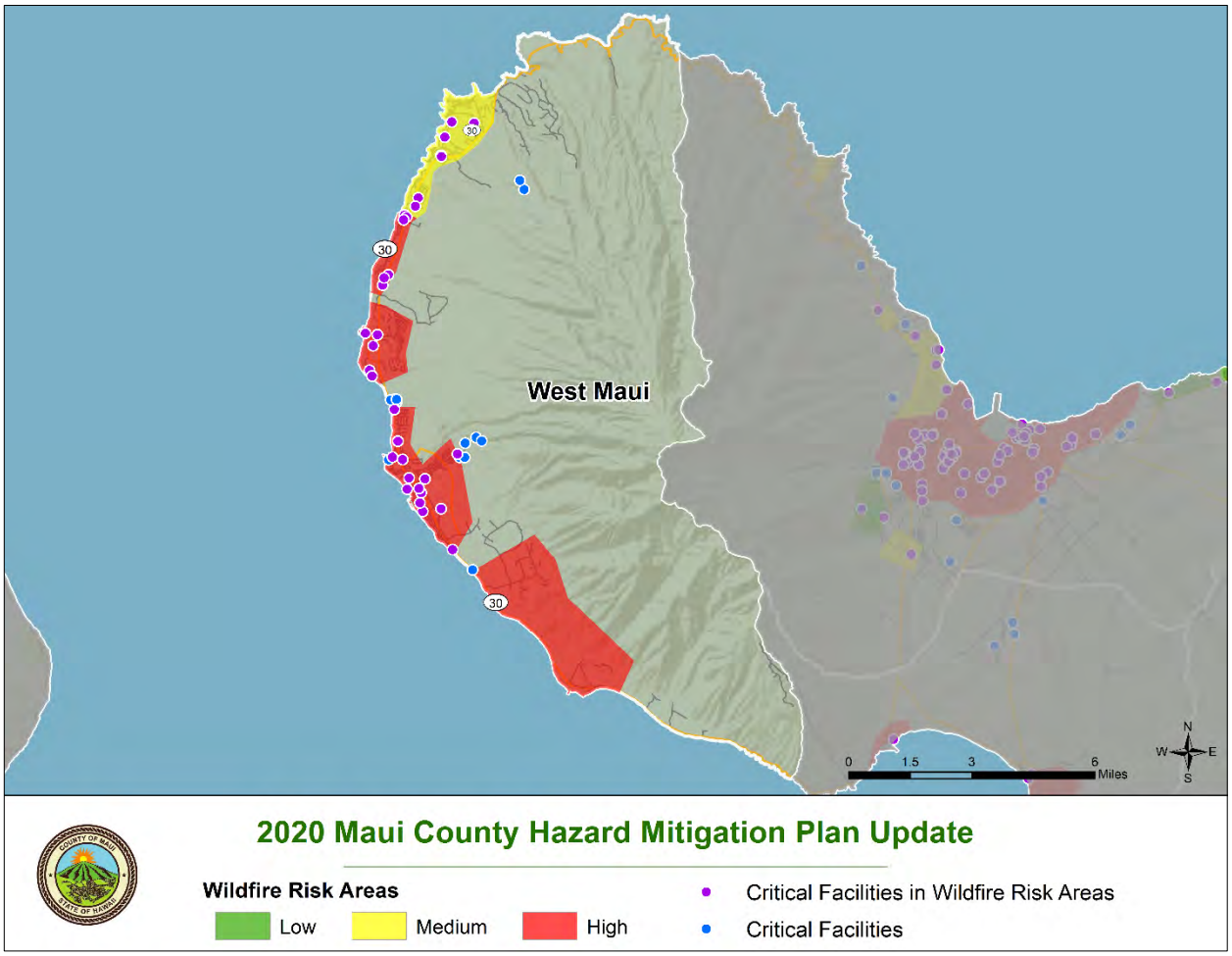

Figure 249. Critical Facilities in Wildfire Risk Areas in the West Maui Community Planning Area.

In addition to buildings and identified critical facilities, utility lines, roads and bridges are vulnerable to the impact of wildfires. When utility lines are damaged by wildfires, functionality of water, sewer, gas, and electricity systems may be compromised.[228] Because of their geographic extent, roads and utility lines can have a greater chance of being impacted by wildfire events. Further, if any section of a road or utility line is damaged by a wildfire, the entire system may be impacted. For instance, a wildfire that results in one area of a road or a bridge being impassible may block accessibility to other roads or locations.

[228] 2018 California State Hazard Mitigation Plan, Public Review Draft, pg. 312. Cal EOS. Retrieved from http://www.caloes.ca.gov/HazardMitigationSite/Documents/009-2018%20SHMP_Public%20Review%20Draft_April%202018_CH6.pdf.

Table 71 presents the number of bridges in each community planning area that are within a wildfire risk area (low, medium, or high). Figure 250 and Figure 251 present bridges within wildfire risk areas on the Islands of Maui and Molokaʻi. There are no NBI bridges on the Island of Lānaʻi.

Table 71. Number of NBI Bridges in Maui County Community Planning Areas.

Community Planning Area	Number of (NBI) Bridges
Hāna	20
Kīhei-Mākena	3
Lānaʻi	N/A
Makawao-Pukalani-Kula	15
Molokaʻi	14
Pāʻia-Haʻikū	10
Wailuku-Kahului	8
West Maui	11
MAUI COUNTY TOTAL	**81 (52%)**

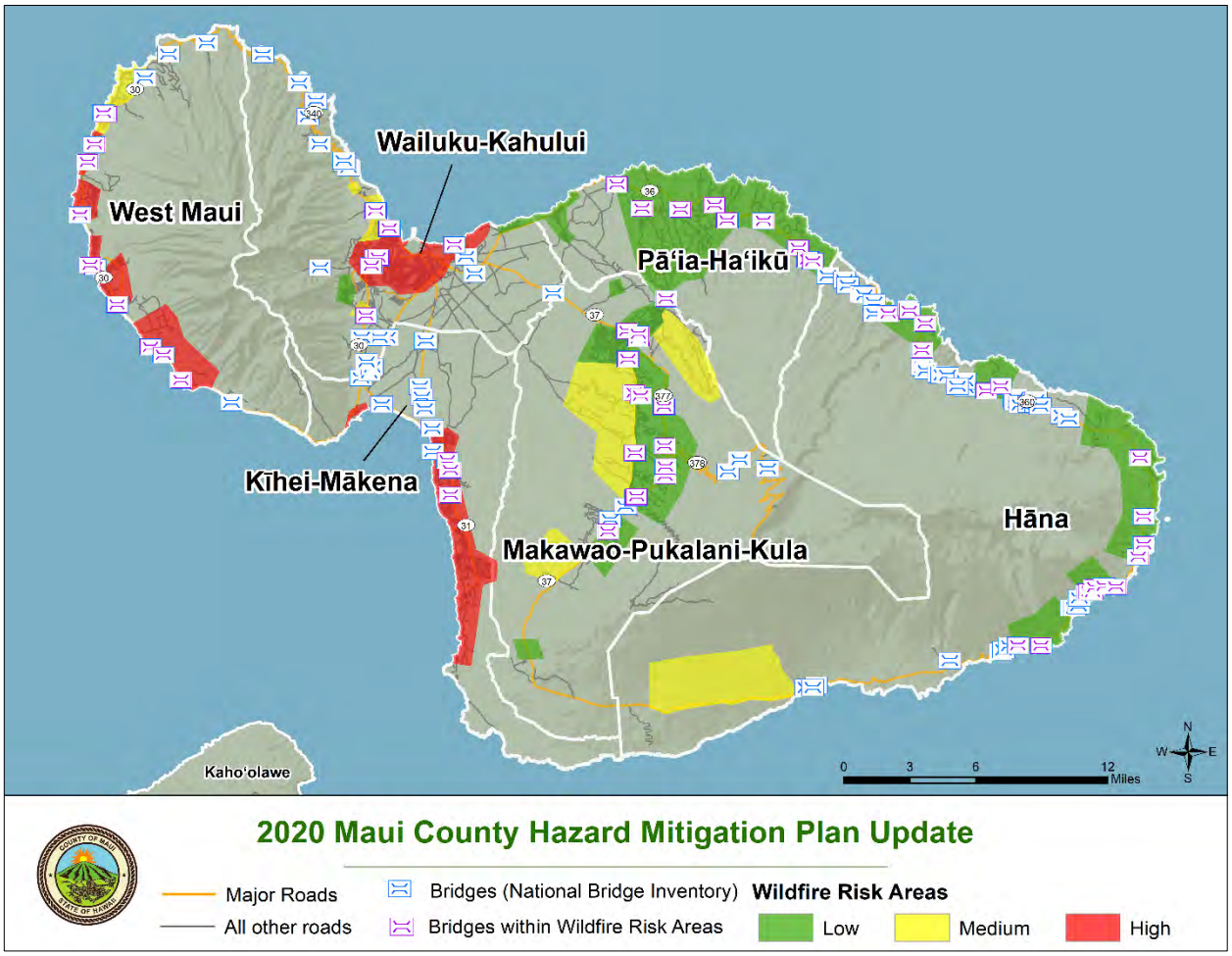

Figure 250. Bridges in Wildfire Risk Areas on Maui Island.

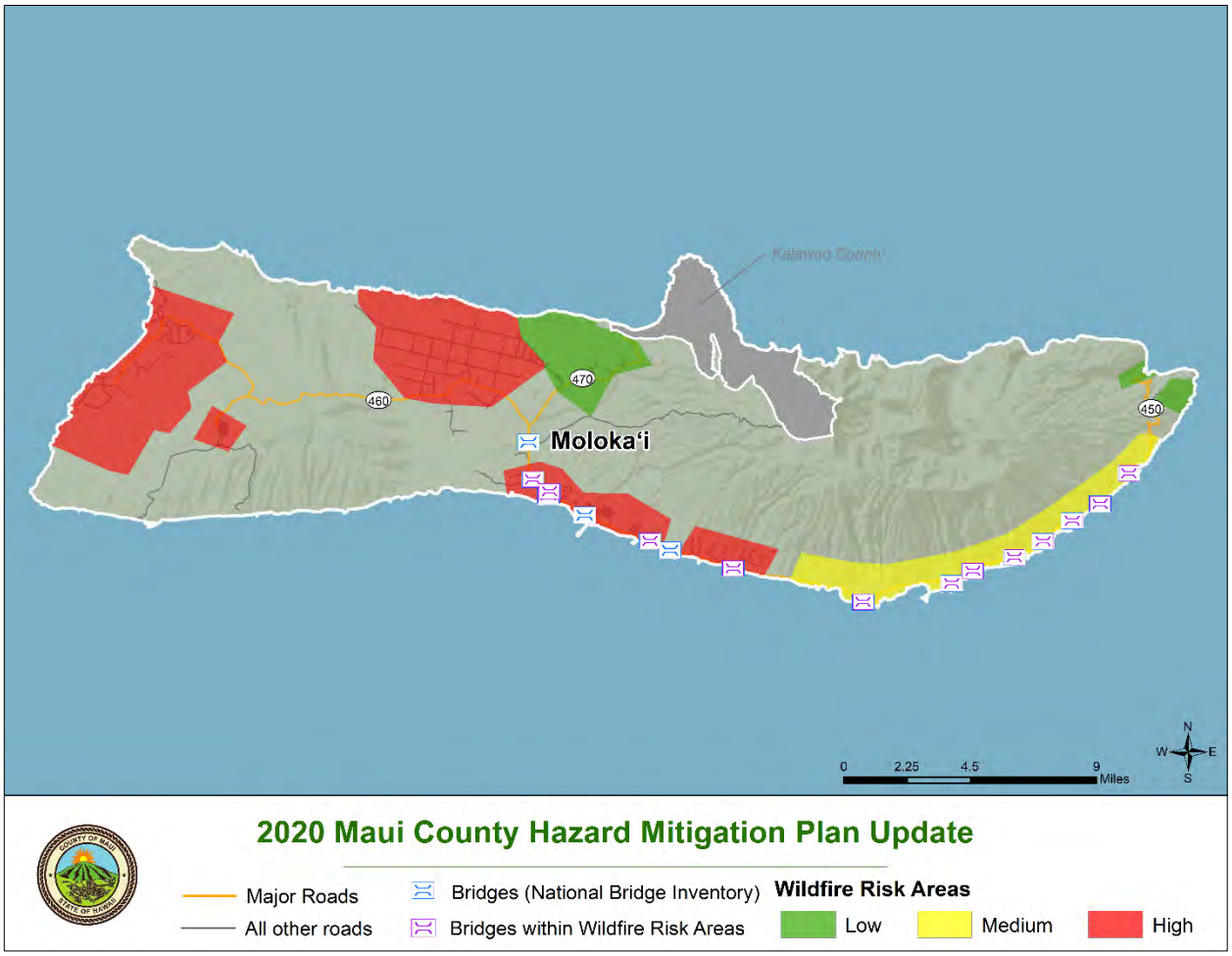

Figure 251. Bridges in Wildfire Risk Areas on Moloka'i Island.

Further, the maps below show roads, county-owned and others, within wildfire risk areas. Many roads may have a segment within a wildfire risk area rather than the entire road being within a risk area.

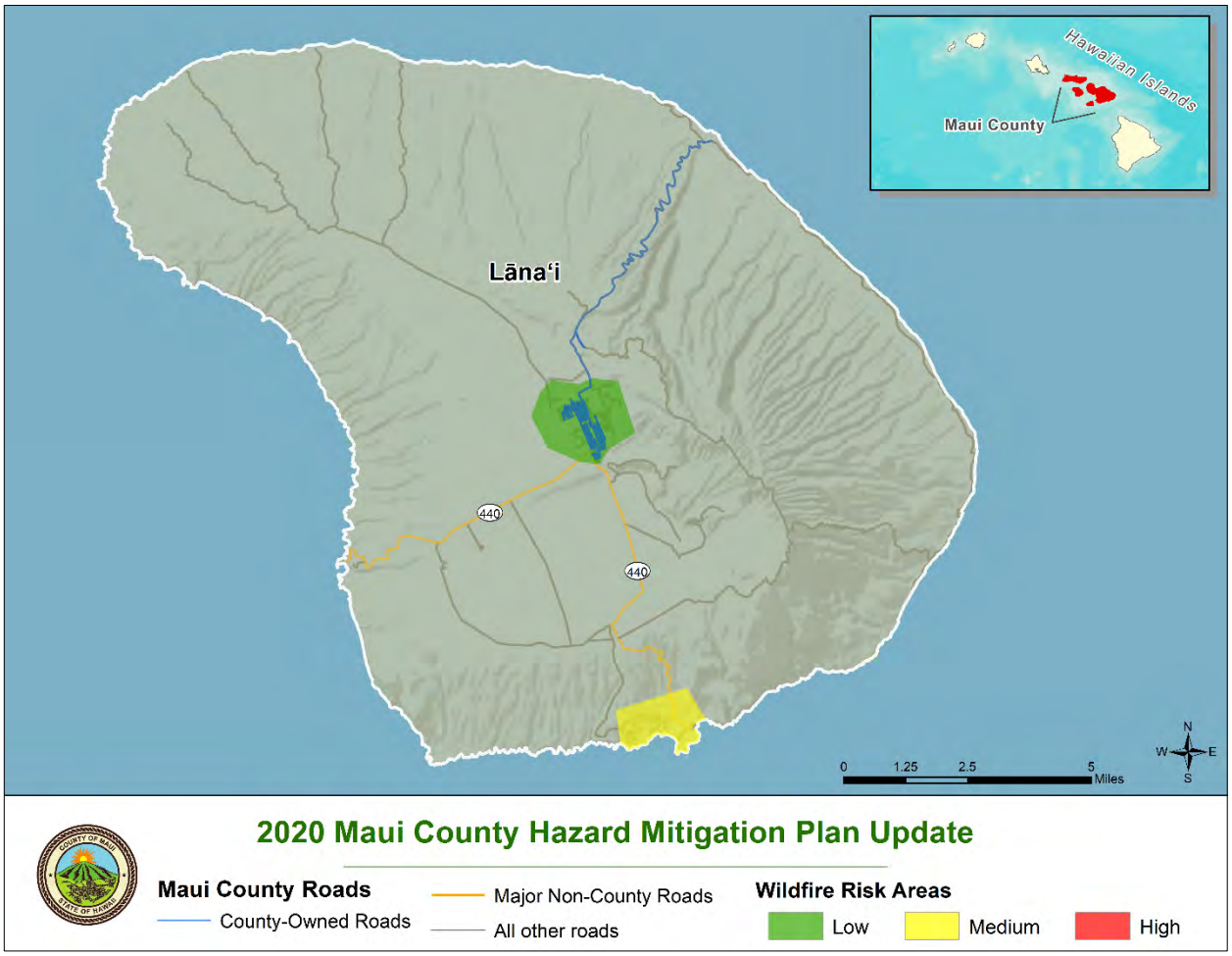

Figure 252. Roads and Wildfire Risk Areas on Lānaʻi Island.

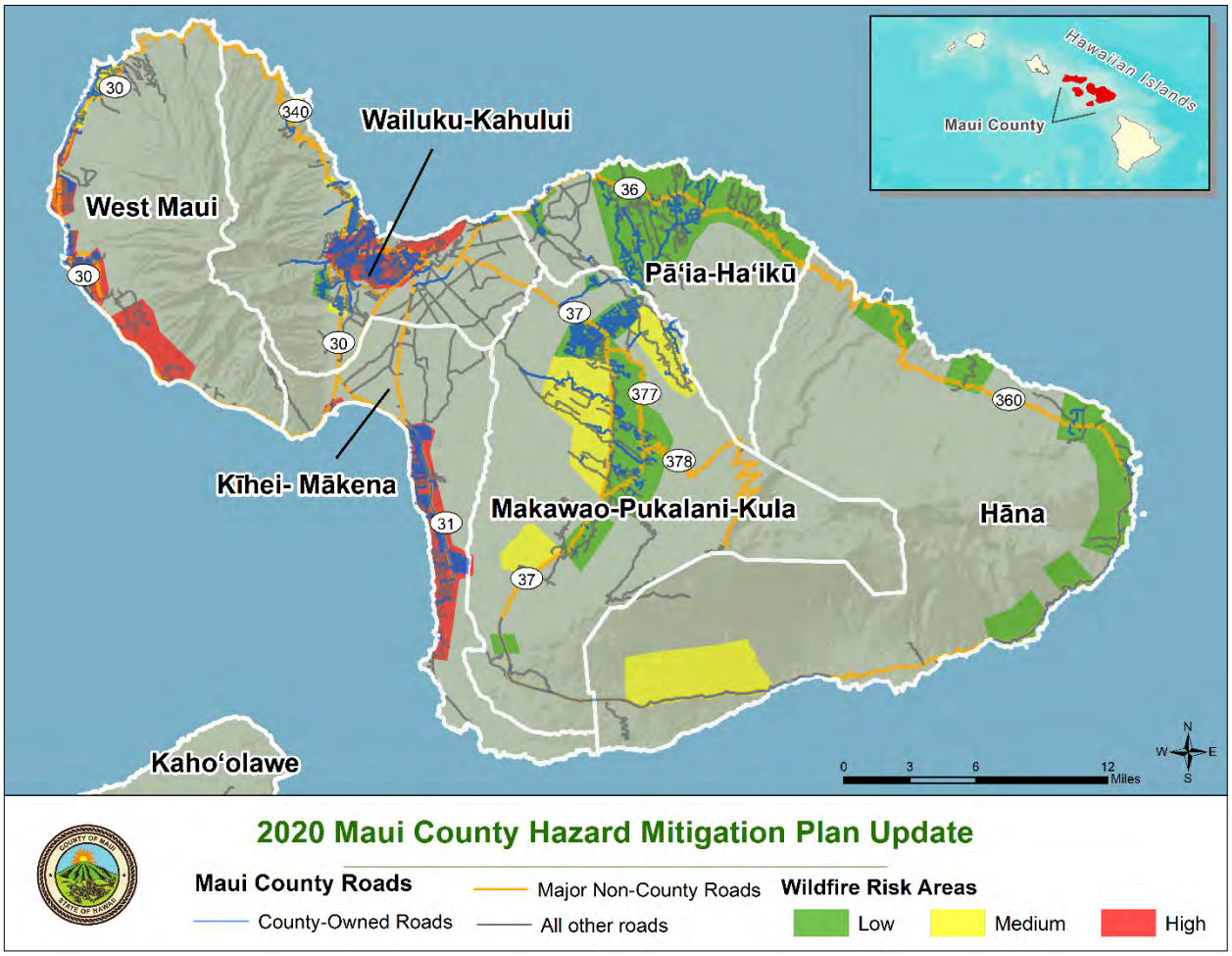

Figure 253. Roads and Wildfire Risk Areas on Maui Island.

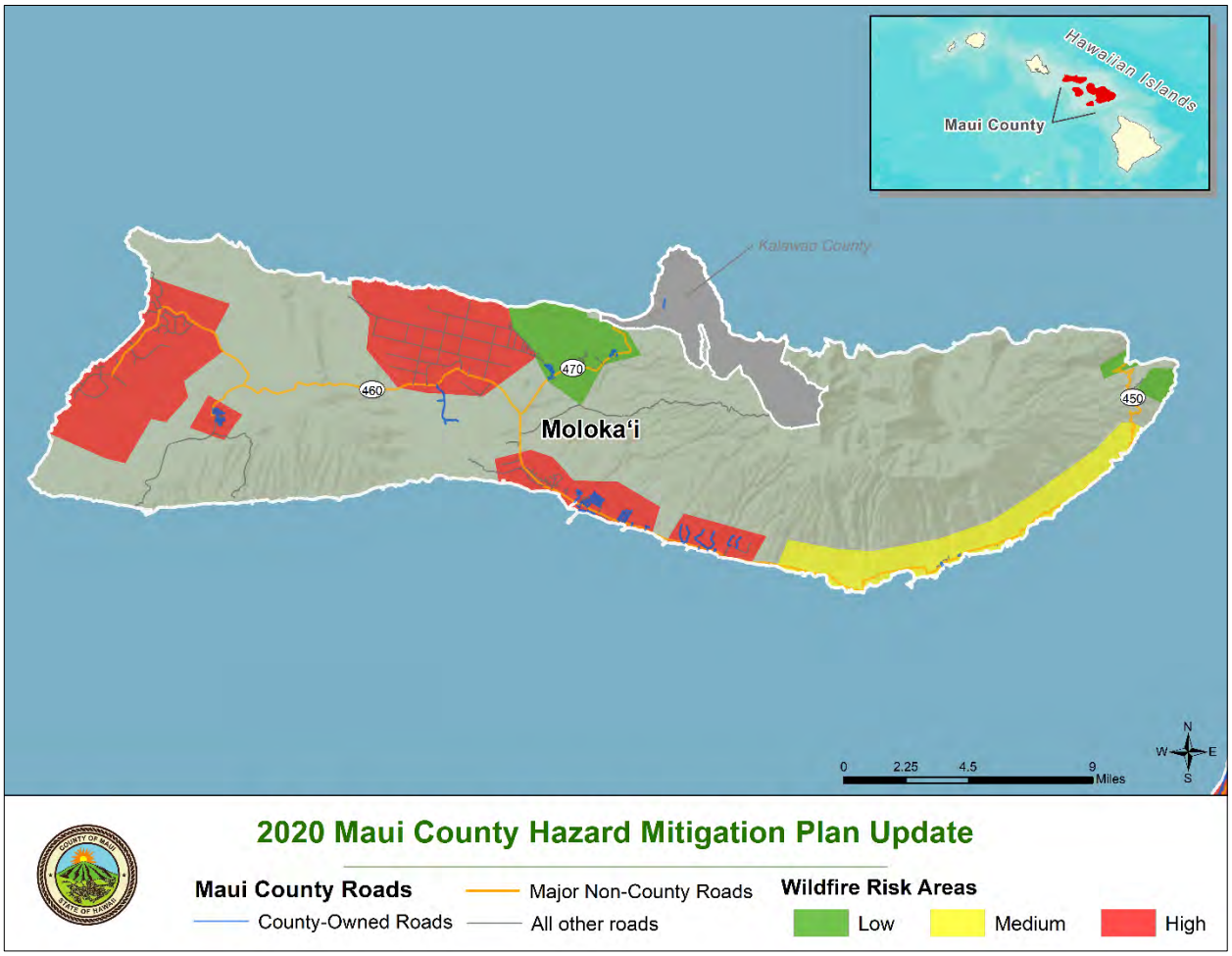

Figure 254. Roads and Wildfire Risk Areas on Moloka'i Island.

Life Safety, Health, Warning, and Evacuation Impacts

Wildfires can have direct threats to life safety by causing deaths and injuries due to smoke inhalation and/or burns. While wildfires are difficult to predict, the NWS issues fire weather watches and fire weather warnings (also called red flag warnings) to alert fire departments and the population at-large of weather and dry conditions that are potentially conducive to the development of wildfires (drought conditions, relative humidity at or below 40%, and winds greater than 20mph). Watches may be issued 12 to 72 hours prior to the expected weather conditions.[229] Large wildfires or those in populated areas may prompt emergency notifications to evacuate. For instance, a July 2019 brushfire in the Kīhei-Mākena community planning area prompted several thousand Maui residents and tourists to evacuate

[229] NWS Honolulu, HI Weather Forecast Office (2020). Questions about products. Retrieved from https://www.weather.gov/hfo/prod_questions.

from Kīhei and Maalea.[230] Visitors and tourists not familiar with local evacuation routes may be at a higher risk to wildfire impacts.

Public Health Impacts

Wildfires can negatively impact public health by lowering air quality due to smoke. Smoke inhalation and increased particulate matter in the air can cause lung irritation and more severe respiratory problems in vulnerable populations, such as young children, the elderly, and individuals with asthma, emphysema, or other underlying respiratory issues.

Impacts to Vulnerable Populations

Based on available hazard information, 79% of structures within Maui County are located within low, medium or high wildfire risk areas. While all Community Planning Areas have some exposure to wildfire risk areas, Kīhei-Mākena has the greatest proportion of its buildings within high wildfire risk areas, at 97%, and Wailuku-Kahului has the greatest overall number of buildings in high wildfire risk areas, at 10,581. Kīhei-Mākena ranks sixth for overall vulnerability, and Wailuku-Kahului has the second highest overall Vulnerability Index score within Maui County.

Wildfires present challenges to vulnerable populations, especially those who have difficulty evacuating due to disability, age, or mobility challenges. The U.S. Fire Administration estimates that "older adults are more than twice as likely than the general population to die in fires."[231] In 2018, the Camp Fire in Paradise, California took the lives of 86 people. Of those positively identified 77% were over the age of 65. Evacuation also presents a challenge for those living in crowded or high-density housing situations, especially in multi-story buildings. Those living in areas with low road density may have fewer options for evacuation. Populations with limited access to information may not receive time critical warning information to enable them to reach places of safety. Those already experiencing socioeconomic constraints may struggle to recover homes and property damaged or destroyed as a result of wildfire.

Populations exhibiting constraints related to household composition, socioeconomic status, access to information, housing characteristics and access to lifelines are susceptible to negative consequences as a result of wildfires. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are described below.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty with mobilizing and evacuating

[230] Gajanan, M. (2019). *Wildfire on Hawaiian Island of Maui forces thousands to evacuate*. Time Magazine. Retrieved from https://time.com/5625325/Hawai'i-maui-wildfire-evacuations/.

[231] Newberry, L. (2019). *Must Reads: Poor, elderly and too frail to escape: Paradise fire killed the most vulnerable residents.* Los Angeles Times. Retrieved from: https://www.latimes.com/local/lanow/la-me-ln-camp-fire-seniors-mobile-home-deaths-20190209-story.html

or taking protective action in a timely fashion during a wildfire. Young children, the elderly, and those with existing medical or respiratory conditions such as asthma or emphysema may be particularly susceptible to the effects of smoke inhalation as a result of fire. If evacuated, these populations will require additional services and care considerations in the response aftermath and during recovery. Special accommodations for these populations must be considered in disaster planning processes.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a natural disaster. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate preparedness actions such as stocking extra food and supplies, support recovery actions such as repairing of homes damaged by fire, or fund mitigation actions that would protect their homes and property from wildfire.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon urgent hazard warning information. Additionally, those who do not speak English well, may not

comprehend hazard warning information to the extent that enables them to make timely decisions and take life-saving actions during a wildfire event.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Populations living in housing built before 1950, and prior to the enactment of modern building codes, are more susceptible to damages and losses due to structural damage as a result of hazard impacts. In addition, higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences as a result of hazard exposure.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges during an evacuation, and have difficulty accessing needed supplies and services before, during and after a hazard event. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health

insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Molokaʻi households also do not have access to a vehicle.

Economic Impacts

Wildfires can cause direct economic losses by destroying or damaging structures, utilities, roads and other critical assets. Wildfires can also cause business interruptions, cause school closures, and divert flights. Tourism can be impacted by large wildfire events.

Further, Hawai'i's native ecosystems are not fire-adapted, and vegetation in burned areas is often replaced by fire-prone non-native shrubs and grasses. This activity increases future susceptibility to wildfires and replaces valuable natural resources with species that could become invasive.

Climate Change Impacts

Maui County has experienced increase drought conditions over the last 30 years and is expected to experience increases in drought frequency and intensity as climate change brings warmer temperatures, decreased streamflows, and decreased precipitation. Drought conditions greatly increase the risk of wildfires. Further, as changing climate conditions make native species more vulnerable to competition from non-native species; continued increases in fire-prone non-native species could increase wildfire frequency and intensity in future.

Hazardous Materials Incidents

Description

Hazardous materials can be found in many forms and quantities that can potentially cause death; serious injury; long-lasting health effects; and damage to buildings, homes, and other property in varying degrees. Such materials are routinely used and stored in many homes and businesses and are also shipped daily on the nation's highways, railroads, waterways, and pipelines. This subsection on the hazardous material hazard is intended to provide a general overview of the hazard, and the threshold for identifying fixed and mobile sources of hazardous materials is limited to general information on highways, and local and FEMA-identified fixed HAZMAT sites determined to be of greatest significance as appropriate for the purposes of this plan.

Hazardous material (HAZMAT) incidents can apply to fixed facilities as well as mobile, transportation-related accidents in the air, by rail, on the nation's highways, and on the water. Approximately 6,774 HAZMAT events occur each year, 5,517 of which are highway incidents, 991 are railroad incidents, and

266 are due to other causes.[232] In essence, HAZMAT incidents consist of solid, liquid, and/or gaseous contaminants that are released from fixed or mobile containers, whether by accident or by design as with an intentional terrorist attack. A HAZMAT incident can last hours to days, while some chemicals can be corrosive or otherwise damaging over longer periods of time. In addition to the primary release, explosions and/or fires can result from a release, and contaminants can be extended beyond the initial area by persons, vehicles, water, wind, and possibly wildlife as well.

HAZMAT incidents can also occur as a result of or in tandem with natural hazard events, such as floods, hurricanes, tornadoes, and earthquakes, which in addition to causing incidents can also hinder response efforts. In the case of Hurricane Floyd in September 1999, communities along the Eastern United States were faced with flooded junkyards, disturbed cemeteries, deceased livestock, floating propane tanks, uncontrolled fertilizer spills, and a variety of other environmental pollutants that caused widespread toxological concern.

Hazardous material incidents can include the spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment of a hazardous material, but exclude: (1) any release which results in exposure to poisons solely within the workplace with respect to claims which such persons may assert against the employer of such persons; (2) emissions from the engine exhaust of a motor vehicle, rolling stock, aircraft, vessel or pipeline pumping station engine; (3) release of source, byproduct, or special nuclear material from a nuclear incident; and (4) the normal application of fertilizer.

Location

As a result of the 1986 Emergency Planning and Community Right to Know Act (EPCRA), the Environmental Protection Agency provides public information on hazardous materials. One facet of this program is to collect information from industrial facilities on the releases and transfers of certain toxic agents. This information is then reported in the Toxic Release Inventory (TRI). TRI sites indicate where such activity is occurring. There are 12 TRI sites located in Maui County. Seven of these are located in the Wailuku-Kahului community planning area, and Pāʻia-Haʻikū, Kīhei-Mākena, West Maui, Lānaʻi, and Molokaʻi each have one TRI site. In addition to TRI sites, mobile HAZMAT incidents can occur on roadways as hazardous materials are transported. The figures below show the locations of TRI sites on each island in Maui County, along with major transportation routes that may be subject to mobile incidents, such as highways and parkways.

[232] FEMA (1997). *Technological Hazards*. Retrieved from https://www.fema.gov/media-library-data/20130726-1545-20490-2423/mhira_te.pdf.

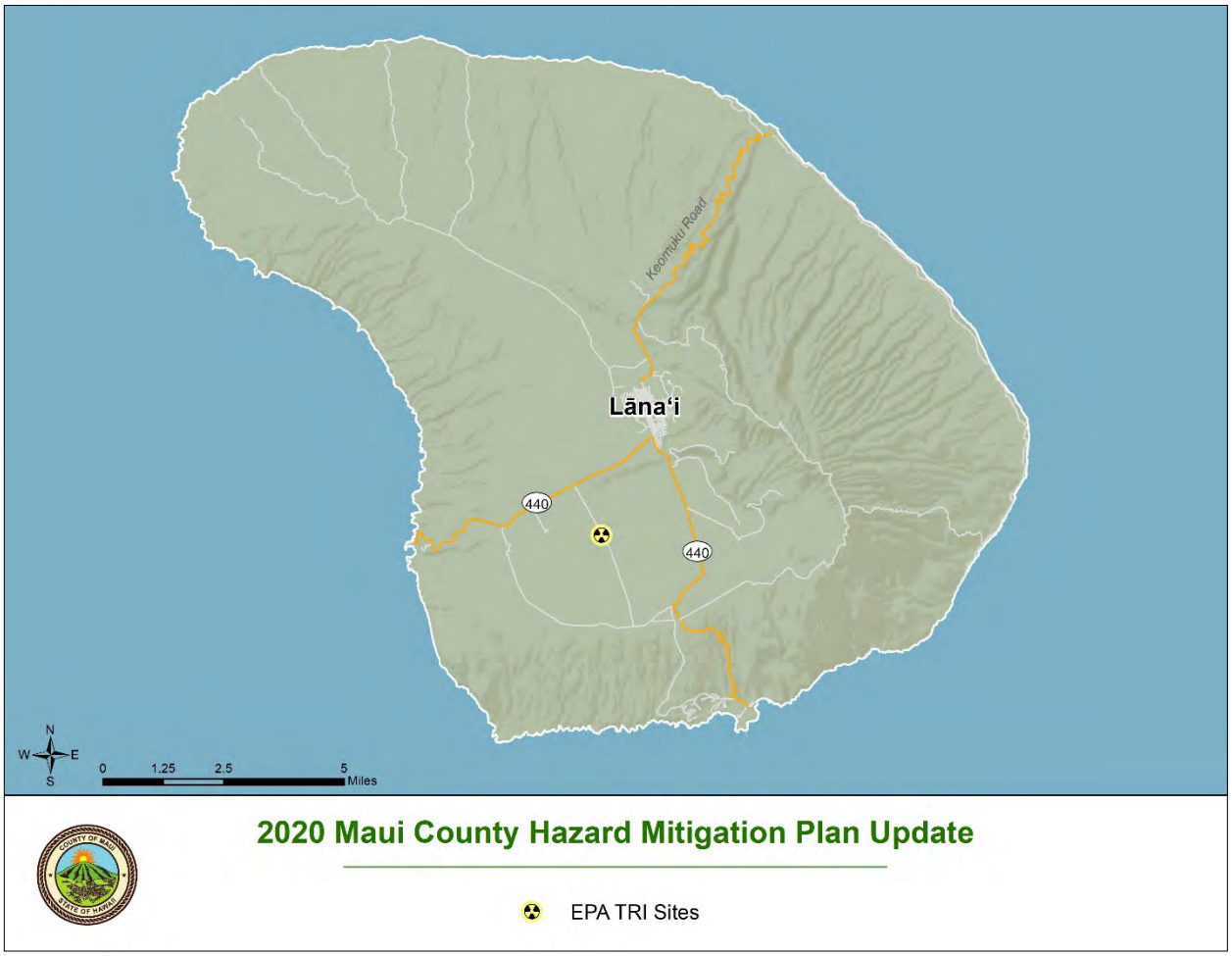

Figure 255. TRI Sites and Major Transportation Routes on the Island of Lānaʻi.

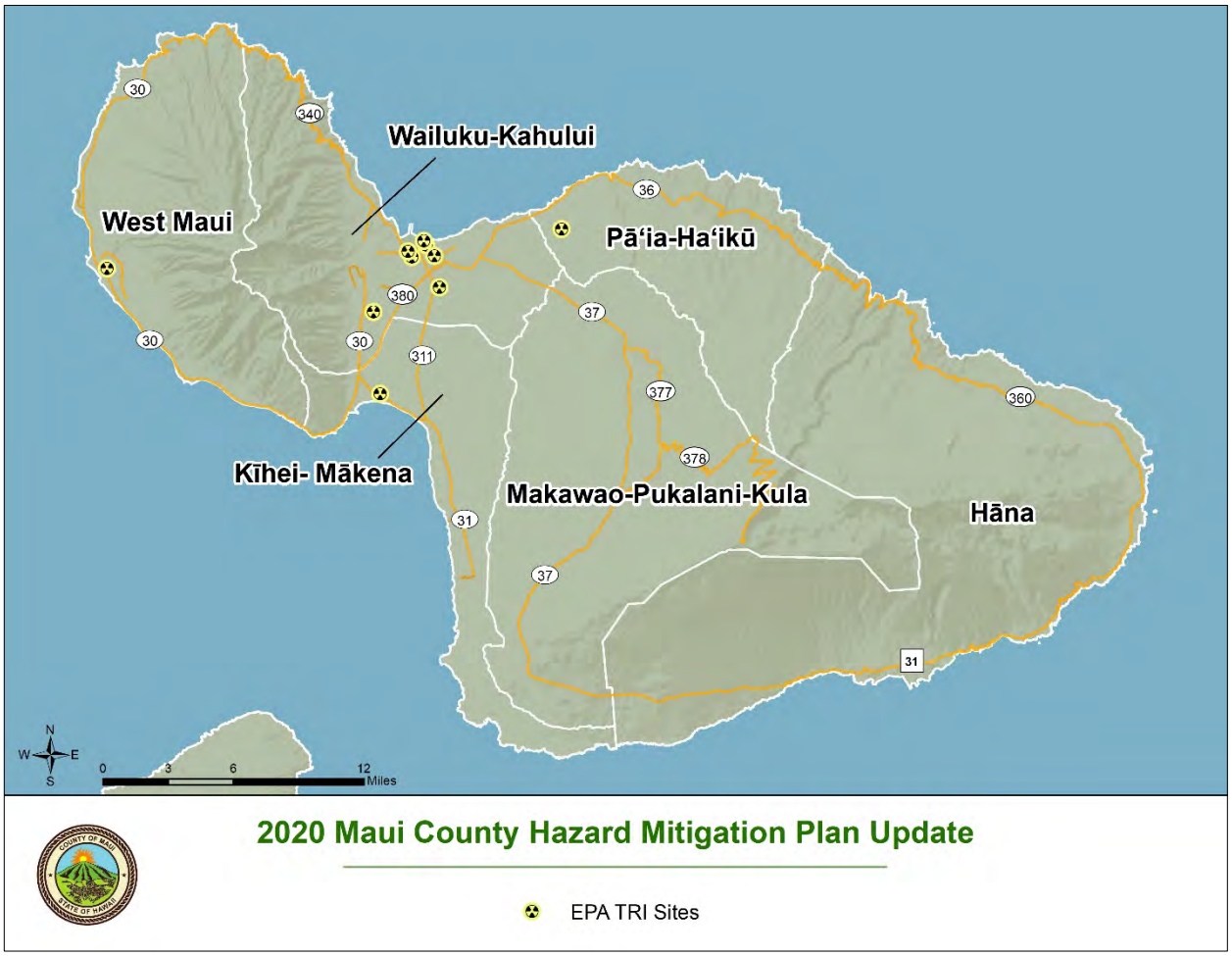

Figure 256. TRI Sites and Major Transportation Routes on the Island of Maui.

Figure 257. TRI Sites and Major Transportation Routes on the Island of Moloka'i.

Previous Occurrences

The U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration (PHMSA) lists historical occurrences throughout the nation. A "serious incident" is a hazardous materials incident that involves:

- a fatality or major injury caused by the release of a hazardous material,
- the evacuation of 25 or more persons as a result of release of a hazardous material or exposure to fire,
- a release or exposure to fire which results in the closure of a major transportation artery,
- the alteration of an aircraft flight plan or operation,
- the release of radioactive materials from Type B packaging,
- the release of over 11.9 galls or 88.2 pounds of a severe marine pollutant, or
- the release of a bulk quantity (over 199 gallons or 882 pounds) of a hazardous material.

However, prior to 2002, a hazardous materials "serious incident" was defined as follows:

- a fatality or major injury due to a hazardous material,
- closure of a major transportation artery or facility or evacuation of six or more persons due to the presence of hazardous material, or
- a vehicle accident or derailment resulting in the release of a hazardous material.

Incidents occurring within Maui County were pulled from the PHSMA database. Two incidents were reported in Maui County between 1990 and May 2020. These events resulted in $262,879 in damages (2019 dollars). These incidents resulted no deaths or injuries, but both of these incidents were considered "serious incidents" as defined by the Pipeline and Hazardous Materials Safety Administration. Descriptions for these incidents are provided below.

- **July 14, 1999 –** A truck carrying oil was involved in a vehicular accident on Honoapiilani Highway in Mā'alaea, releasing 200 liquid gallons of oil. This incident resulted in $260,472 (2019 dollars) in damages.
- **January 28, 2009 –** A malfunctioning tanker released 1,140 liquid gallons of liquefied petroleum gas on Halama Street in Kīhei. The truck was towed to an isolated area where propane was burned off with the Maui Fire Department on standby. This incident resulted in $2,407 (2019 dollars) in damages.

In addition to the events reported by PHMSA, Maui County officials reported that hazardous materials incidents associated with illegal dumping is a problem in the county. Within the county, these are referred to a "open dumps" and contain hazardous materials.

Extent

The extent of hazardous materials incidents can be defined in terms of amount of material released. According to USDOT PHMSA, the largest hazardous materials incident reported in the planning area is a highway incident in 2009 that resulted in the release of 1,140 liquid gallons of oil in the City of Kīhei. However, incidents of greater hazardous materials releases are possible.

Probability of Future Events

The probability of hazardous materials events is difficult to determine given their unpredictability. Based on a reported 2 events in 30 years from PHSMA, Maui County has historically experienced one hazardous materials incident every 15 years. However, it is likely that both mobile and fixed-site incidents occurring within the county have gone unreported. Within Maui County, certain community planning areas are more likely to experience hazardous materials incidents than others. For instance, both reported events occurred in Kīhei, and over half of all the TRI sites in Maui County are located in the Wailuku-Kahului. The table below presents landslide probabilities for each community planning area.

Table 72. Hazardous Materials Incident Probabilities for Maui County Community Planning Areas.

Community Planning Area	Landslide Probability
Hāna	Possible (1% to 10% annual chance)
Kīhei-Mākena	Likely (10% to 90% annual chance)
Lānaʻi	Possible (1% to 10% annual chance)
Makawao-Pukalani-Kula	Possible (1% to 10% annual chance)
Molokaʻi	Possible (1% to 10% annual chance)
Pāʻia-Haʻikū	Possible (1% to 10% annual chance)
Wailuku-Kahului	Likely (10% to 90% annual chance)
West Maui	Possible (1% to 10% annual chance)

Vulnerability

All current and future buildings, infrastructure, and populations in Maui County are considered at risk to hazardous materials incidents. Those located near TRI sites or busy transportation routes may be at a higher risk to hazardous materials incidents.

Although historical evidence, existing Toxic Release Inventory sites, and reports from county officials indicate that Maui County is susceptible to hazardous materials incidents, there are few reports of damage. Most hazardous materials incidents that occur are contained and suppressed before destroying any property or threatening lives. However, they can have a significant negative impact. Such events can cause deaths, completely shut down facilities for 30 days or more, and cause affected properties to be destroyed or suffer major damage. During a hazardous materials incident, solid, liquid, and/or gaseous contaminants may be released from fixed or mobile containers. Weather conditions will directly affect how the hazard develops. Certain chemicals may travel through the air or water, affecting a much larger area than the point of the incident itself. Non-compliance with fire and building codes, as well as failure to maintain existing fire and containment features, can substantially increase the damage from a hazardous materials release. The duration of a hazardous materials incident can range from hours to days. Warning time is minimal to none.

Further, Maui County's island geography means that any substance that goes into storm drains, whether from an accidental hazardous materials release or illegal dumping, goes directly into the ocean, impacting water quality and marine life.

Building and Infrastructure Impacts (including Critical Facilities)

In order to conduct the vulnerability assessment for this hazard, GIS analysis was used for fixed and mobile areas. In both scenarios, two sizes of buffers—500 and 2,500 meters—were used. These areas

are assumed to respect the different levels of effect: immediate (primary) and secondary. Primary and secondary impact sites were selected based on guidance from FEMA 426, Reference Manual to Mitigate Potential Terrorist Attacks Against Buildings and engineering judgment.

Fixed-Site Analysis

For the fixed-site analysis, geo-referenced TRI sites in Maui County, along with buffers, were used for analysis**.** The results indicate the approximate number of parcels, buildings, and improved value, as shown in Table 73 (fixed sites). Parcels and buildings included in the 500-meter buffer are also included in the 2,500-meter buffer. Therefore, totals were not calculated in the tables below.

Table 73. Exposure of Parcels, Buildings, and Improved Value to HAZMAT Fixed-Sites (TRI Sites).

TRI Site impact Areas	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Hāna								
500m	0	0%	0	0%	$0	$0	$0	0%
2,500m	0	0%	0	0%	$0	$0	$0	0%
Kīhei-Mākena								
500m	3	0%	15	0%	$10,337,801	$5,168,899	$15,506,700	0%
2,500m	448	2%	48	1%	$184,890,394	$92,445,193	$277,335,587	2%
Lānaʻi								
500m	3	0%	4	0%	$3,584,439	$1,792,219	$5,376,658	1%
2,500m	33	2%	22	1%	$10,460,944	$5,230,472	$15,691,416	2%
Makawao-Pukalani-Kula								
500m	0	0%	0	0%	$0	$0	$0	0%
2,500m	1	0%	0	0%	$0	$0	$0	0%
Molokaʻi								
500m	8	0%	2	0%	$2,389,500	$1,194,750	$3,584,250	0%
2,500m	160	3%	54	2%	$15,596,600	$7,798,300	$23,394,900	2%
Pāʻia-Haʻikū								
500m	218	4%	238	3%	$39,110,813	$19,555,407	$58,666,220	3%
2,500m	827	16%	961	13%	$189,776,686	$94,888,339	$284,665,025	14%
Wailuku-Kahului								
500m	1,033	6%	702	4%	$468,108,925	$234,054,461	$702,163,386	8%
2,500m	10,935	61%	10,330	61%	$3,754,490,119	$1,877,245,045	$5,631,735,164	64%
West Maui								
500m	750	4%	496	8%	$167,136,867	$83,568,434	$250,705,301	1%
2,500m	3,953	22%	2,832	44%	$1,305,847,684	$652,923,845	$1,958,771,529	10%
MAUI COUNTY TOTALS								
2,500m	16,357	21%	14,247	24%	$5,461,062,427	$2,730,531,214	$8,191,593,641	15%

Community planning areas within Maui County have varying exposure to fixed HAZMAT sites. The Hāna community planning area has no exposure to TRI sites, and Makawao-Pukalani-Kula has one parcel, and no structures, within the secondary impact area (2,500 meters). Wailuku-Kahului and West Maui have the greatest exposure, with up to 61% and 44% of buildings located within secondary impact areas, respectively. The figures below show buildings within these impact areas for each community planning area.

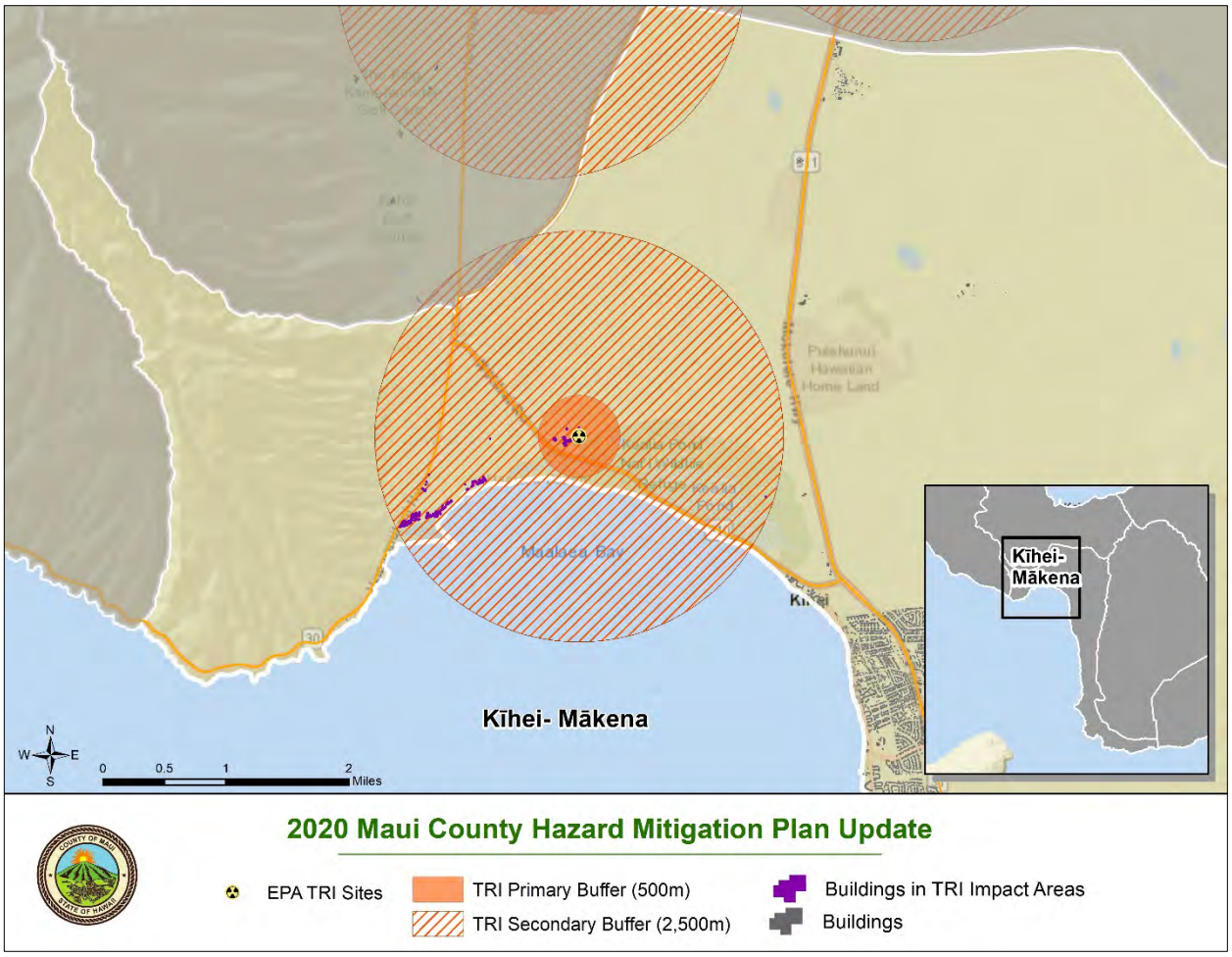

Figure 258. Buildings in Fixed-Site Impact Areas in the Kīhei-Mākena Community Planning Area.

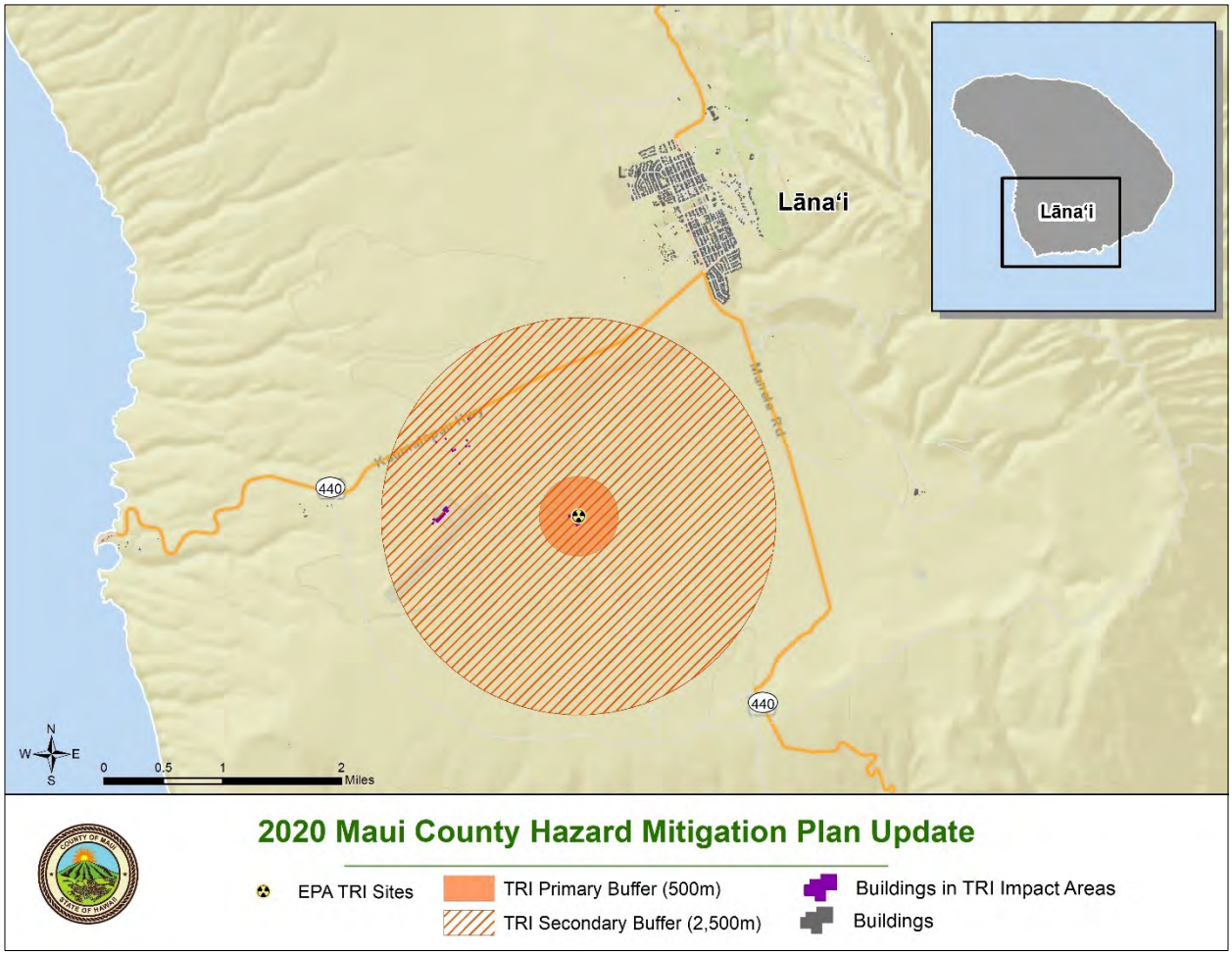

Figure 259. Buildings in Fixed-Site Impact Areas in the Lānaʻi Community Planning Area.

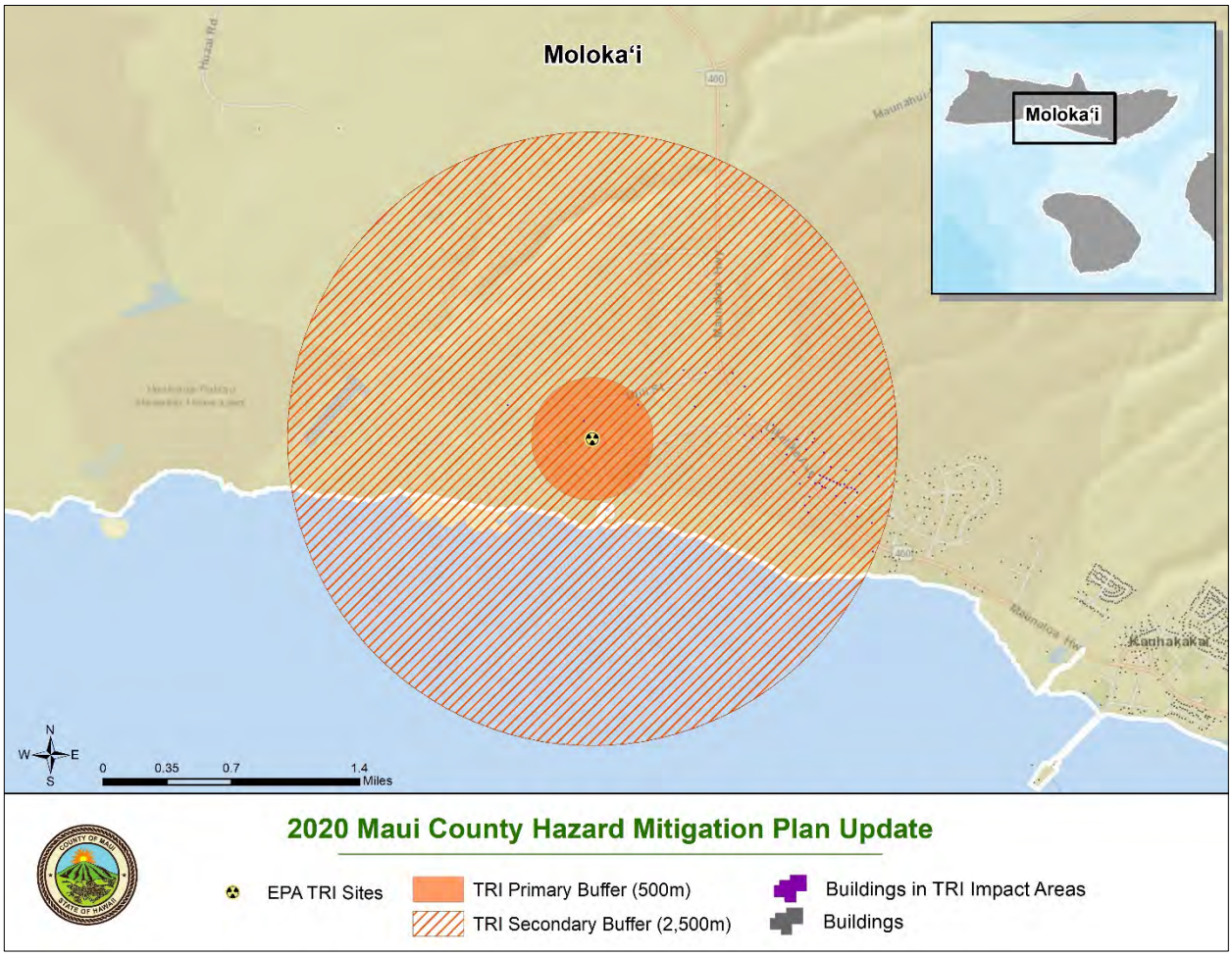

Figure 260. Buildings in Fixed-Site Impact Areas in the Moloka'i Community Planning Area.

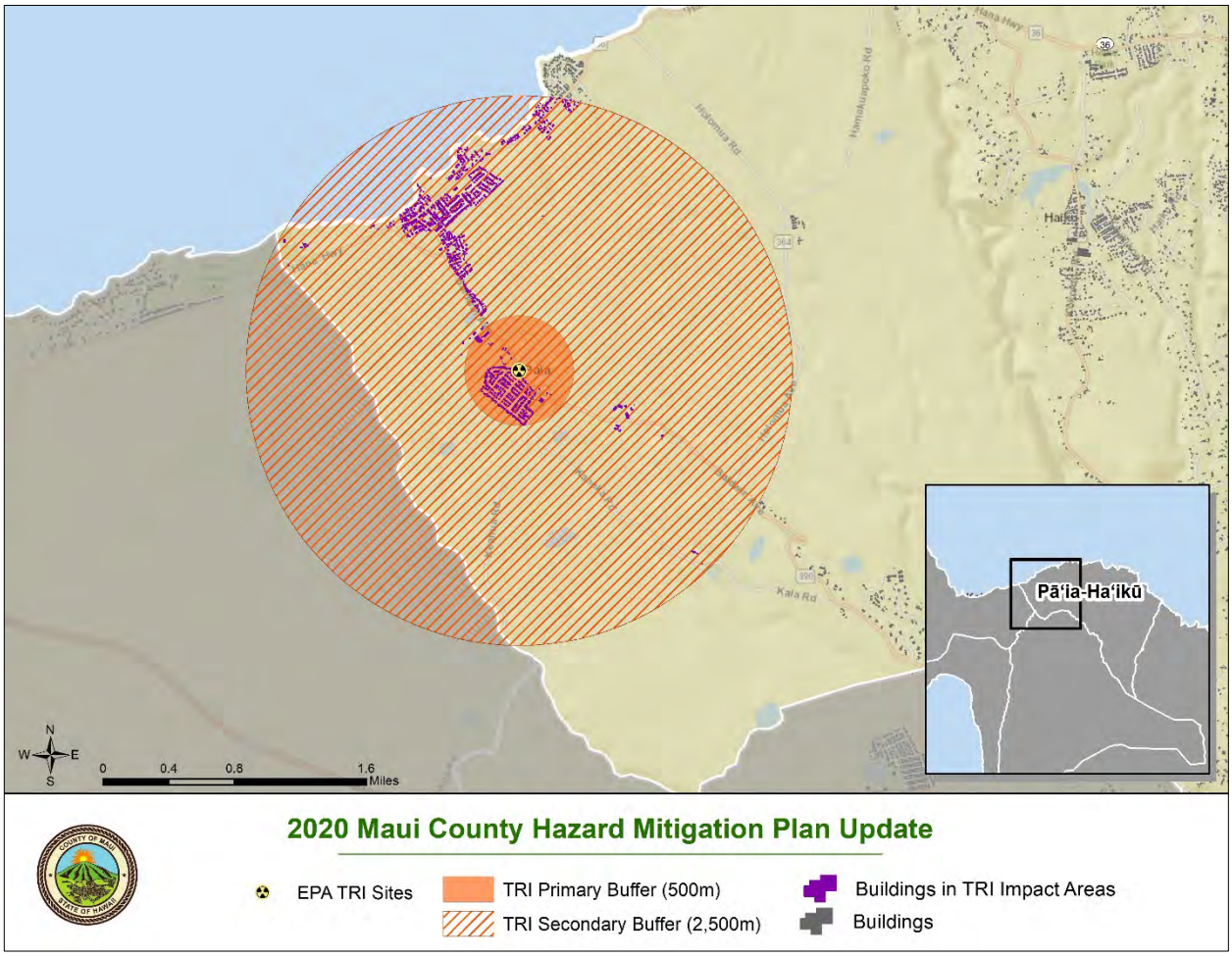

Figure 261. Buildings in Fixed-Site Impact Areas in the Pāʻia-Haʻikū Community Planning Area.

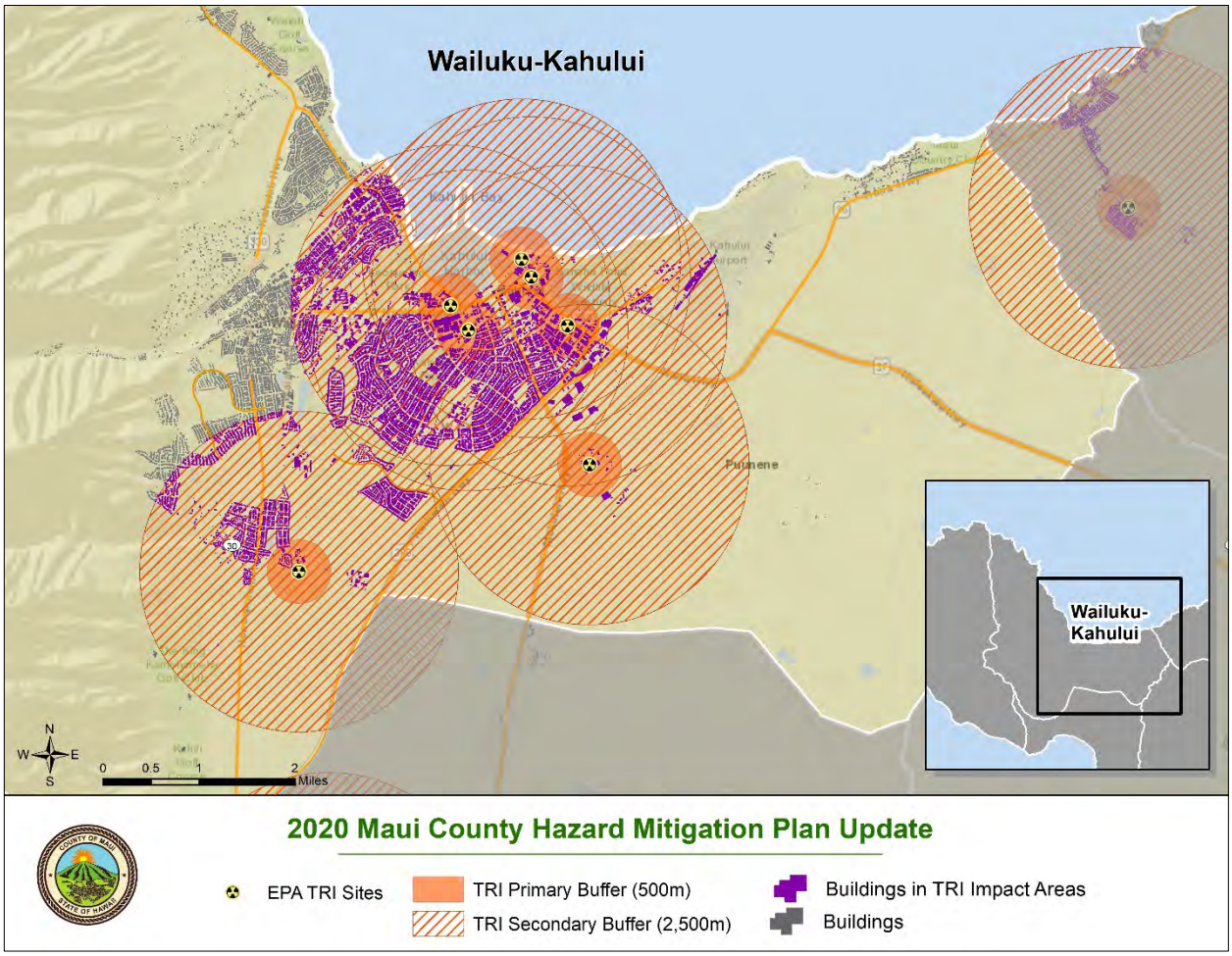

Figure 262. Buildings in Fixed-Site Impact Areas in the Wailuku-Kahului Community Planning Area.

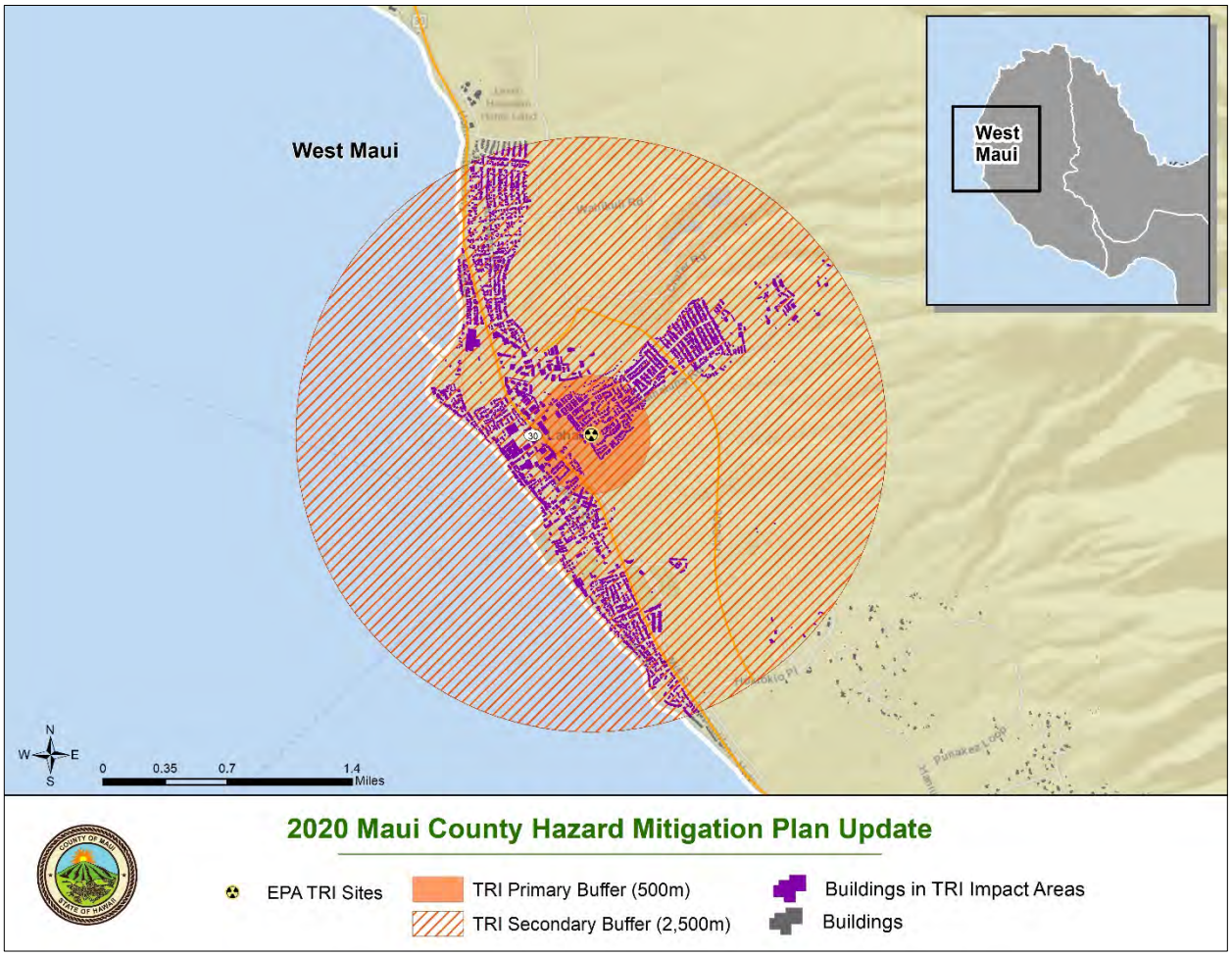

Figure 263. Buildings in Fixed-Site Impact Areas in the West Maui Community Planning Area.

GIS analysis was used to determine number of critical facilities within hazardous materials fixed-site impact areas. The table below presents the number of critical facilities within these impact areas for each community planning area. Overall, there are 93 potentially at-risk critical facilities within Maui County fixed-site hazardous materials impacts areas.

Table 74. Potentially At-Risk Critical Facilities in Fixed-Site Hazardous Materials Impacts Areas.

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Commercial Facilities	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	**2 (100%)**
Communications Facilities	0	0	0	0	0	N/A	0	N/A	**0 (0%)**

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Emergency Services	0	1	0	0	0	1	6	0	**8 (22%)**
Energy	0	N/A	N/A	N/A	1	N/A	2	N/A	**3 (60%)**
Food and Agriculture	0	0	N/A	N/A	N/A	N/A	0	N/A	**0 (0%)**
Government Facilities	N/A	N/A	N/A	N/A	0	N/A	2	N/A	**2 (14%)**
Healthcare and Public Health	0	0	0	0	0	0	20	4	**24 (50%)**
Mass care	0	0	0	0	1	3	12	6	**22 (29%)**
Transportation	0	N/A	1	N/A	0	N/A	12	0	**13 (48%)**
Water and Wastewater Systems	0	0	N/A	0	0	3	7	9	**19 (25%)**
TOTAL	**0 (0%)**	**1 (3%)**	**1 (6%)**	**0 (0%)**	**2 (6%)**	**7 (44%)**	**63 (59%)**	**19 (37%)**	**93 (31%)**

The figures below show critical facilities in Maui County fixed-site hazardous materials impacts areas by community planning area.

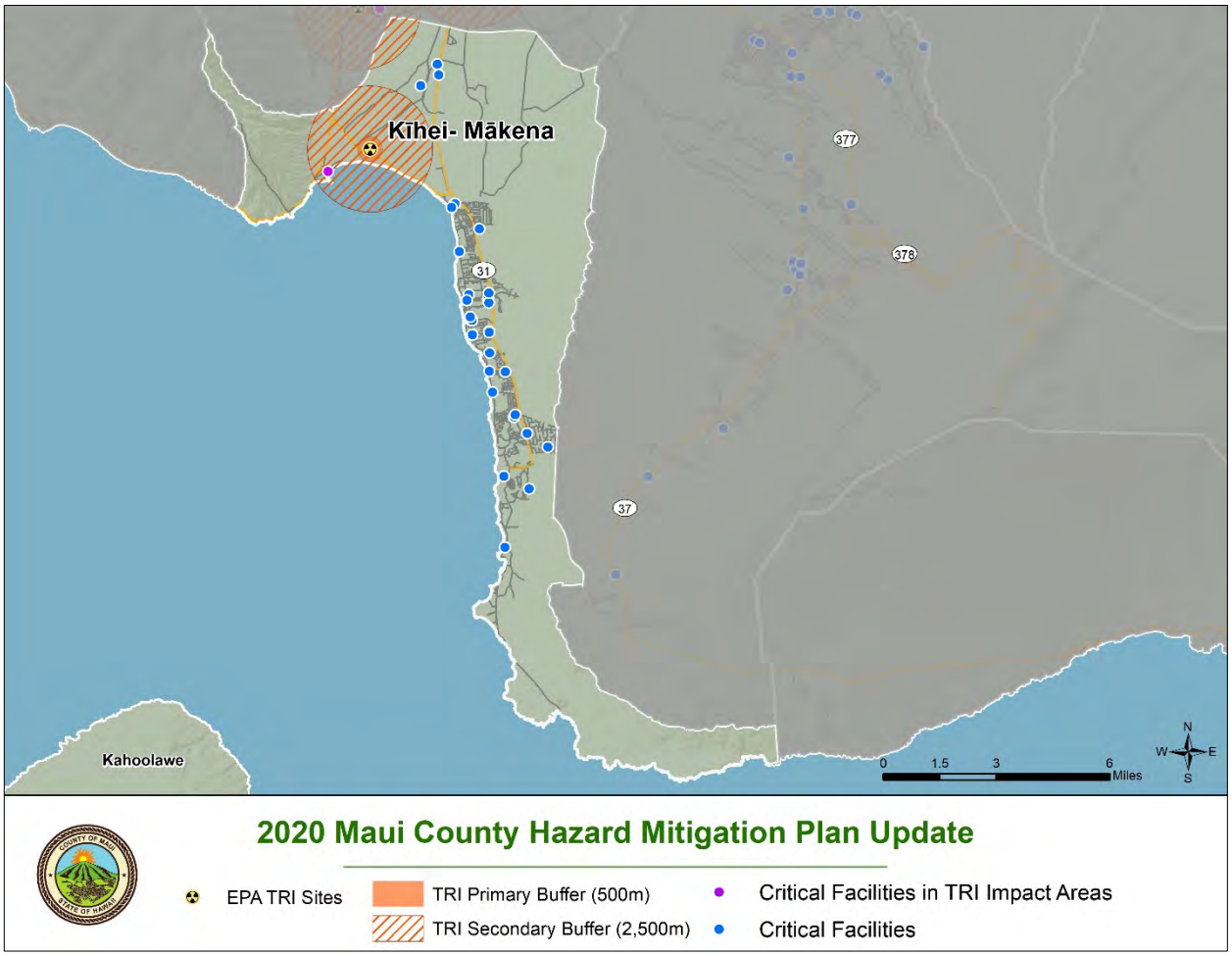

Figure 264. Critical Facilities in Fixed-Site Impact Areas in the Kīhei-Mākena Community Planning Area.

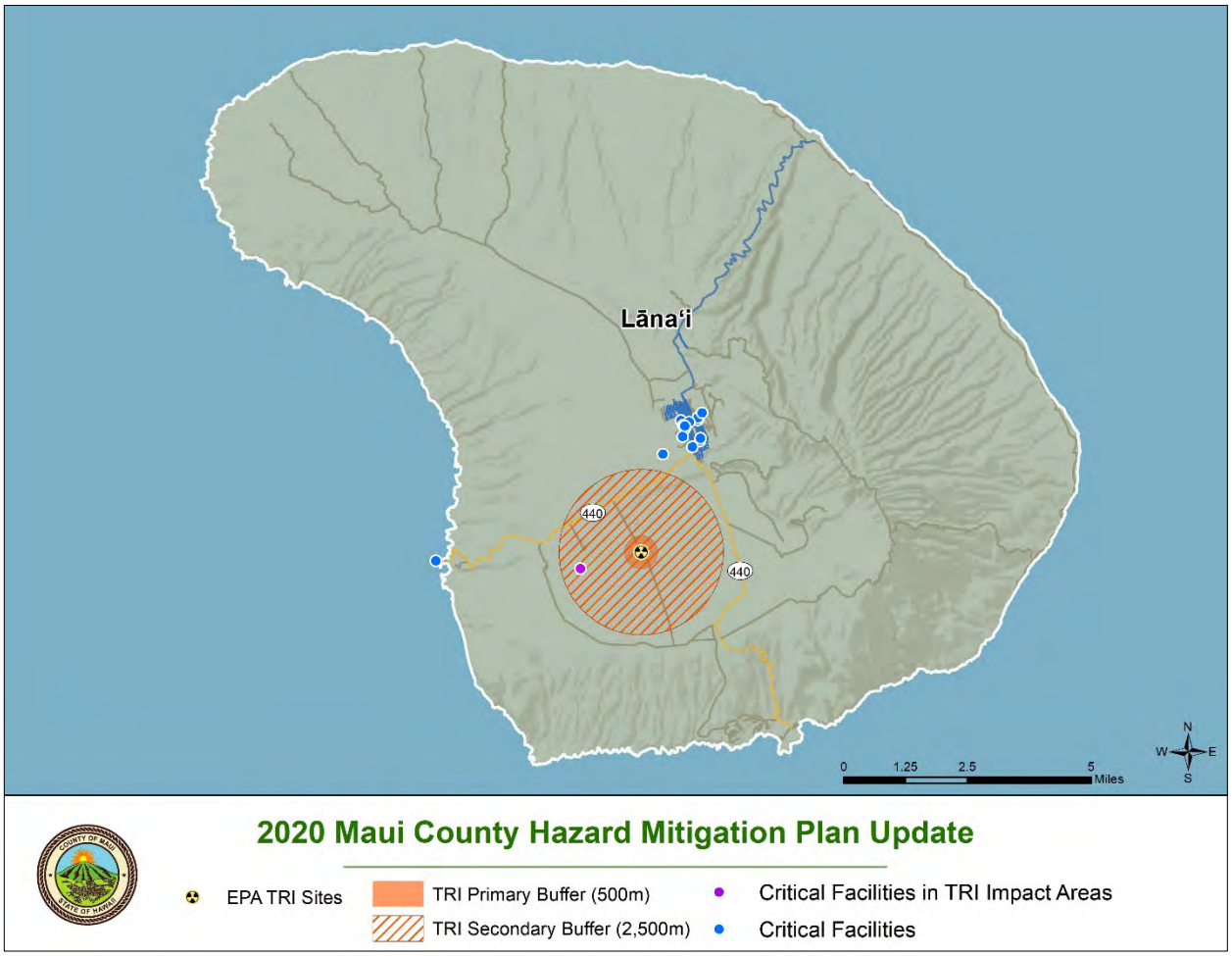

Figure 265. Critical Facilities in Fixed-Site Impact Areas in the Lānaʻi Community Planning Area.

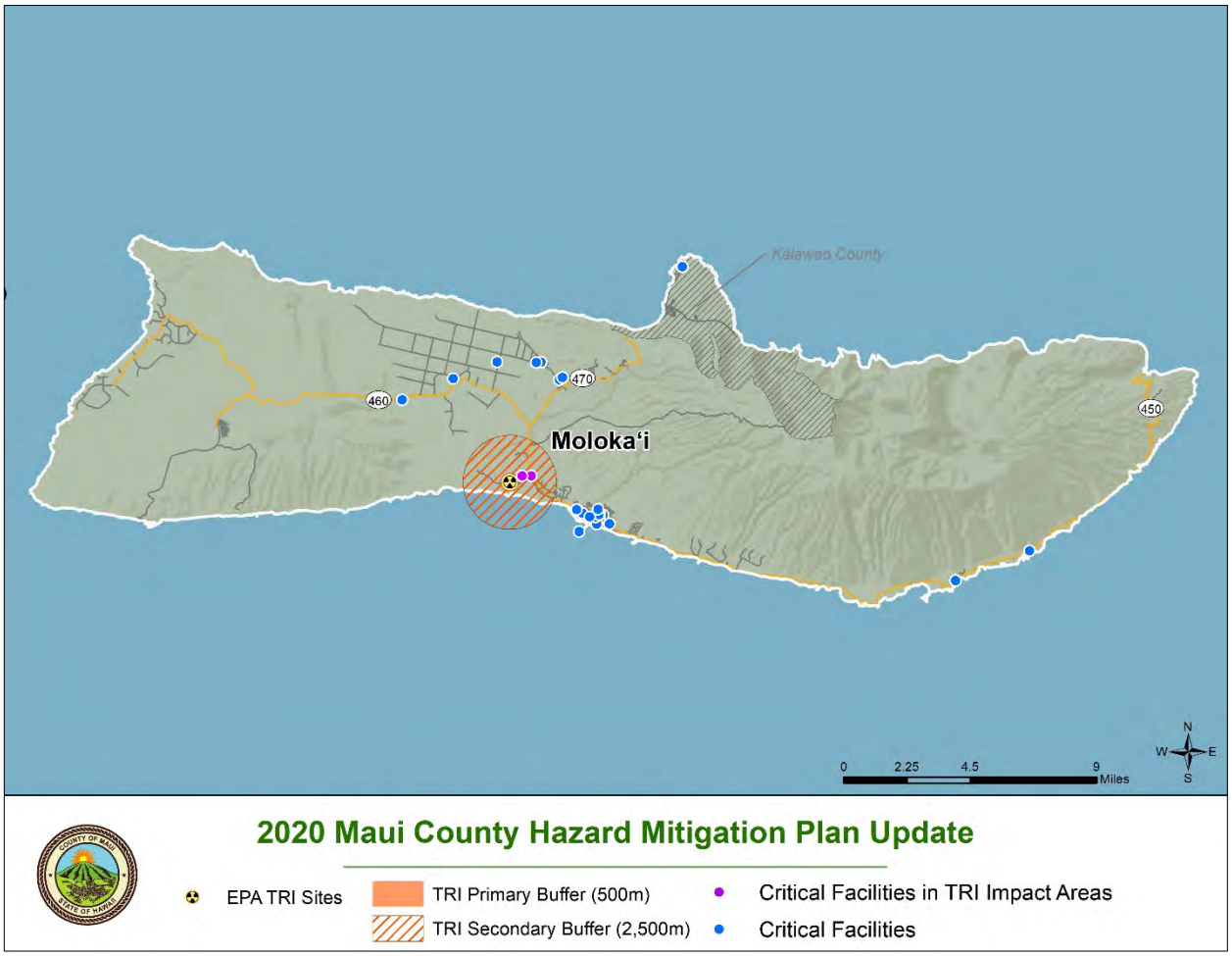

Figure 266. Critical Facilities in Fixed-Site Impact Areas in the Moloka'i Community Planning Area.

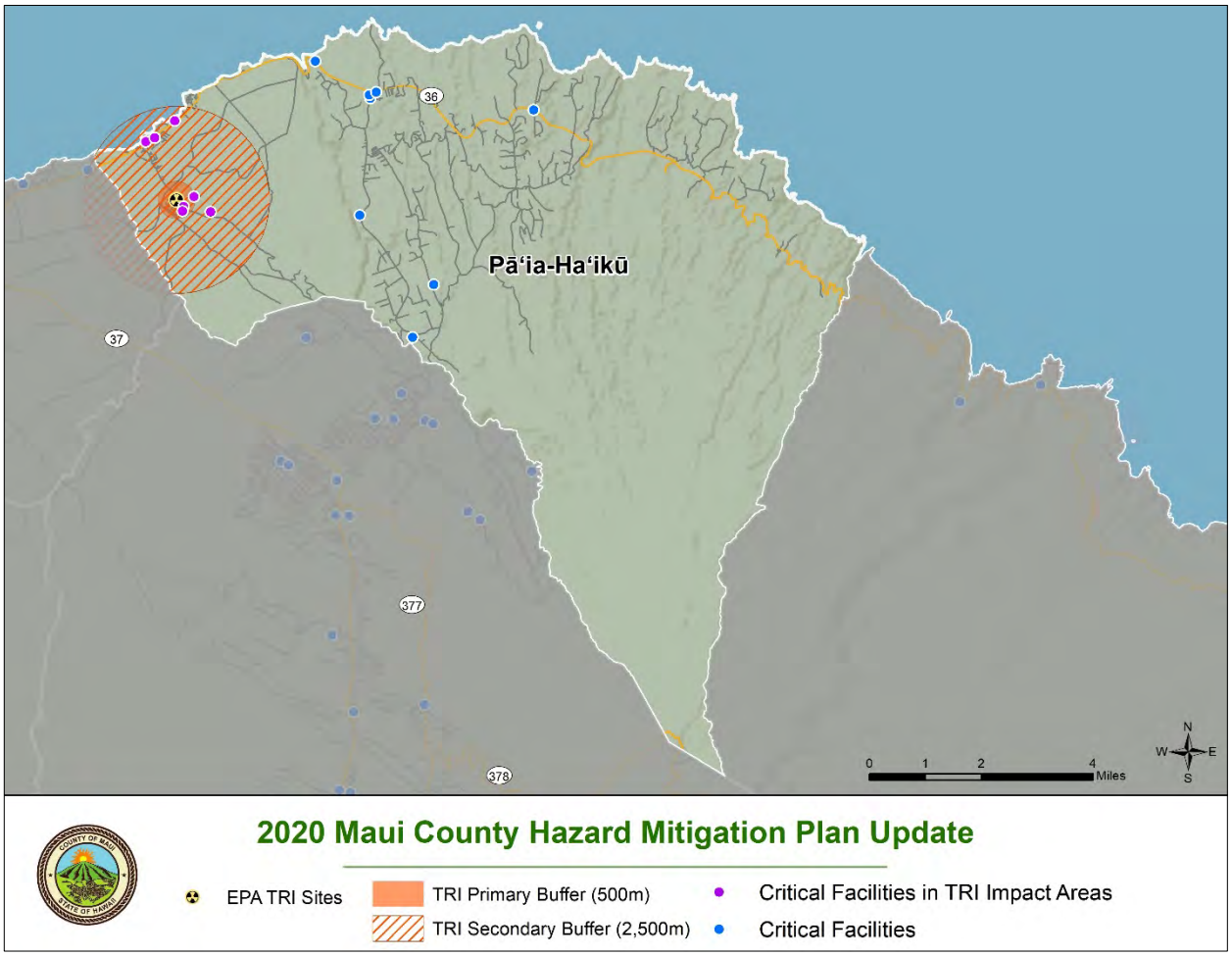

Figure 267. Critical Facilities in Fixed-Site Impact Areas in the Pāʻia-Haʻikū Community Planning Area.

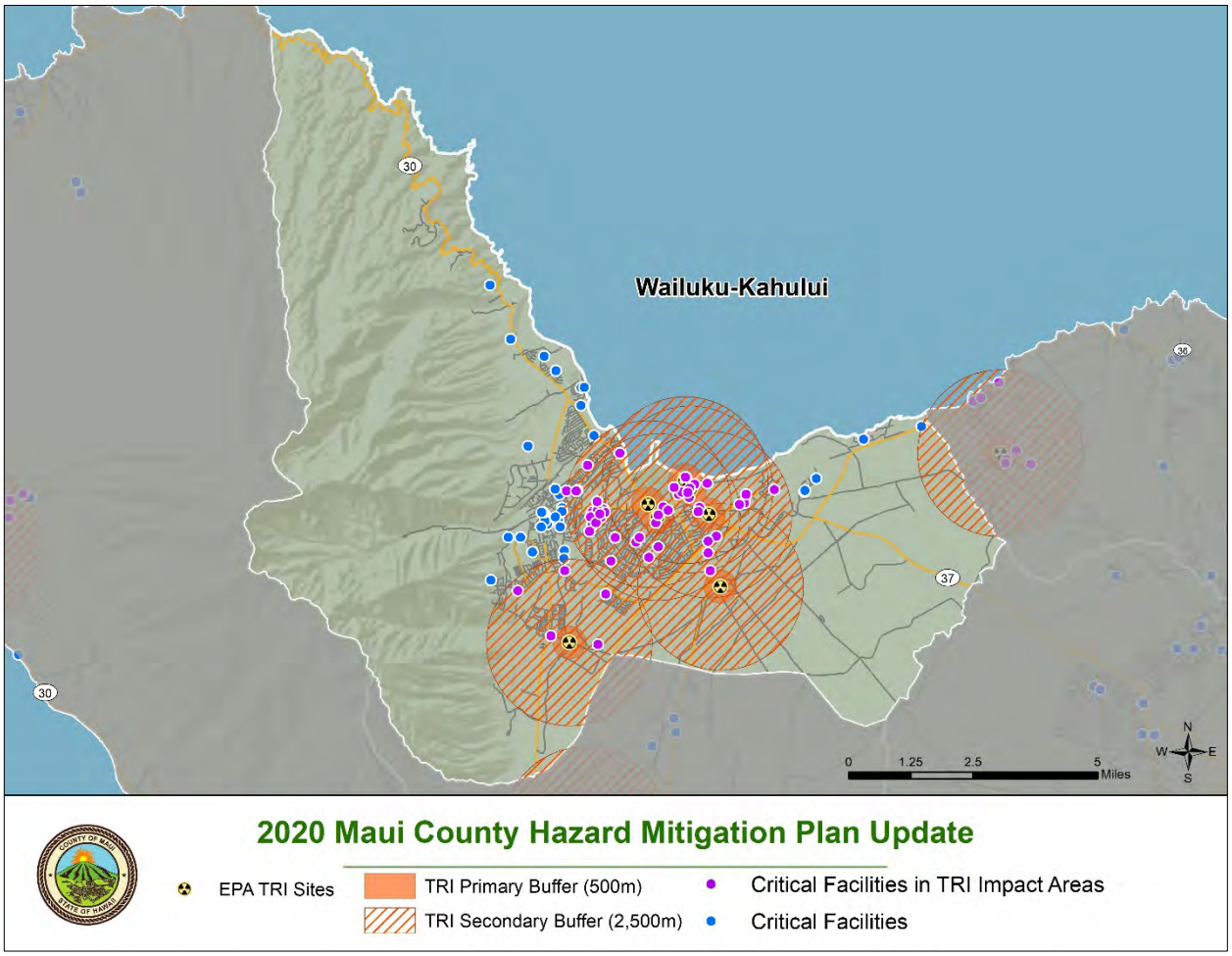

Figure 268. Critical Facilities in Fixed-Site Impact Areas the Wailuku-Kahului Community Planning Area.

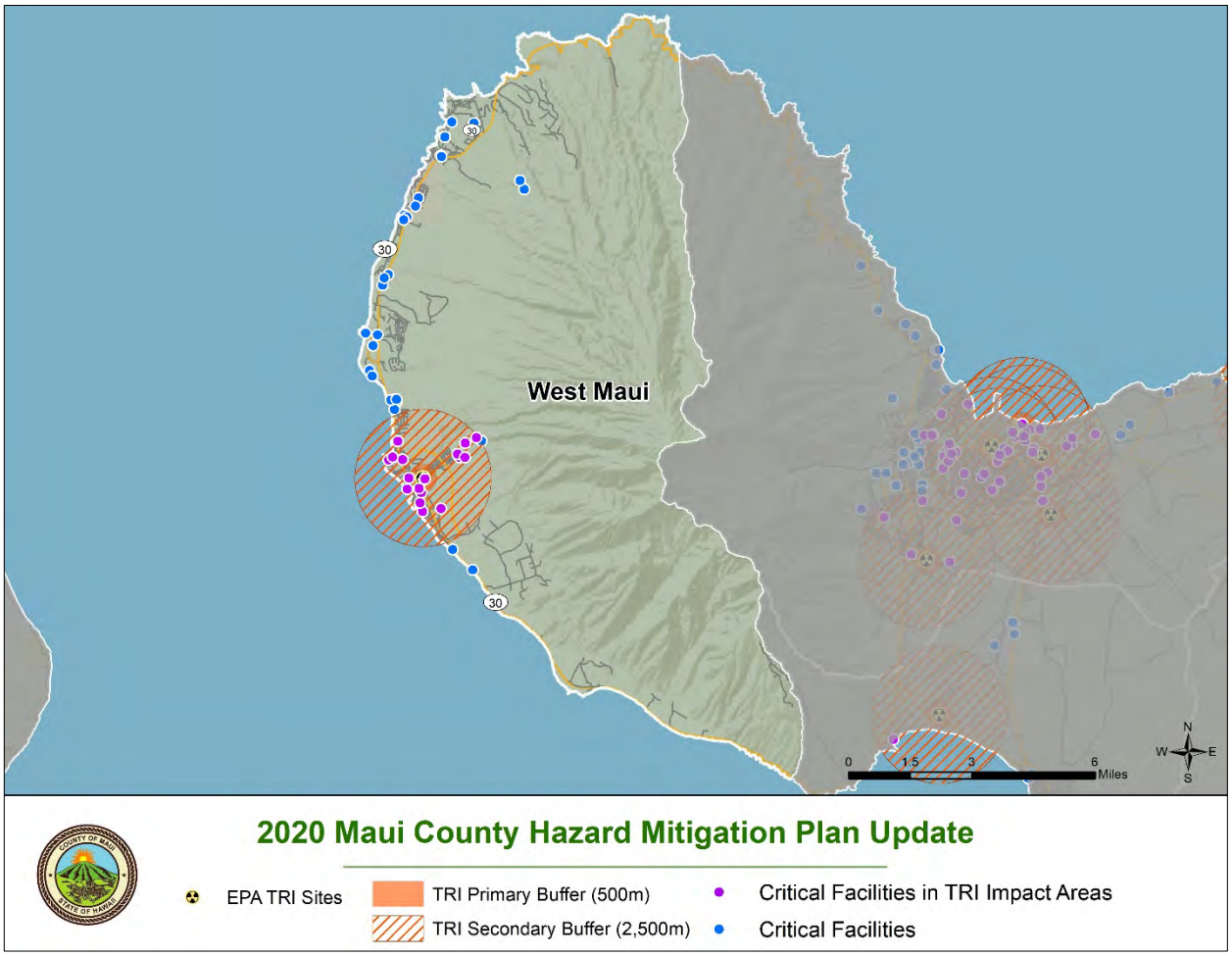

Figure 269. Critical Facilities in Fixed-Site Impact Areas in the West Maui Community Planning Area.

Mobile (Transportation) Analysis

For the mobile analysis, major transportation routes (state highways, county arterial roadways) where hazardous materials are primarily transported that could adversely impact people and buildings, were used for the GIS buffer analysis. The table below presents the number of buildings within mobile HAZMAT impacts areas for each community planning area.

Table 75. Exposure of Parcels, Buildings, and Improved Value to HAZMAT Mobile-Sites.

Mobile Impact Areas	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
Hāna								
500m	1,520	73%	1,360	69%	$166,393,697	$83,196,847	$249,590,544	76%

Mobile Impact Areas	Number of At-Risk Parcels	%	Number of At-Risk Buildings	%	Building Value	Content Value	Total Value of At-Risk Buildings	%
2,500m	2061	99%	1,941	99%	$218,270,863	$109,135,423	$327,406,286	100%
Kīhei-Mākena								
500m	10,501	58%	5,123	59%	$4,587,131,366	$2,293,565,676	$6,880,697,042	41%
2,500m	17,722	97%	8,507	98%	$10,765,439,234	$5,382,719,616	$16,148,158,850	95%
Lānaʻi								
500m	755	51%	880	49%	$330,828,998	$165,414,500	$496,243,498	48%
2,500m	1,432	98%	1,803	100%	$695,187,996	$347,594,010	$1,042,782,006	100%
Makawao-Pukalani-Kula								
500m	3,246	34%	4,233	33%	$926,576,332	$463,288,189	$1,389,864,521	33%
2,500m	8,630	89%	11,622	90%	$2,573,928,837	$1,286,964,459	$3,860,893,296	92%
Molokaʻi								
500m	4,224	69%	1,562	62%	$519,029,800	$259,514,900	$778,544,700	64%
2,500m	5,775	94%	2,392	95%	$785,844,100	$392,922,050	$1,178,766,150	97%
Pāʻia-Haʻikū								
500m	1,936	37%	2,057	28%	$429,251,164	$214,625,584	$643,876,748	32%
2,500m	4,293	82%	5,601	76%	$1,042,200,192	$521,100,087	$1,563,300,279	77%
Wailuku-Kahului								
500m	11,674	65%	10,513	62%	$4,066,415,795	$2,033,207,888	$6,099,623,683	70%
2,500m	17,924	100%	16,944	100%	$5,830,260,754	$2,915,130,356	$8,745,391,110	100%
West Maui								
500m	14,758	81%	4,866	76%	$10,120,287,116	$5,060,143,574	$15,180,430,690	79%
2,500m	17,981	99%	6,407	99%	$12,863,694,865	$6,431,847,456	$19,295,542,321	100%
MAUI COUNTY TOTALS								
2,500m	**75,818**	**96%**	**55,217**	**94%**	**$434,774,826,841**	**$417,387,413,421**	**$452,162,240,262**	**97%**

A significant number of buildings and parcels in all Maui County community planning areas are at risk to mobile HAZMAT incidents due to their proximity to major roadways. Within primary impact areas, the Pāʻia-Haʻikū community planning area has the lowest proportion of buildings at-risk, at 28% of buildings at risk. Conversely, at 76%, West Maui has the highest proportion of buildings within primary impact areas. All community planning areas have at least three-quarters of their buildings located within secondary impact areas. It should be noted that many of Maui Island's major transportation routes, such as Hāna Highway, Honoapiilani Highway, Kahekili Highway, Kuihelani Highway, and Mokulele Highway, converge in Wailuku-Kahului, as the island's main airport and harbor are located in Kahului. The figures below show buildings within these impact areas for each community planning area.

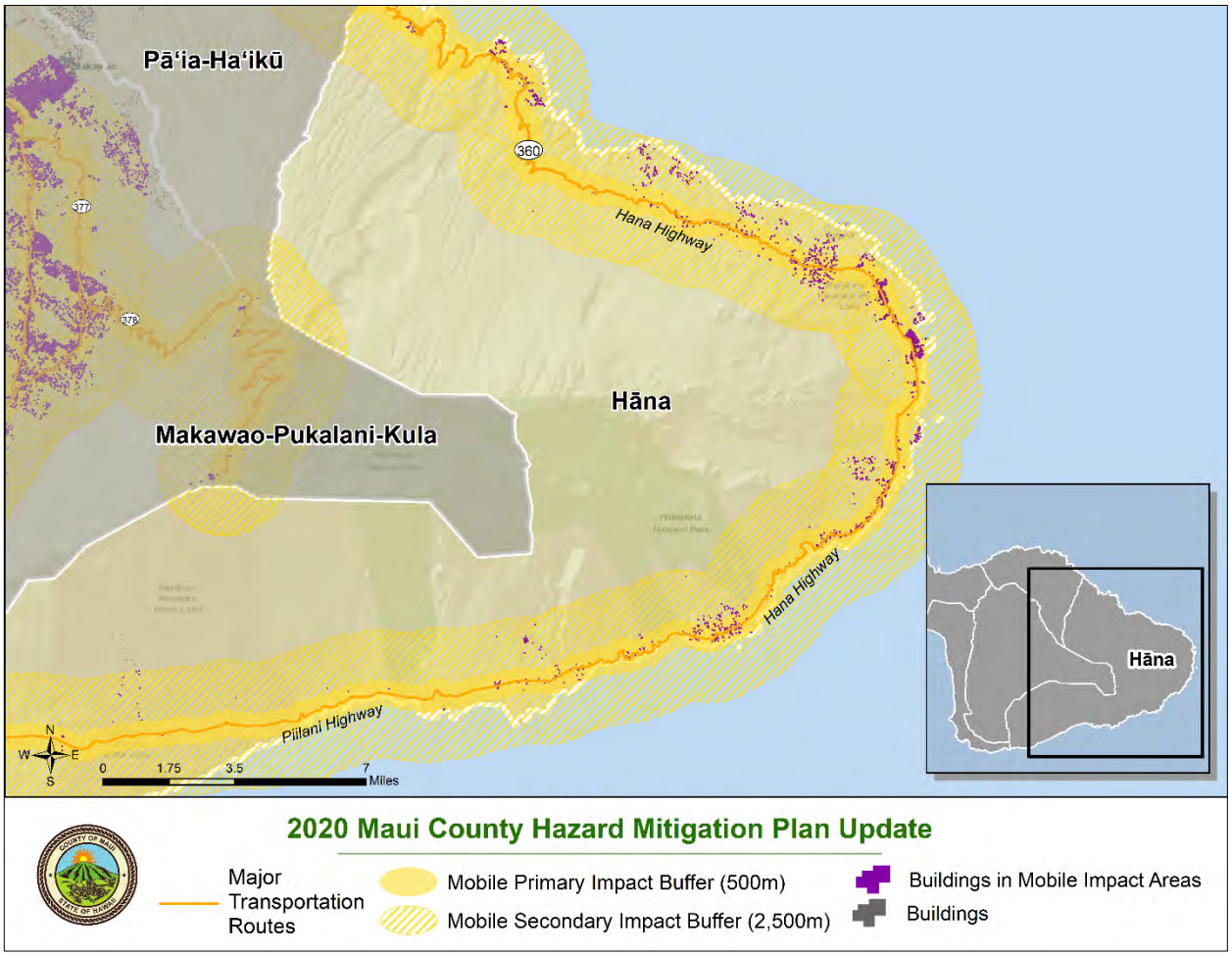

Figure 270. Buildings in Mobile HAZMAT Impact Areas in the Hāna Community Planning Area.

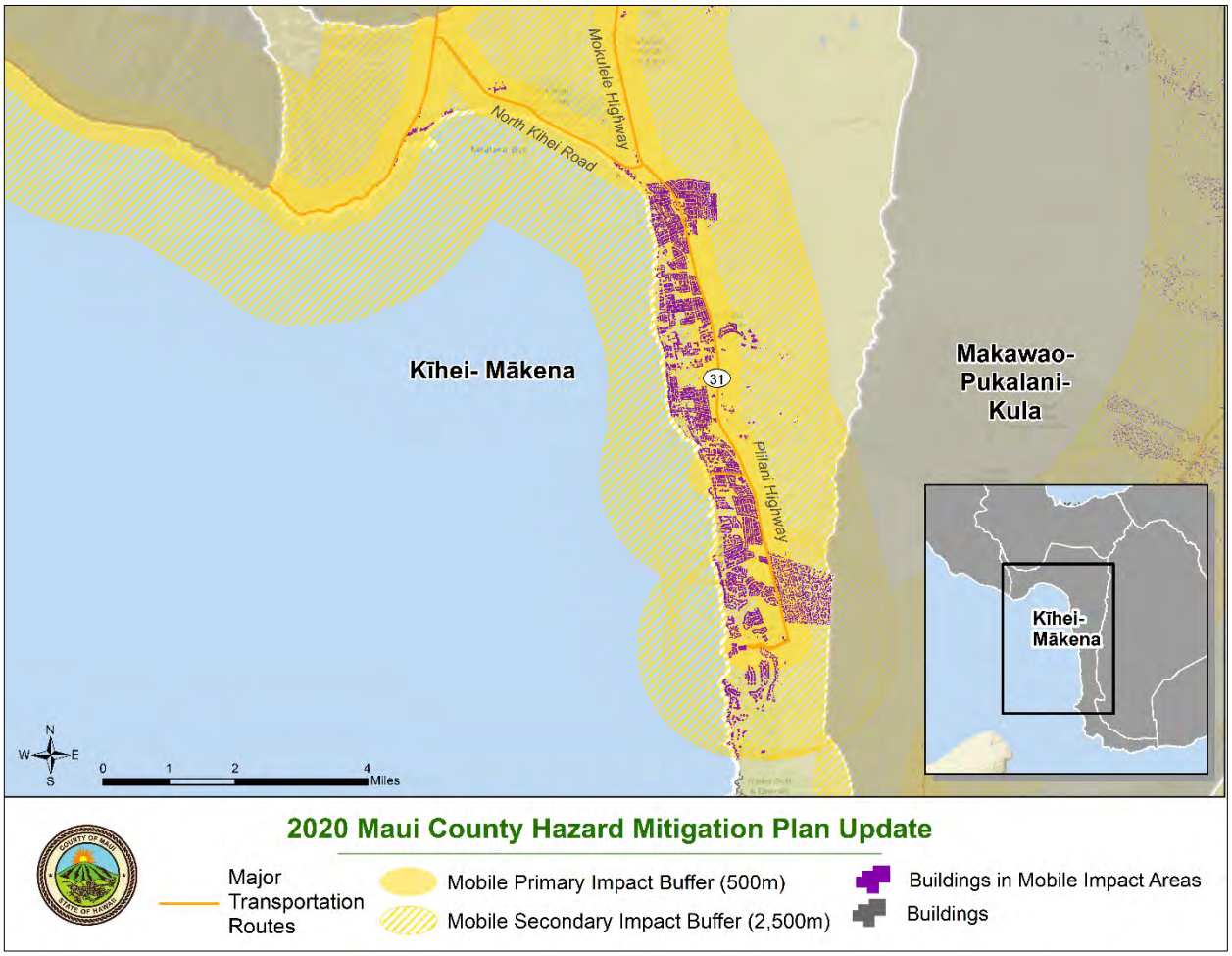

Figure 271. Buildings in Mobile HAZMAT Impact Areas in the Kīhei-Mākena Community Planning Area.

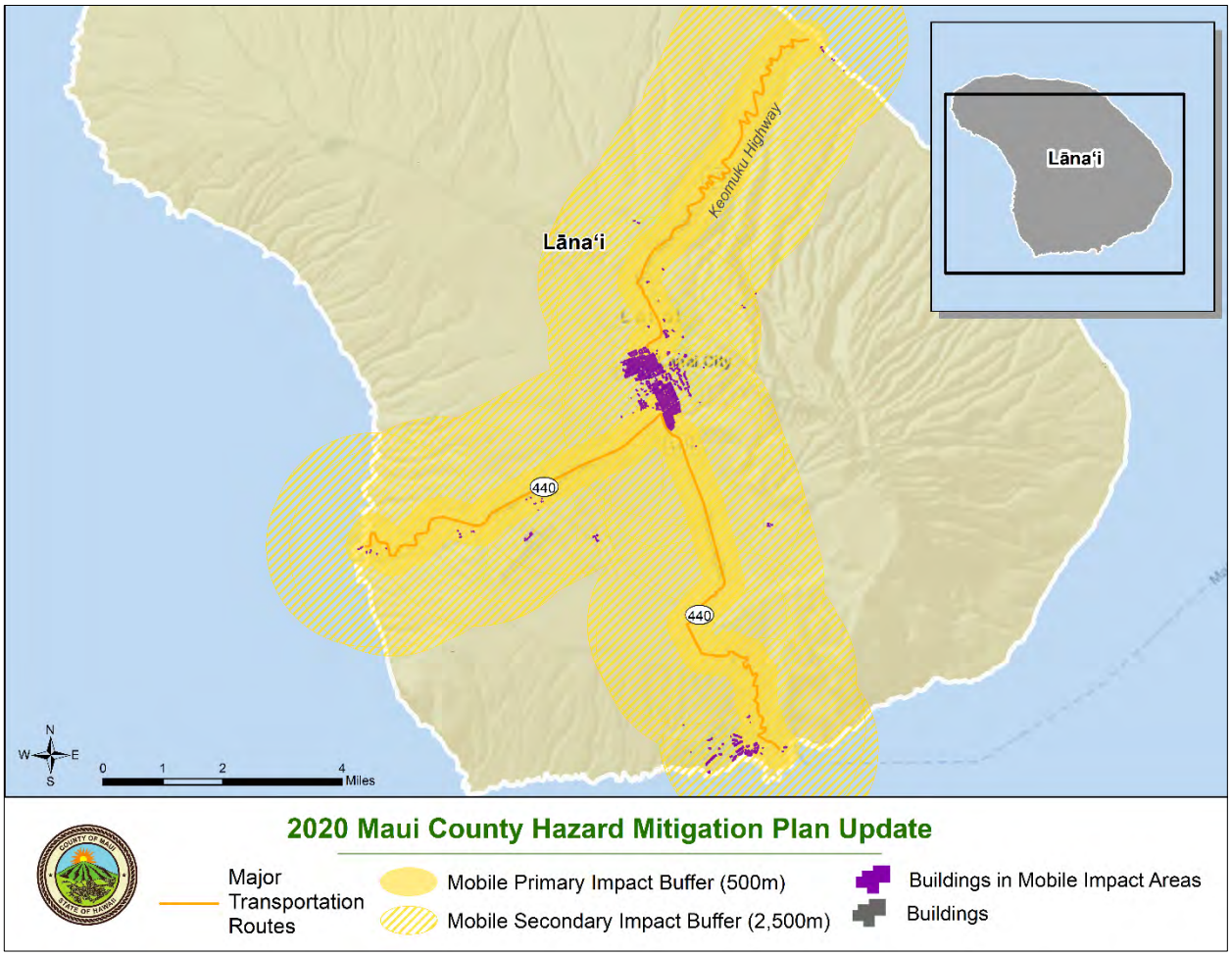

Figure 272. Buildings in Mobile HAZMAT Impact Areas in the Lānaʻi Community Planning Area.

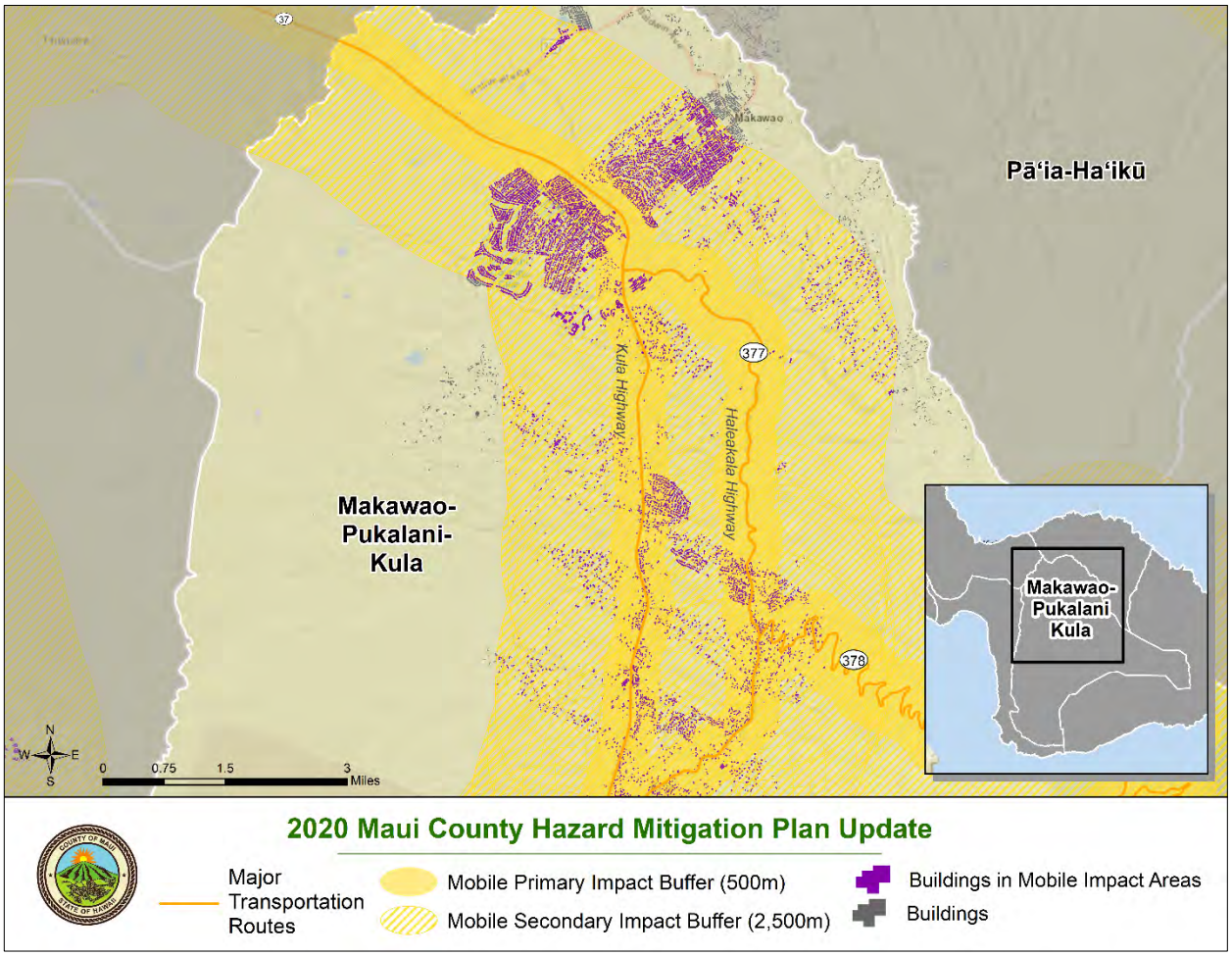

Figure 273. Buildings in Mobile HAZMAT Impact Areas in the Northern Makawao-Pukalani-Kula Community Planning Area.

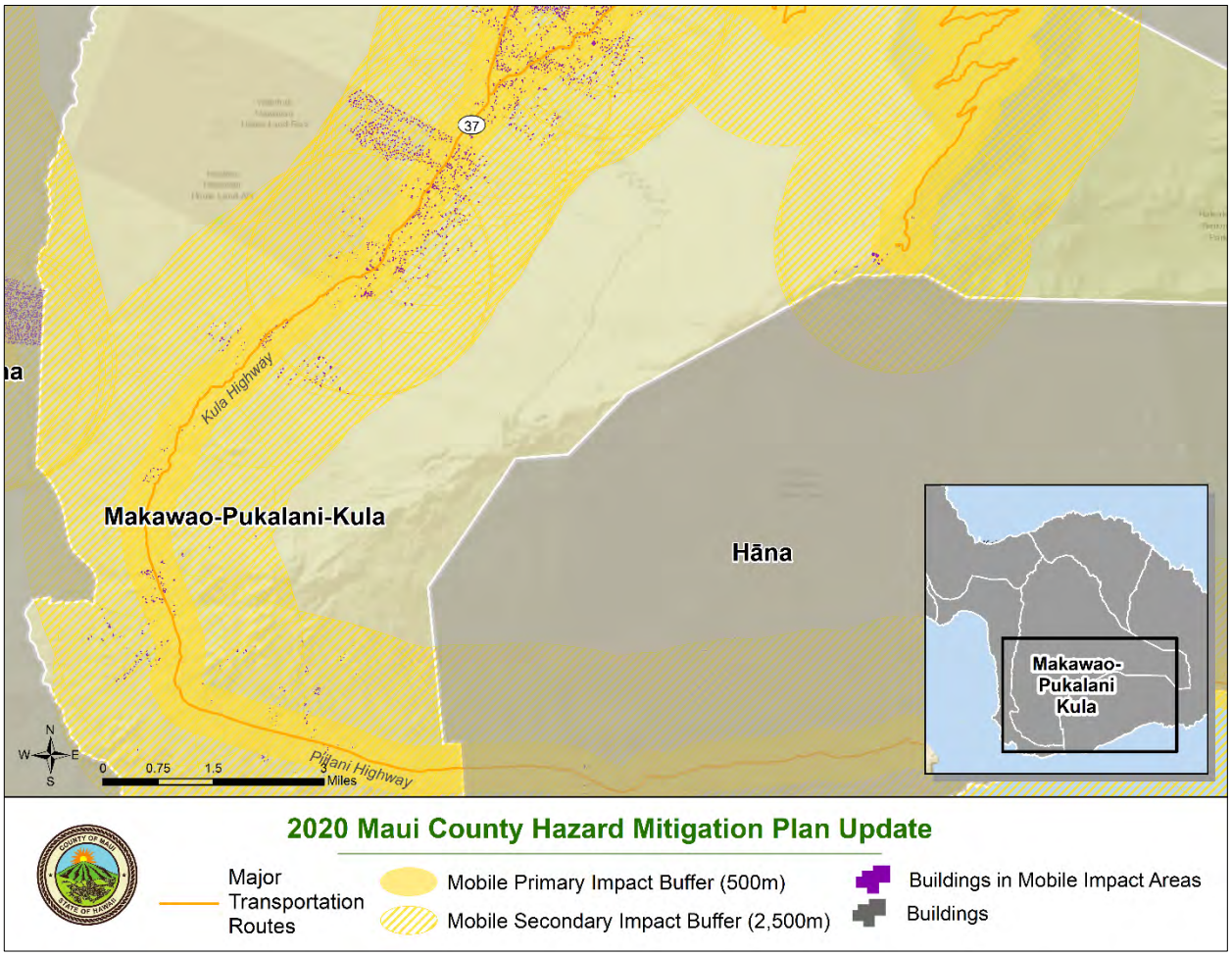

Figure 274. Buildings in Mobile HAZMAT Impact Areas in the Southern Makawao-Pukalani-Kula Community Planning Area.

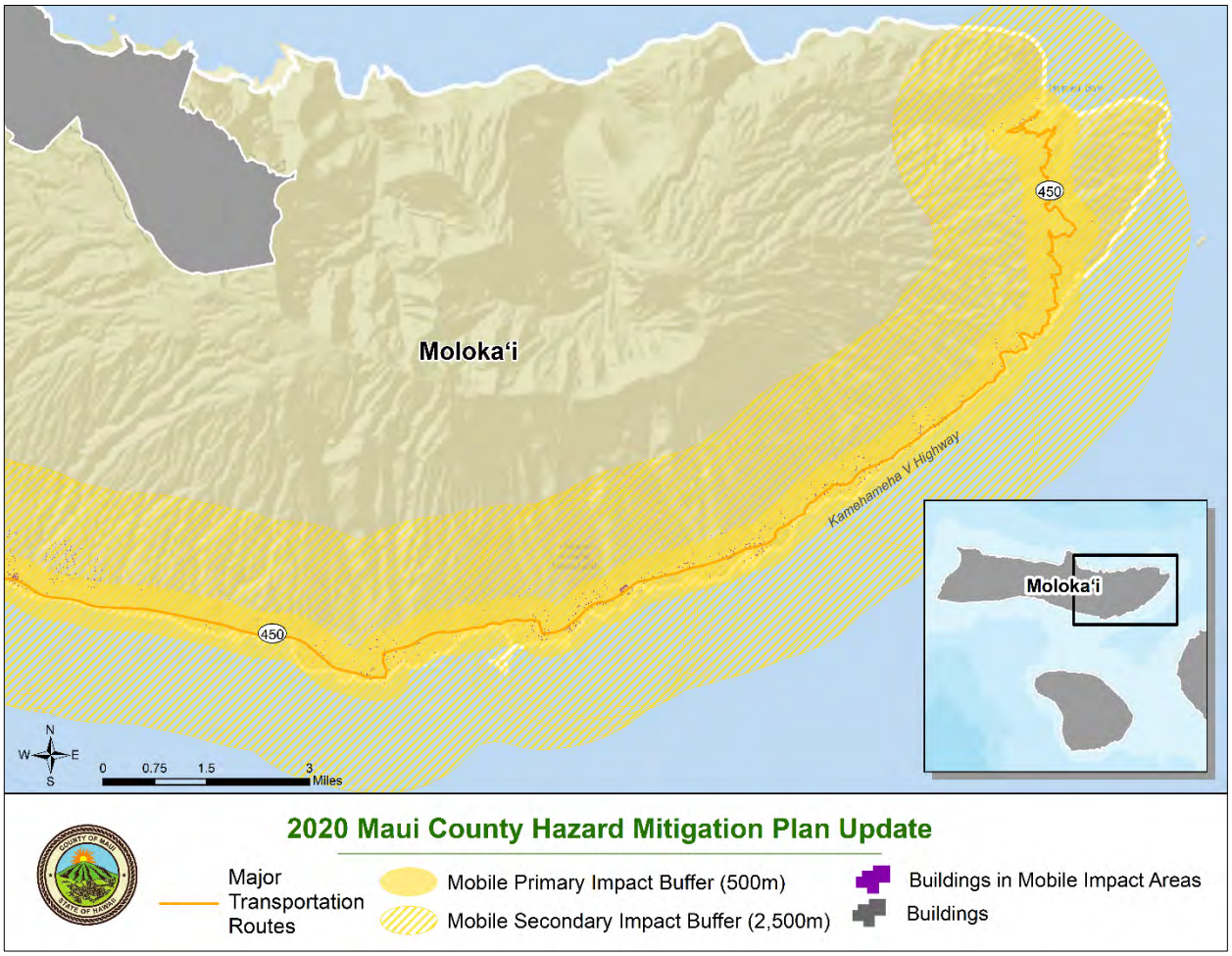

Figure 275. Buildings in Mobile HAZMAT Impact Areas in the Eastern Moloka‘i Community Planning Area.

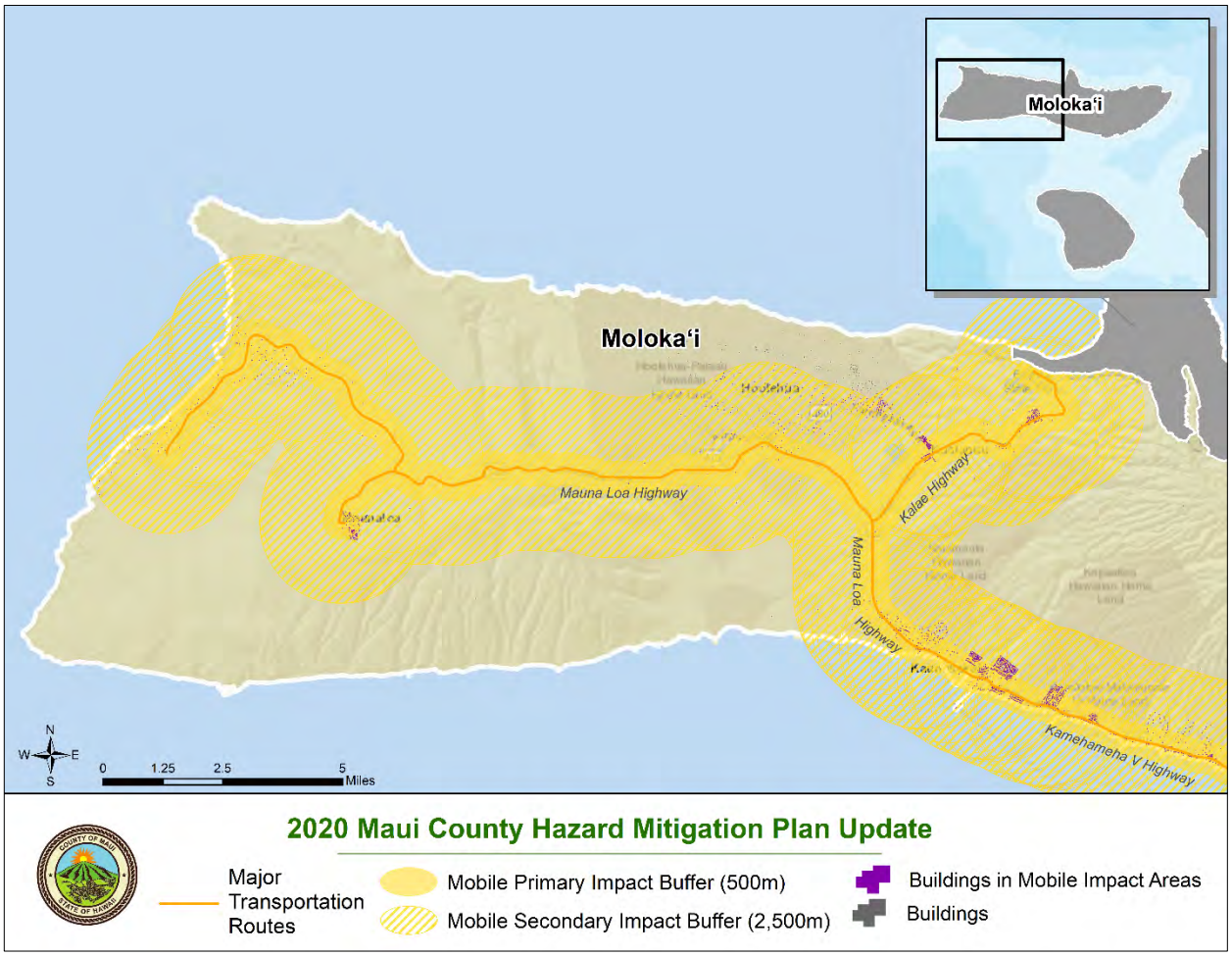

Figure 276. Buildings in Mobile HAZMAT Impact Areas in the Western Moloka'i Community Planning Area.

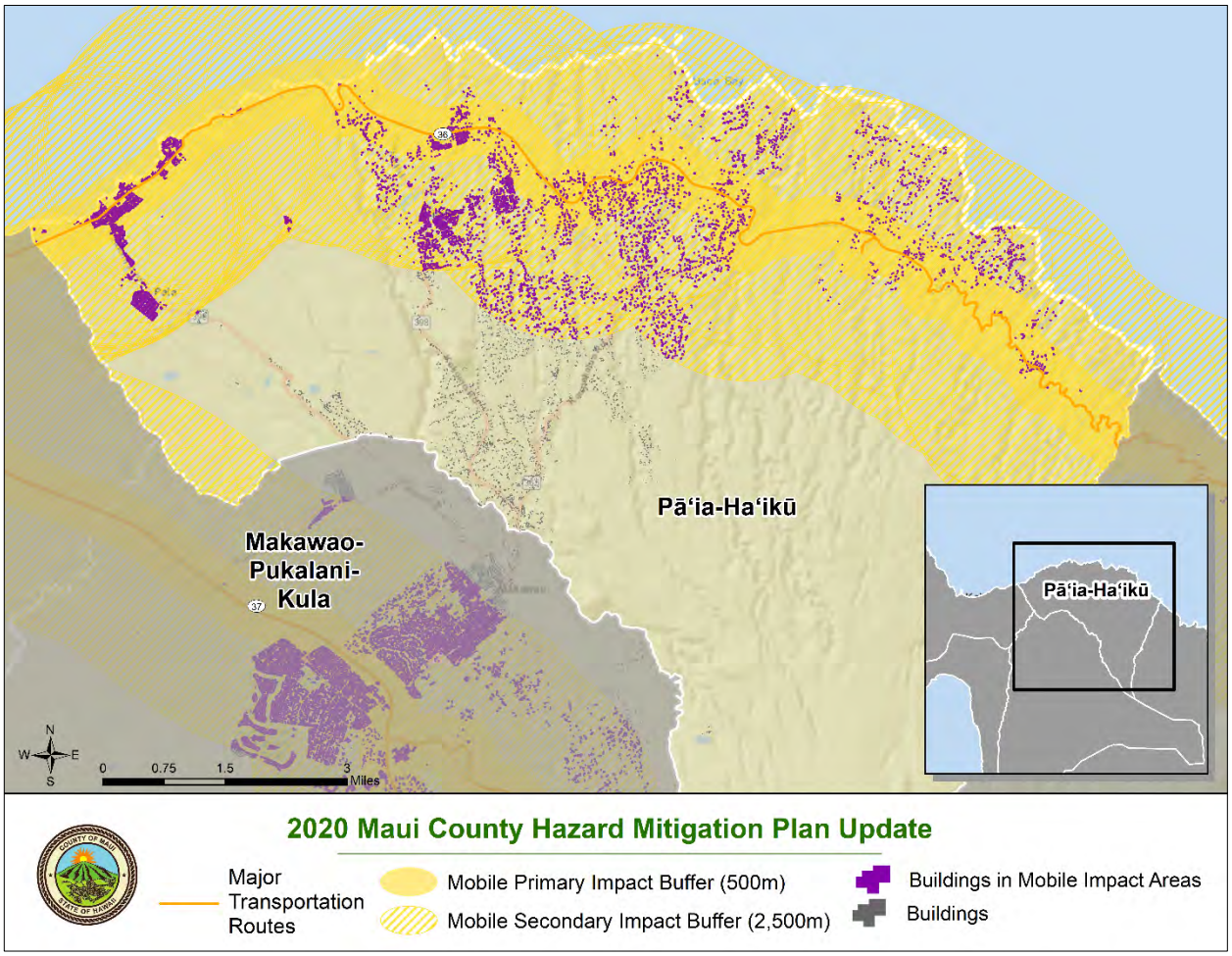

Figure 277. Buildings in Mobile HAZMAT Impact Areas in the Pāʻia-Haʻikū Community Planning Area.

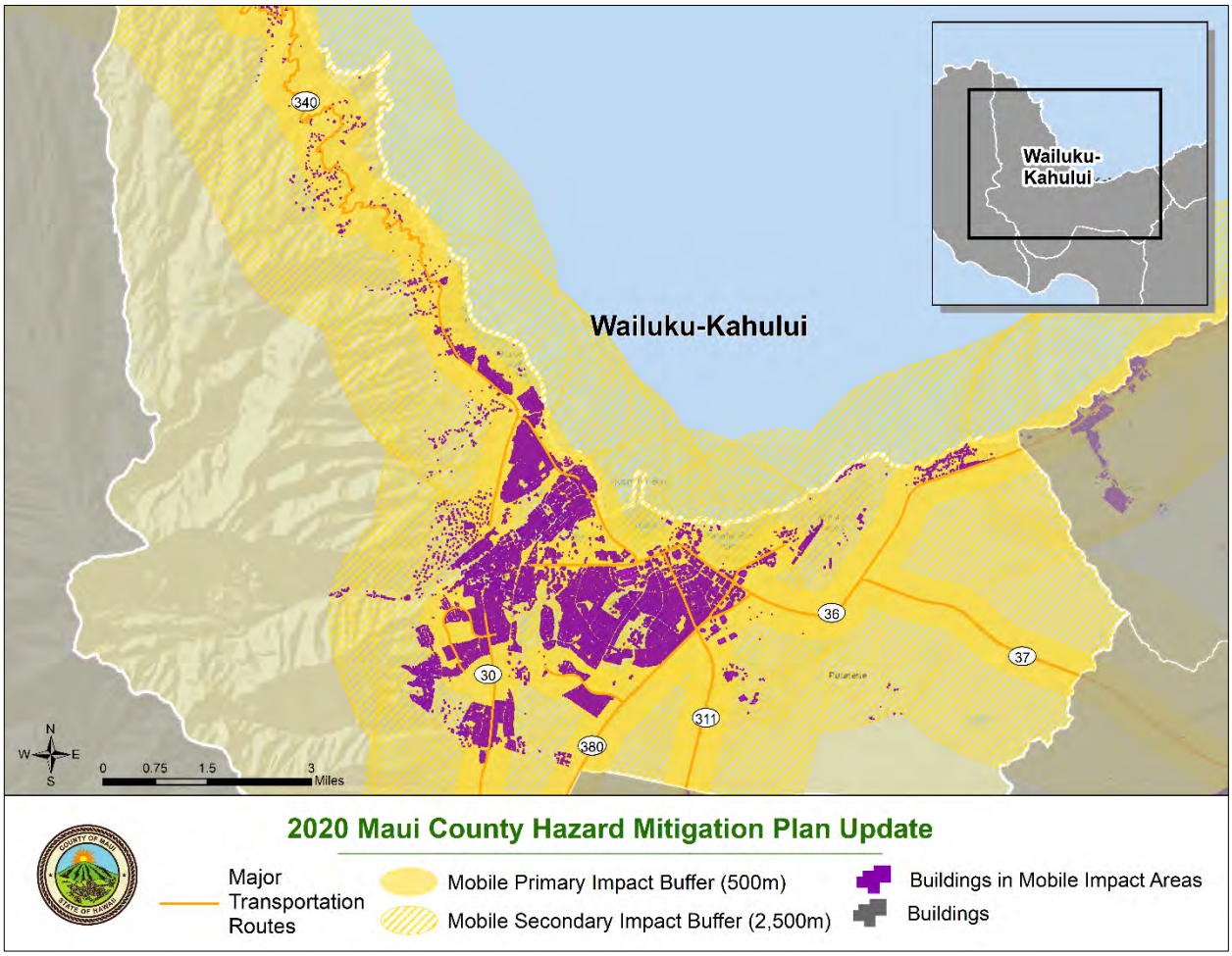

Figure 278. Buildings in Mobile HAZMAT Impact Areas in the Wailuku-Kahului Community Planning Area.

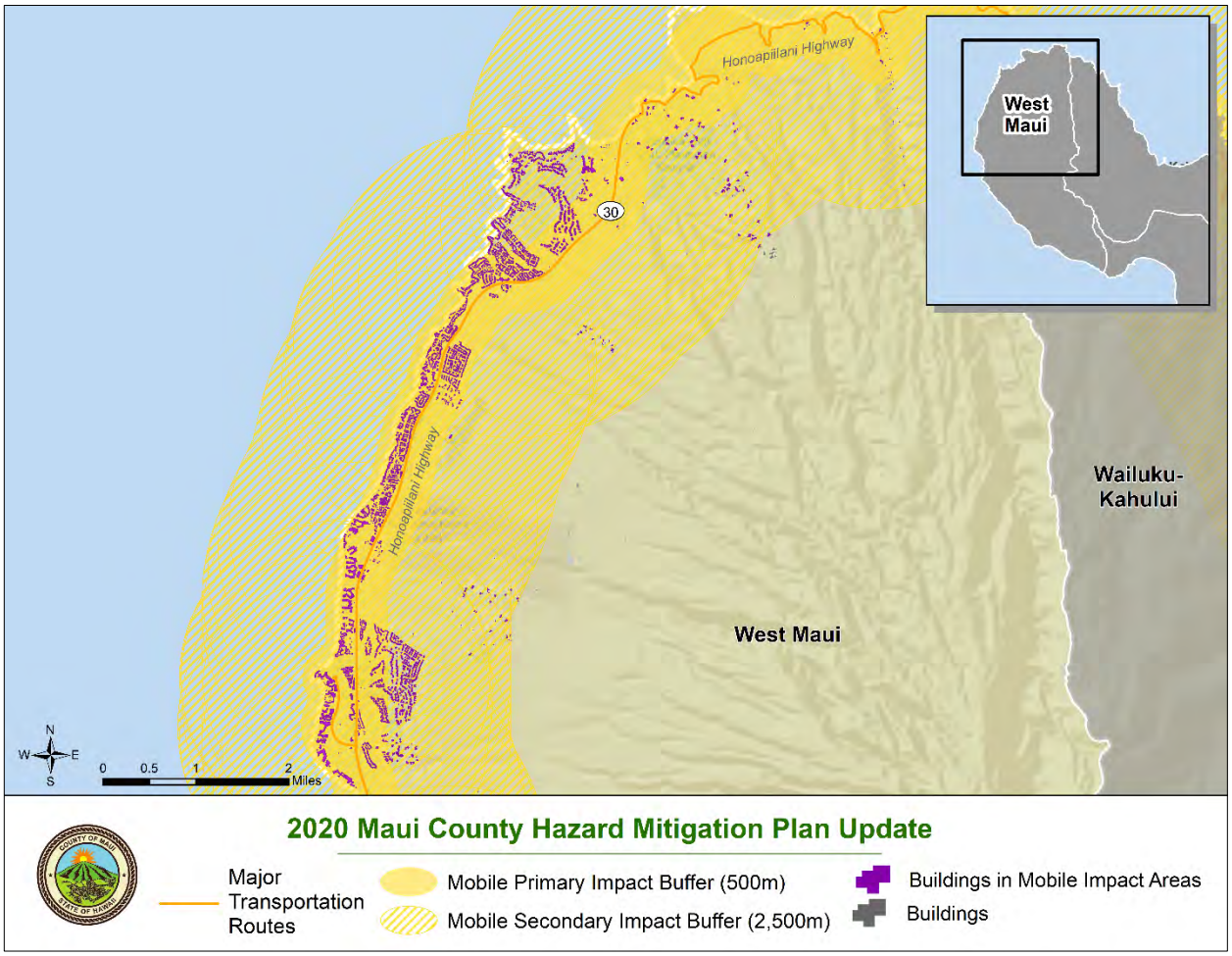

Figure 279. Buildings in Mobile HAZMAT Impact Areas in the Northern West Maui Community Planning Area.

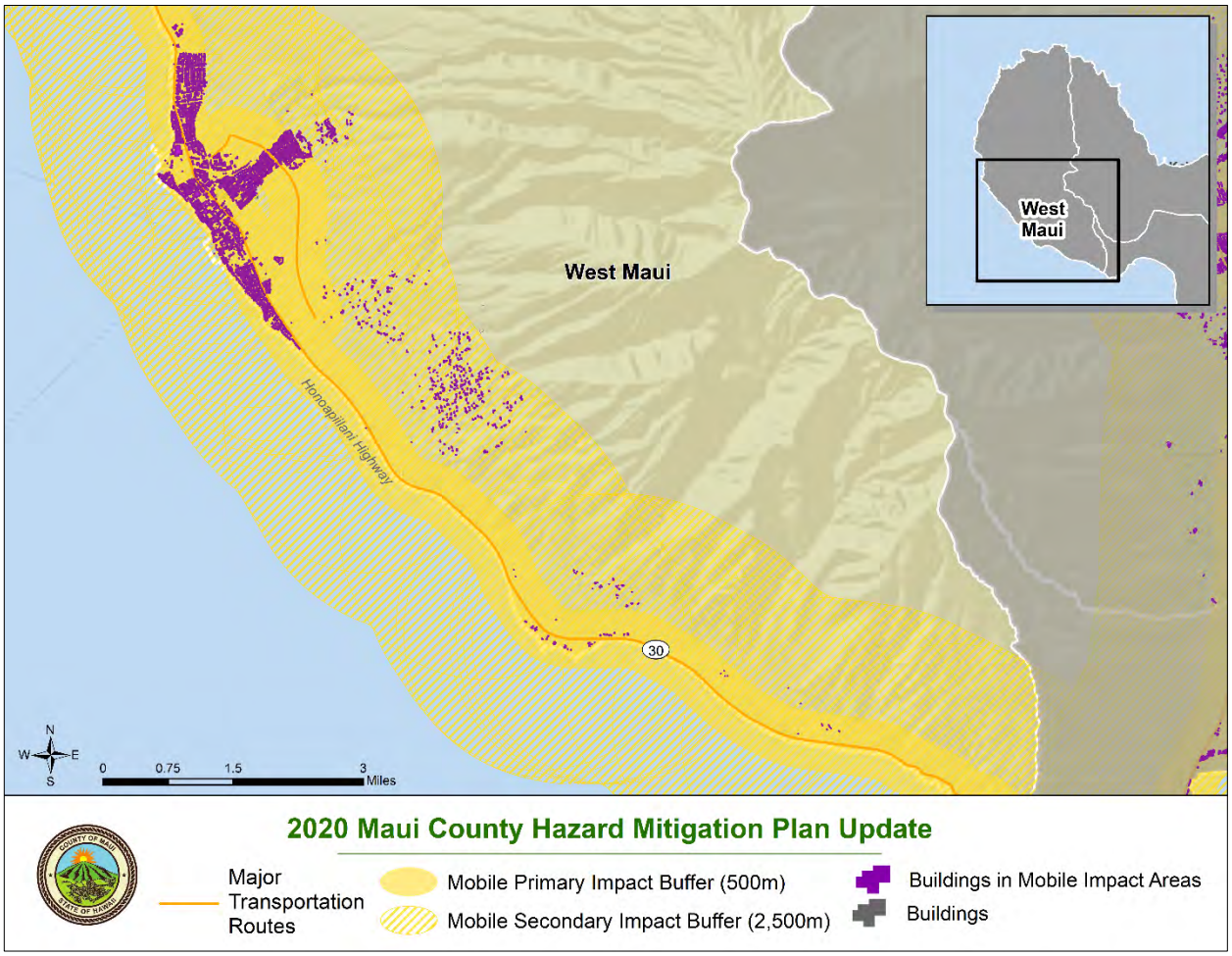

Figure 280. Buildings in Mobile HAZMAT Impact Areas in the Southern West Maui Community Planning Area.

GIS analysis was used to determine number of critical facilities within mobile hazardous materials impact areas. The table below presents the number of critical facilities within these impact areas for each community planning area. Due to the proximity of many critical facilities to major transportation routes, the majority of Maui County's critical facilities are within mobile hazardous materials impact areas. Overall, there are 282 potentially at-risk critical facilities within Maui County mobile hazardous materials impacts areas.

Table 76. Potentially At-Risk Critical Facilities in Mobile Hazardous Materials Impacts Areas.

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Commercial Facilities	N/A	N/A	N/A	N/A	N/A	N/A	2	N/A	**2 (100%)**

Category	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	TOTAL
Communications Facilities	1	2	1	2	1	N/A	1	N/A	**8 (0%)**
Emergency Services	3	5	3	3	6	2	9	5	**36 (97%)**
Energy	2	N/A	N/A	N/A	1	N/A	2	N/A	**5 (100%)**
Food and Agriculture	1	1	N/A	N/A	N/A	N/A	1	N/A	**3 (100%)**
Government Facilities	N/A	N/A	N/A	N/A	2	N/A	12	N/A	**14 (100%)**
Healthcare and Public Health	1	3	4	3	3	1	26	6	**47 (98%)**
Mass care	3	9	5	10	12	5	18	10	**72 (96%)**
Transportation	1	N/A	3	N/A	3	N/A	15	4	**26 (96%)**
Water and Wastewater Systems	2	12	N/A	4	3	3	20	25	**69 (90%)**
TOTAL	**14 (100%)**	**32 (97%)**	**16 (100%)**	**22 (81%)**	**31 (97%)**	**11 (69%)**	**106 (100%)**	**50 (96%)**	**282 (95%)**

The figures below show critical facilities in Maui County fixed-site hazardous materials impacts areas by community planning area.

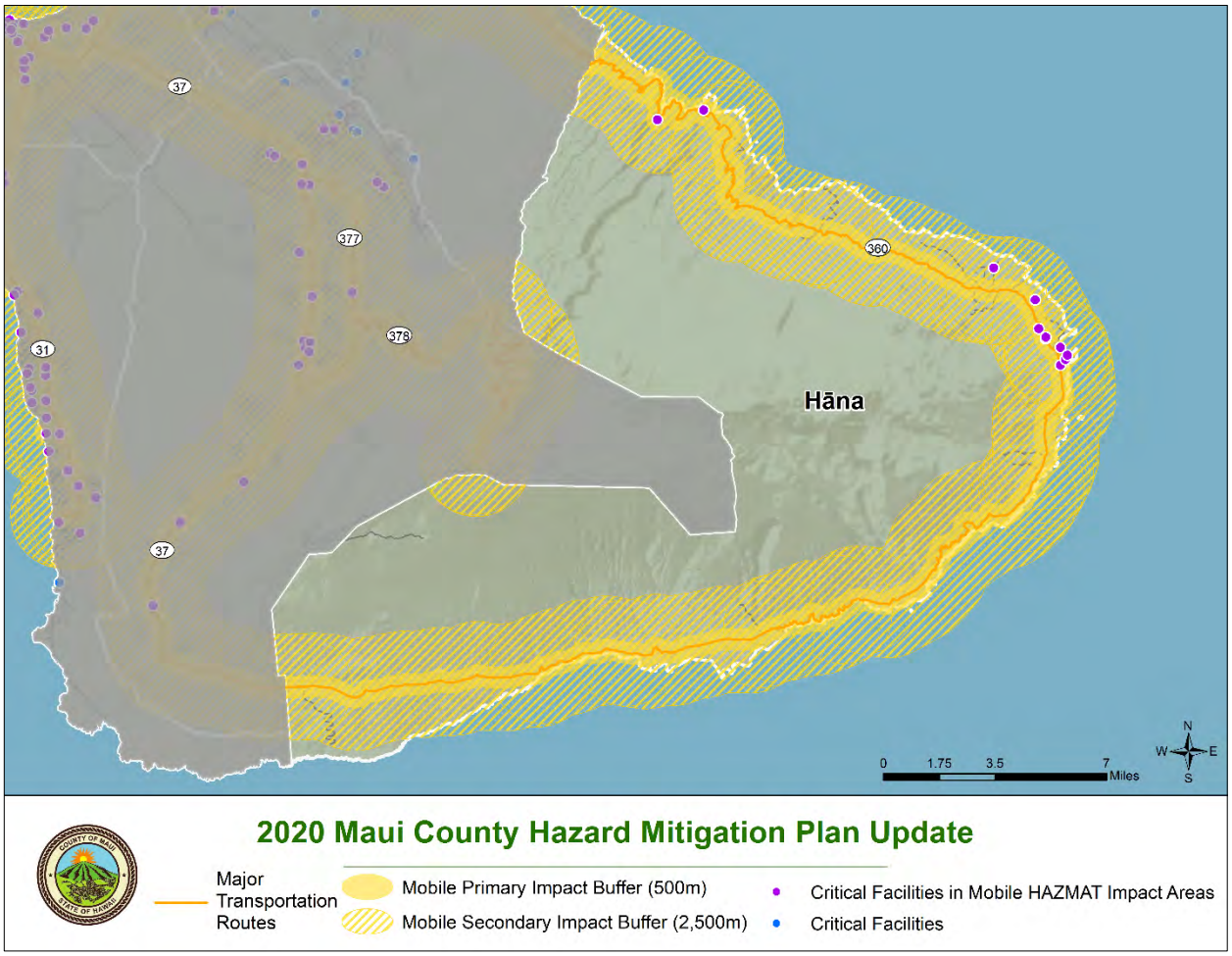

Figure 281. Critical Facilities in Mobile HAZMAT Impact Areas in the Hāna Community Planning Area.

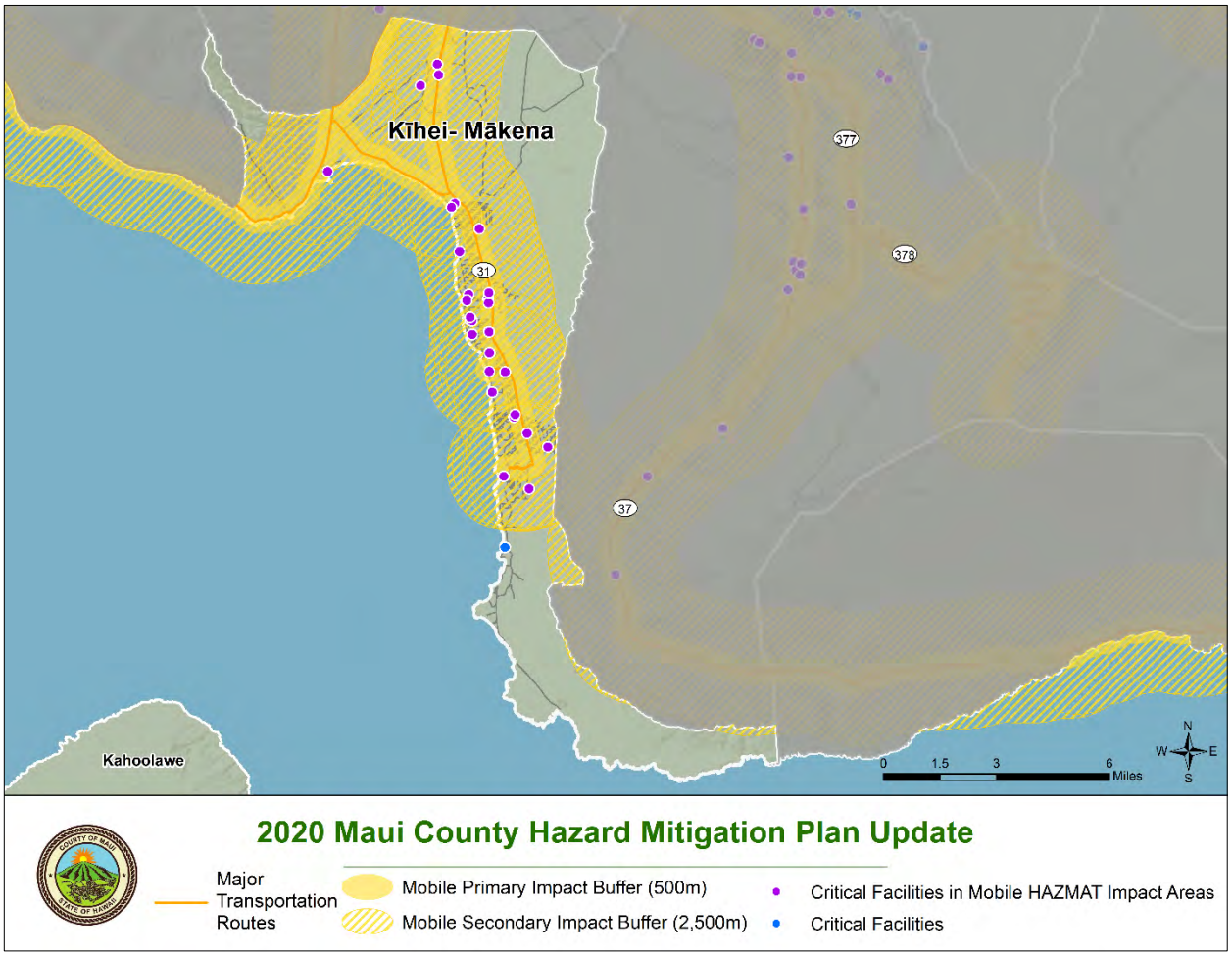

Figure 282. Critical Facilities in Mobile HAZMAT Impact Areas in the Kīhei-Mākena Community Planning Area.

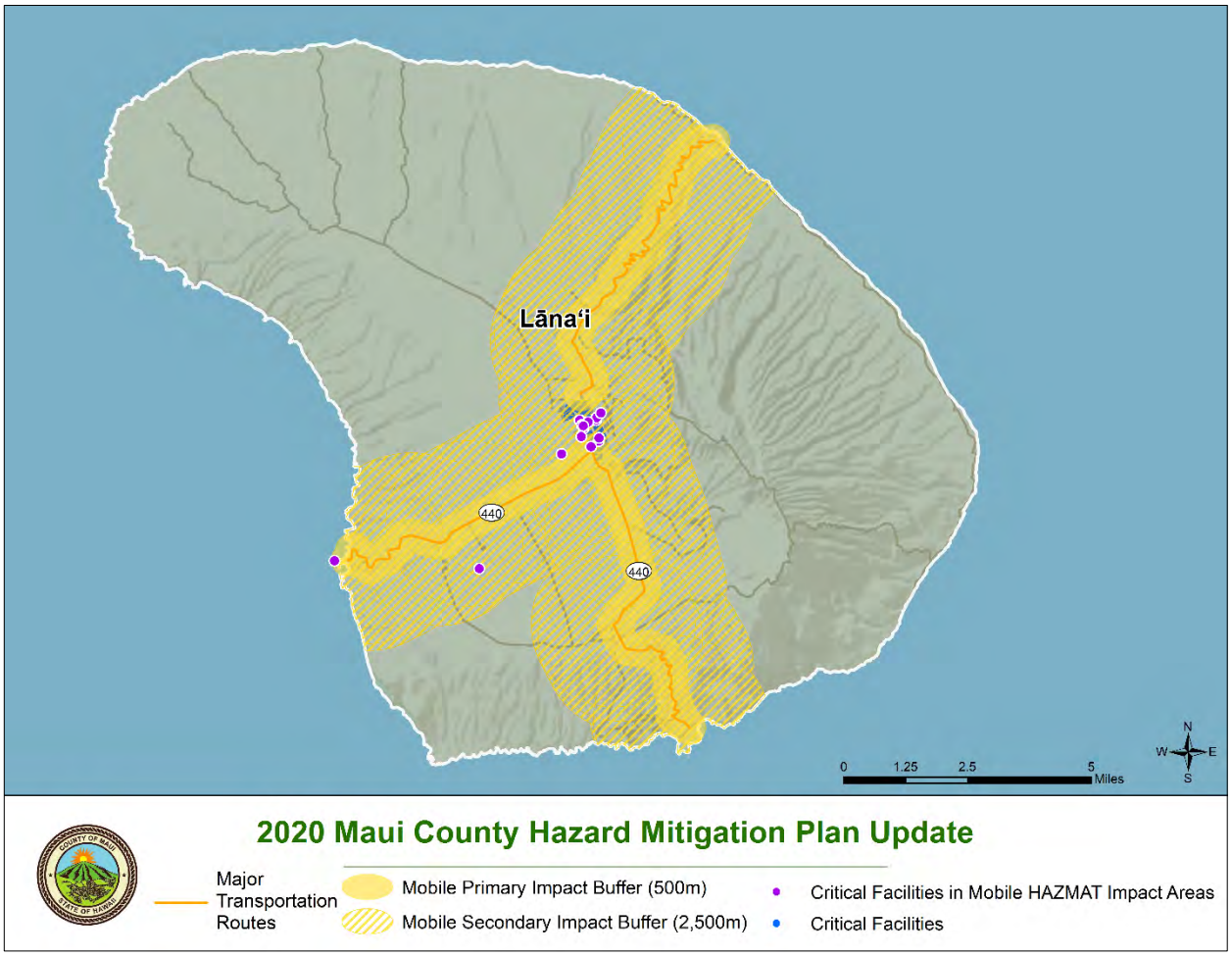

Figure 283. Critical Facilities in Mobile HAZMAT Impact Areas Impact Areas in the Lānaʻi Community Planning Area.

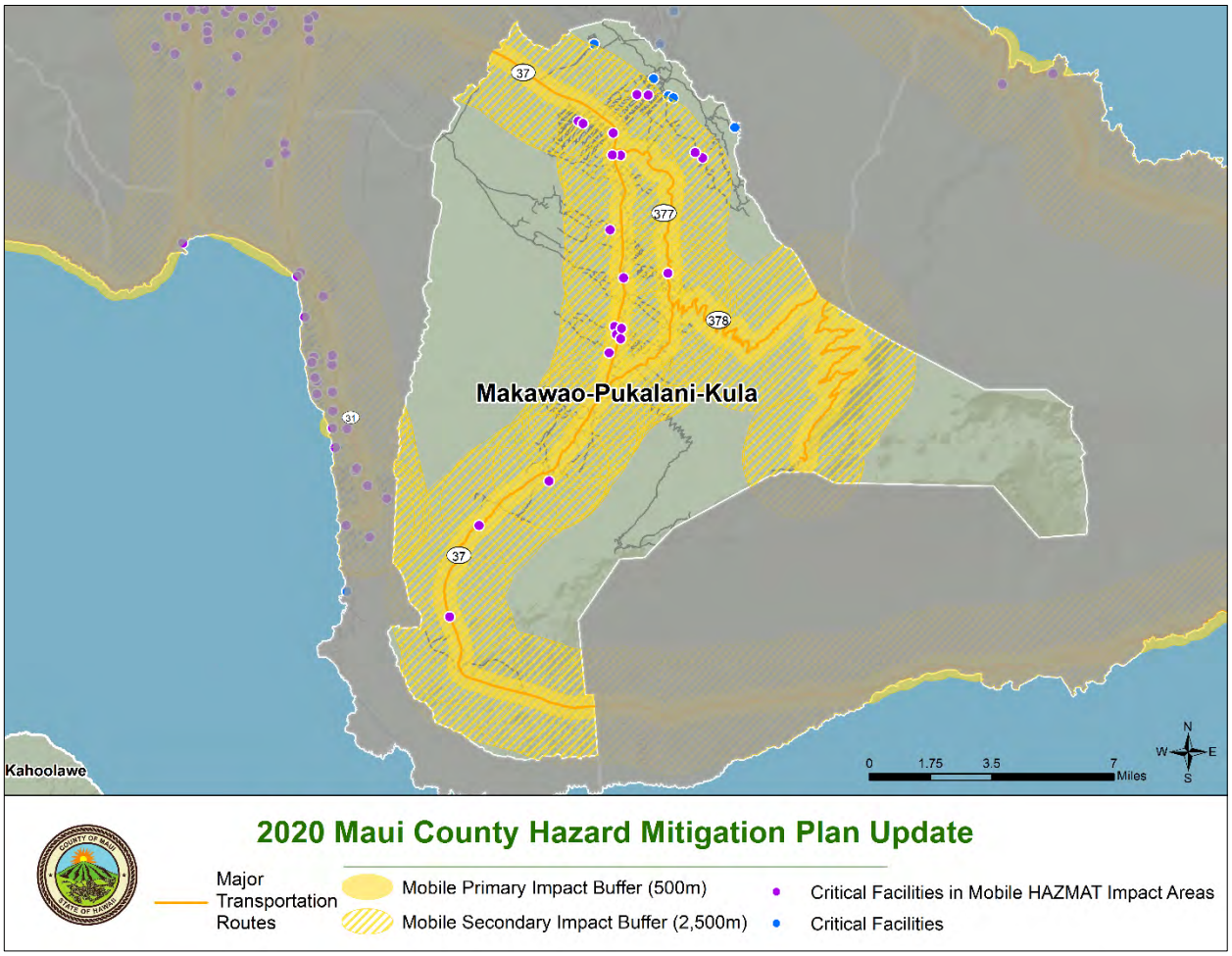

Figure 284. Critical Facilities in Mobile HAZMAT Impact Areas Impact Areas in the Makawao-Pukalani-Kula Community Planning Area.

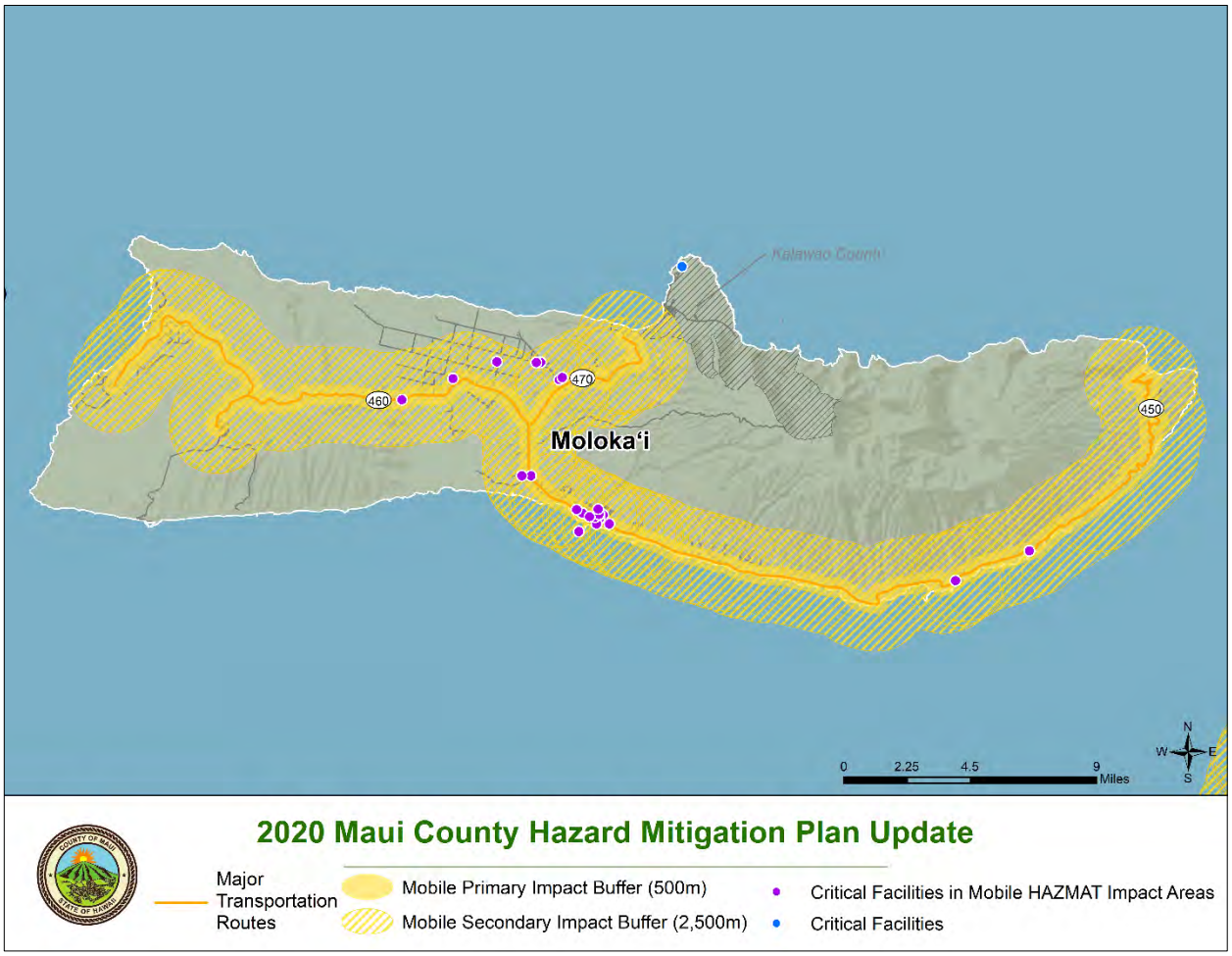

Figure 285. Critical Facilities in Mobile HAZMAT Impact Areas Impact Areas in the Moloka'i Community Planning Area.

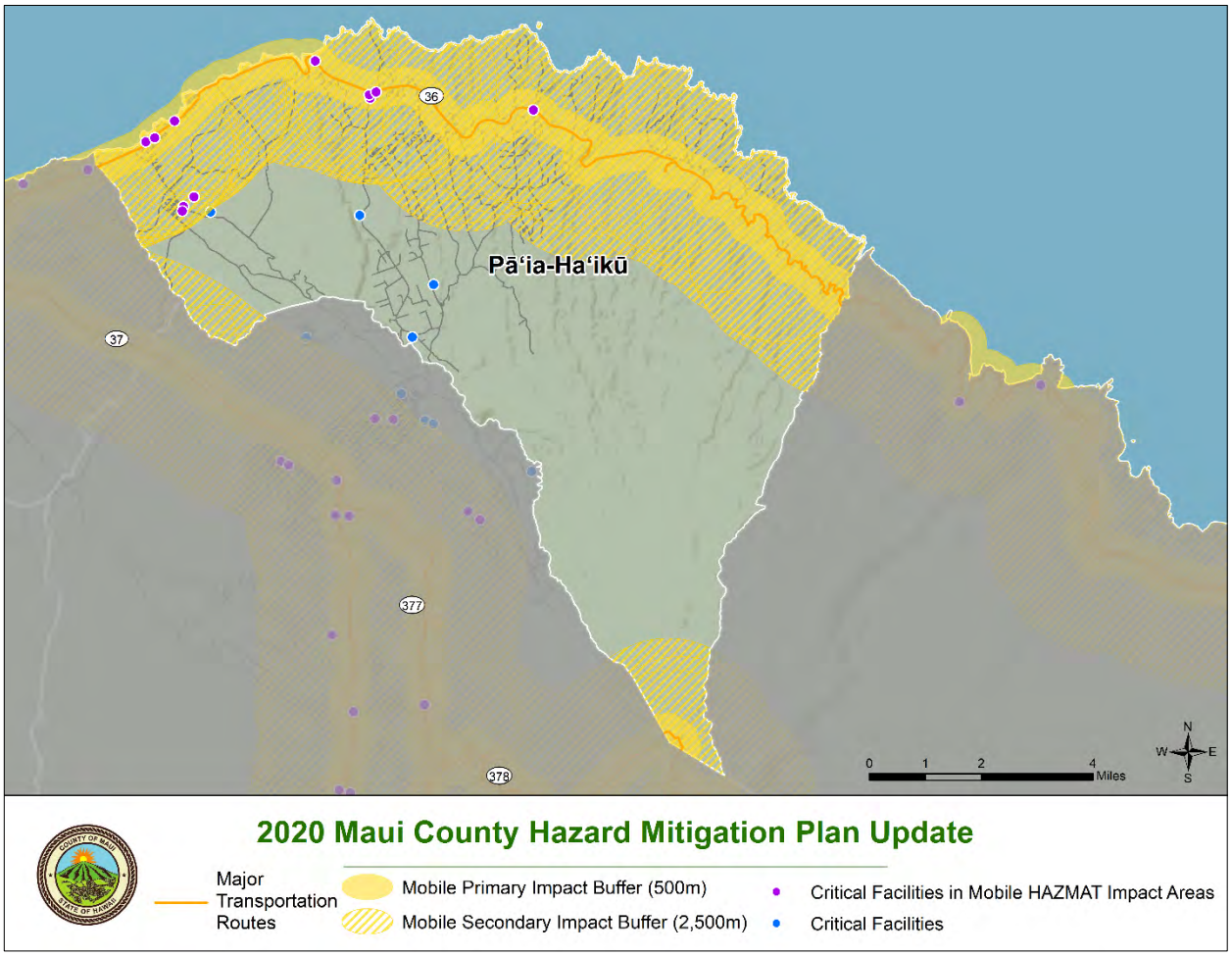

Figure 286. Critical Facilities in Mobile HAZMAT Impact Areas in the Pāʻia-Haʻikū Community Planning Area.

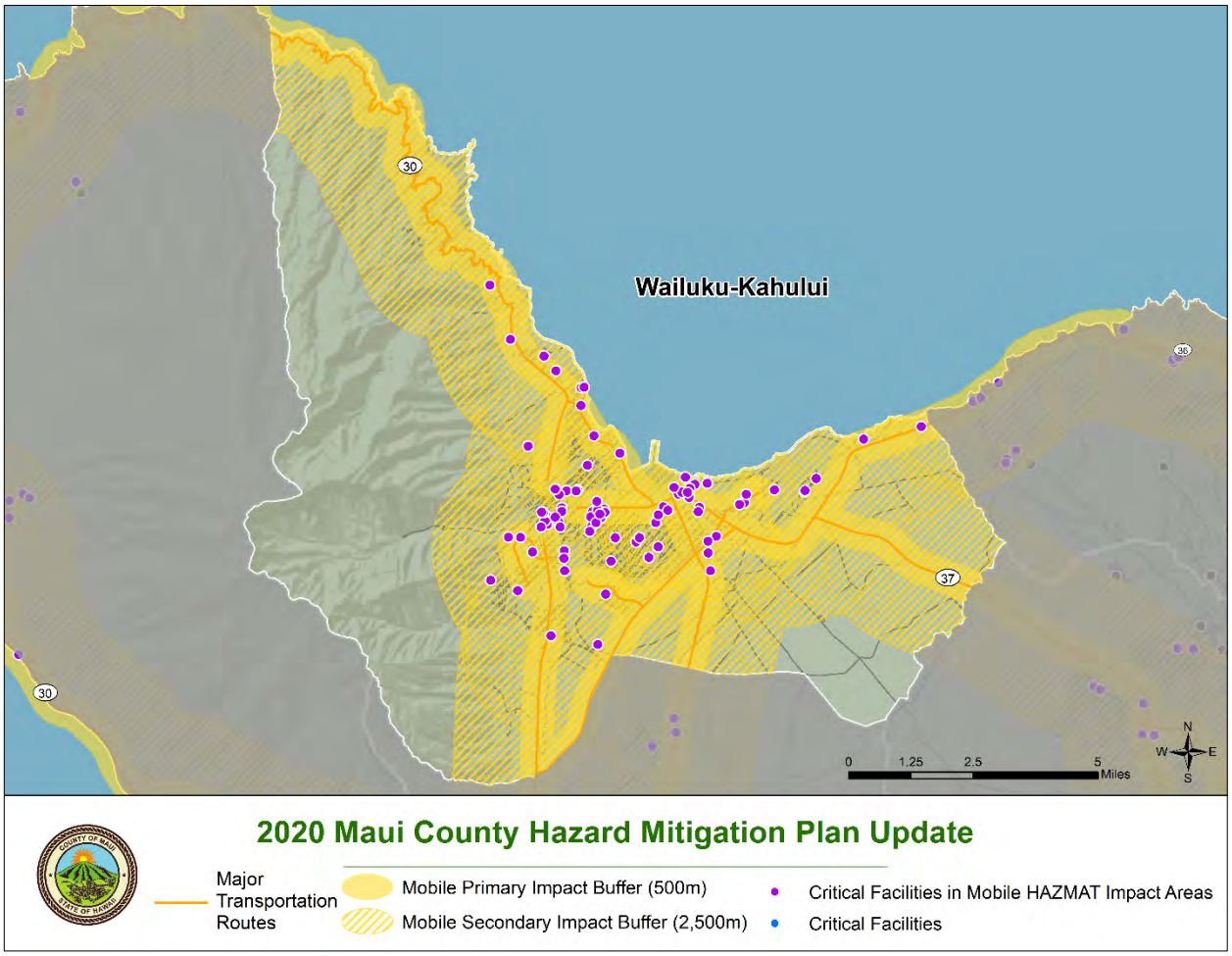

Figure 287. Critical Facilities in Mobile HAZMAT Impact Areas the Wailuku-Kahului Community Planning Area.

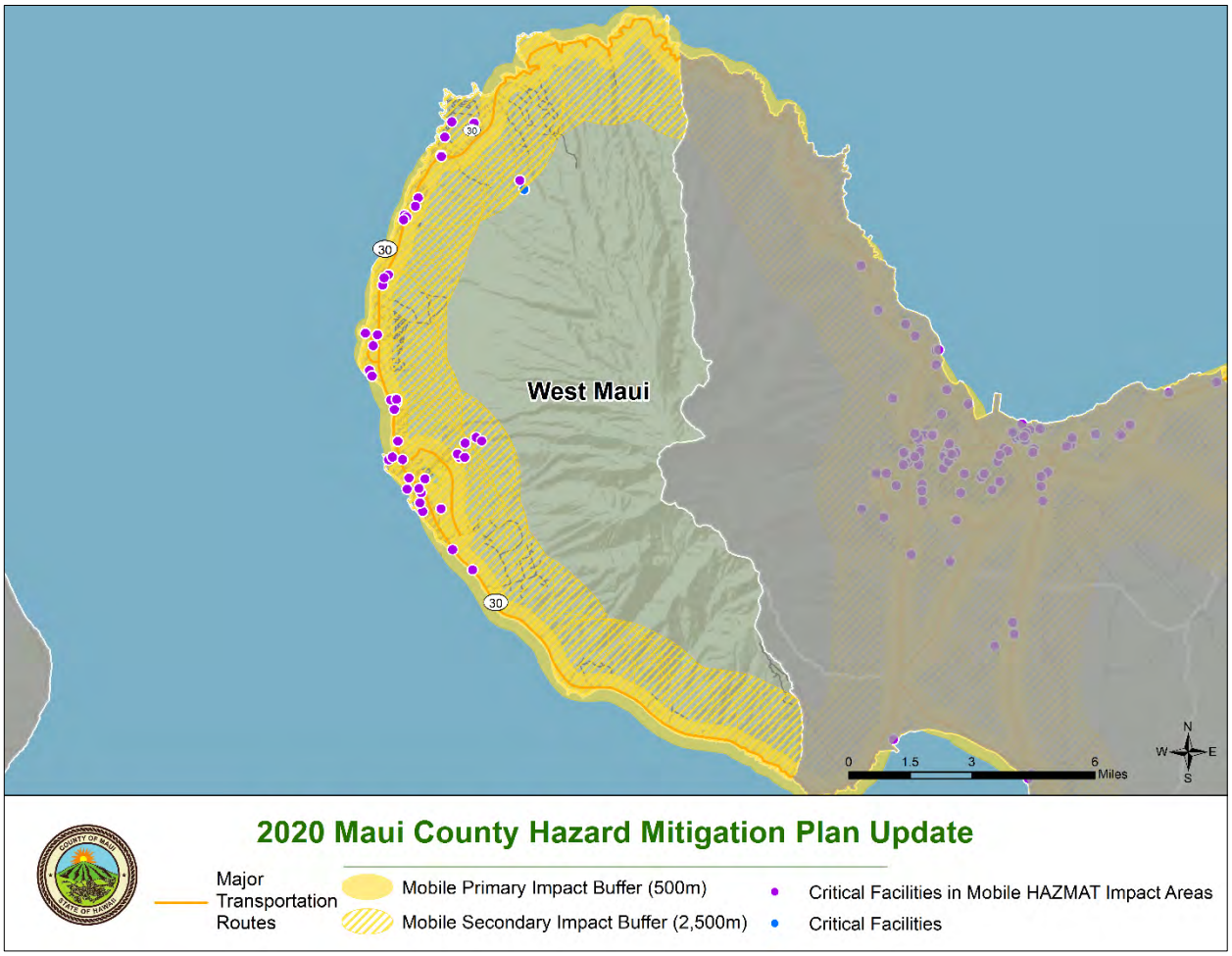

Figure 288. Critical Facilities in Mobile HAZMAT Impact Areas in the West Maui Community Planning Area.

Transportation Infrastructure

Although not presented by potential loss values, infrastructure such as roads, bridges, and utilities have the potential to be impacted by hazardous materials incidents, particularly in an incident involving a corrosive material. Often, this infrastructure is being used to transport hazardous materials, making them especially at-risk.

There are 22 bridges within TRI primary and secondary impact areas in Maui County. These bridges are presented in the table below and shown in Figure 289 and Figure 290. There are no bridges within the NBI on the Island of Lānaʻi.

Table 77. Number of NBI Bridges in Maui County Community Planning Areas in Tsunami Evacuation Zones.

Community Planning Area	Number of (NBI) Bridges in Impact Areas
Hāna	0
Kīhei-Mākena	2
Lānaʻi	N/A
Makawao-Pukalani-Kula	0
Molokaʻi	5
Pāʻia-Haʻikū	0
Wailuku-Kahului	12
West Maui	3
MAUI COUNTY TOTAL	**22 (14%)**

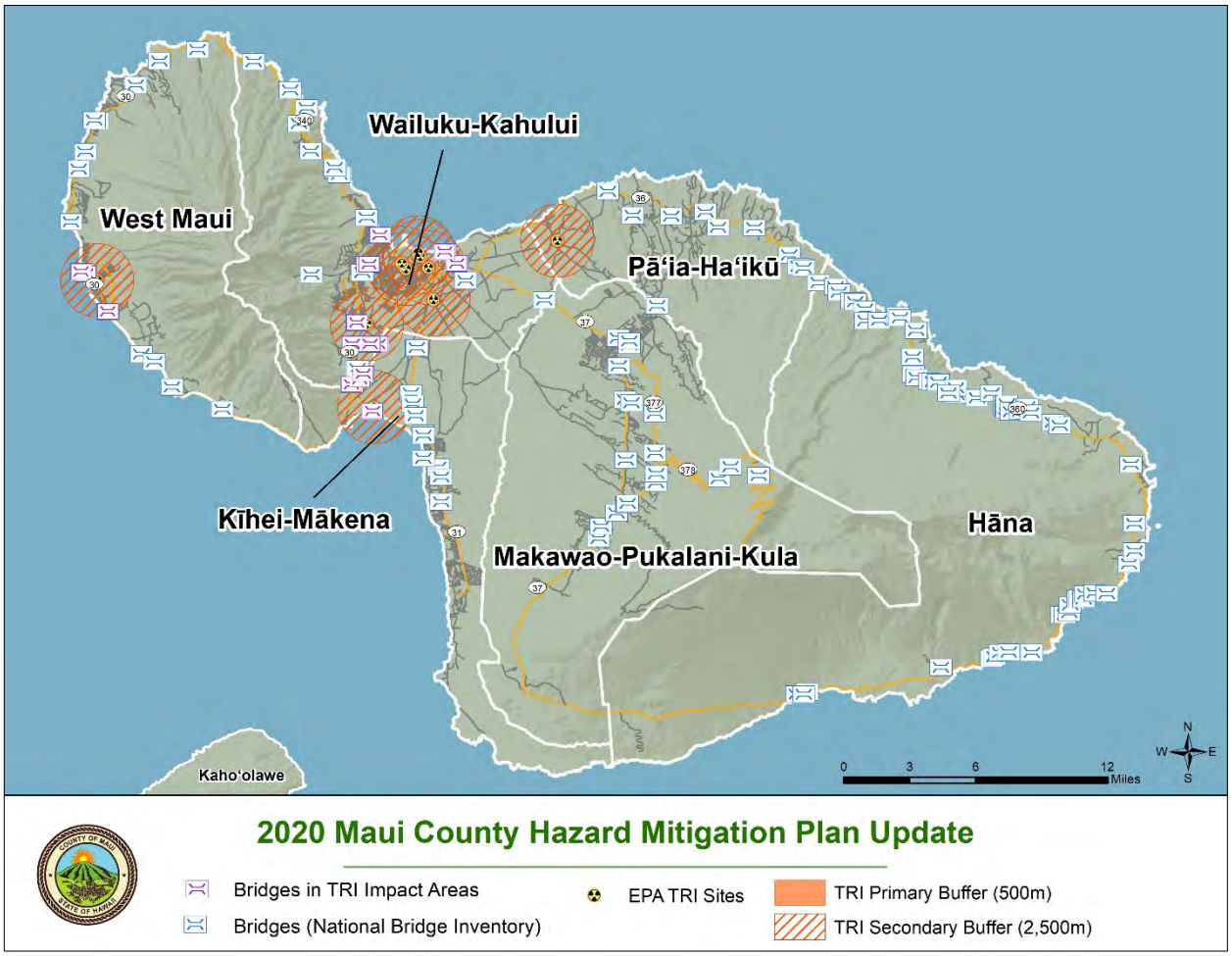

Figure 289. Bridges in Fixed-Site Impact Areas on Maui Island.

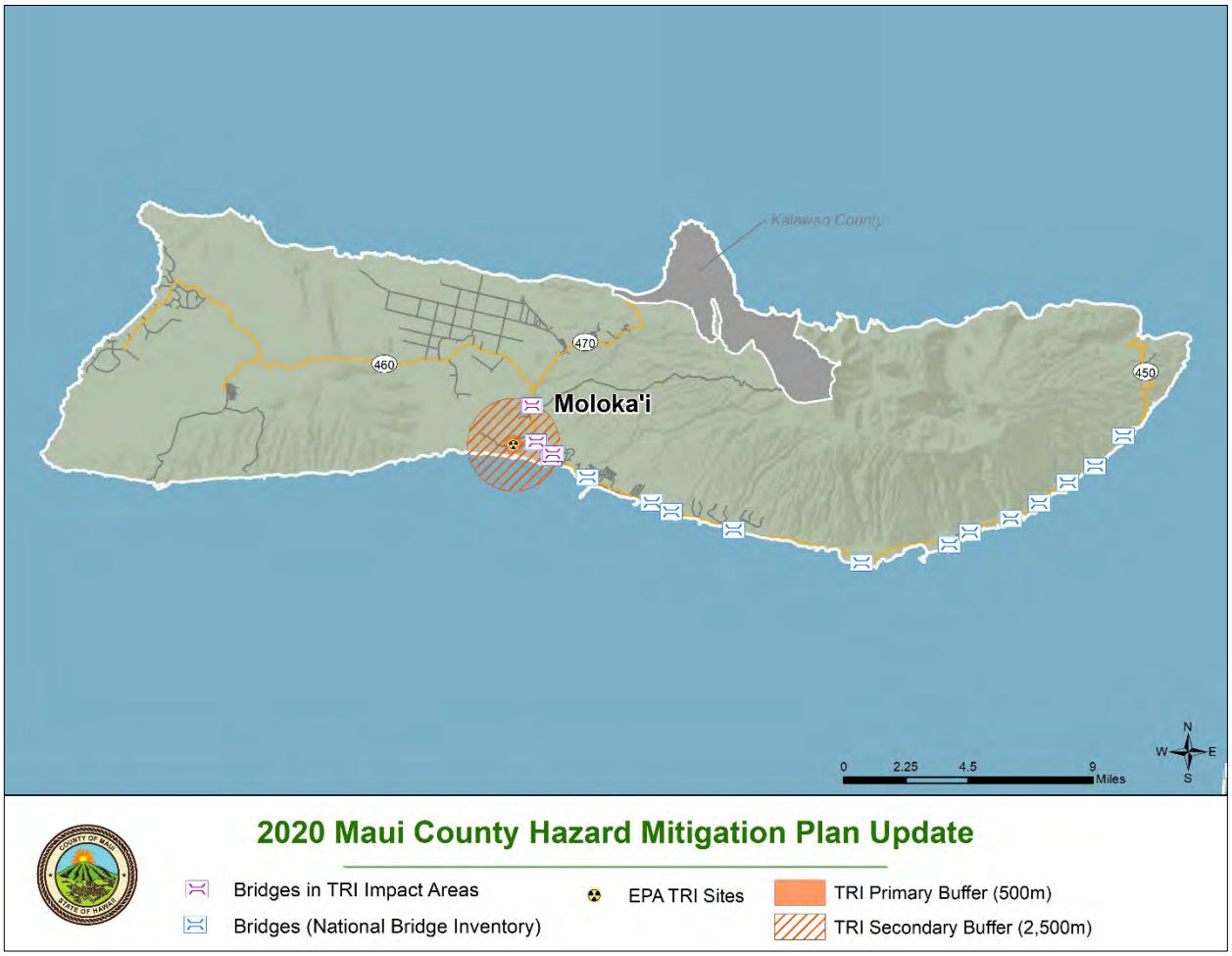

Figure 290. Bridges in Fixed-Site Impact Areas on Molokaʻi Island.

Further, the figure below shows roadways, county-owned and others, alongside TRI fixed-site primary and secondary impact areas on Maui Island. No roads identified as being county-owned were in the fixed-site primary or secondary impact areas on the islands of Molokaʻi or Lānaʻi. However, as hazardous materials are transported on roadways and across bridges, all roads and bridges within Maui County are considered at-risk to mobile hazardous materials incidents.

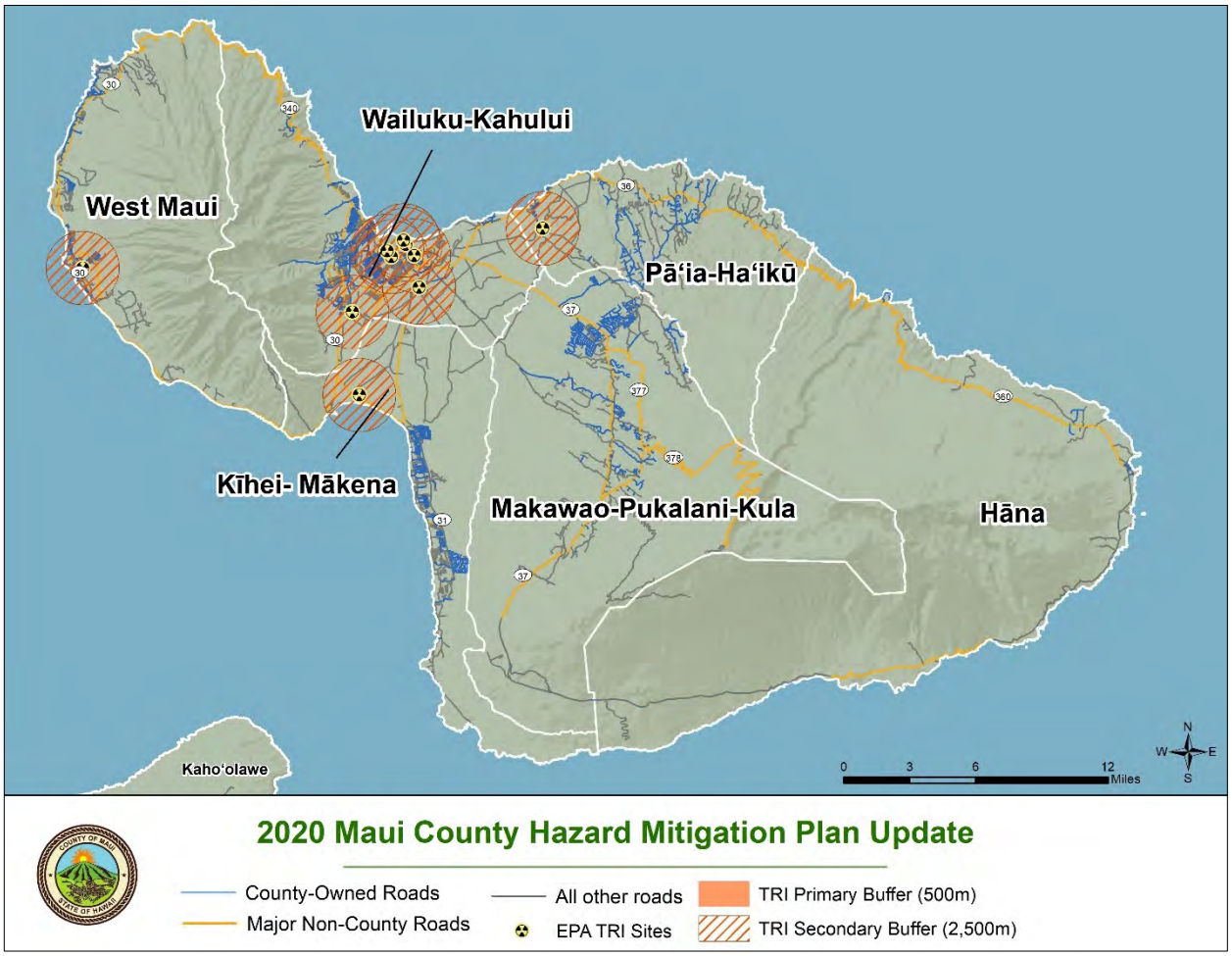

Figure 291. Roads and Fixed-Site Impact Areas on Maui Island.

Life Safety, Health, Warning, and Evacuation Impacts

HAZMAT incidents can result in injuries or fatalities when employees, responders, and civilians come in contact with hazardous materials. In certain events, persons may not realize they have been exposed until symptoms are presented. HAZMAT incidents may result in the need for evacuations, road closures, or sheltering in place. Hazardous materials incidents occur with little to no warning.

Public Health Impacts

HAZMAT incidents impact public health when incidents are widespread and/or long-lasting. HAZMAT incidents have the potential to contaminate drinking water sources, or to contaminate air through the release of toxic gases. One such example is Graniteville, South Carolina, where in 2005 a train derailment resulted in approximately nine deaths, 600 people seeking medical care, and the evacuation

of over 5,400 people.[233] In Maui County, trucks carrying hazardous materials are often traveling along narrow roadways near water sources or through the densely populated areas.

Impacts to Vulnerable Populations

Based on available hazard information, hazardous materials incidents may affect the entire county of Maui due to the locations of TRI sites within Community Planning Areas, and the potential for hazardous material spills during transport along major transportation routes. The Wailuku-Kahului Community Planning Area has the greatest number of TRI sites (seven) within the county. Pāʻia-Haʻikū, Kīhei-Mākena, West Maui, Lānaʻi, and Molokaʻi Community Planning Areas each have one TRI site. These areas rank eighth, sixth, third, fifth, and first, respectively, for overall vulnerability.

Populations exhibiting constraints related to household composition, socioeconomic status, access to information, housing characteristics and access to lifelines are susceptible to negative consequences as a result of hazardous materials incidents. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are described below.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty with mobilizing and evacuating or taking protective action in a timely fashion. Further, the deaf or hard of hearing may not hear audible evacuation orders or warnings about hazardous material spills. Once evacuated, these populations will require additional services and care considerations in the response aftermath and during recovery. Special accommodations for these populations must be considered in disaster planning processes.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

[233] Collision of Norfolk Southern Freight Train 192 With Standing Norfolk Southern Local Train P22 With Subsequent Hazardous Materials Release. (2005). National Transportation Safety Board. Retrieved from https://www.ntsb.gov/investigations/AccidentReports/Pages/RAR0504.aspx.

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a natural disaster. The unemployed, low-income households, and those receiving public assistance have little to no financial buffers that would facilitate actions to protect themselves from hazardous material spills.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon urgent hazard warning information. Additionally, those who do not speak English well, may not comprehend hazard warning information to the extent that enables them to make timely decisions and take life-saving actions.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Older structures may lack compliance with fire or building codes, making them more susceptible to hazard impacts. Populations living in housing built before 1950, may therefore be more vulnerable. Additionally, those in higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility to negative consequences as a result of exposure to hazardous materials.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges during an evacuation, and have difficulty accessing needed supplies and services before, during and after a hazard event. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Molokaʻi households also do not have access to a vehicle.

Economic Impacts

HAZMAT incidents can result in business disruption or closures, road closures, and property damage, all of which have an economic impact on the community. The permanent loss of a business due to a HAZMAT incident could result in lost tax revenue and jobs for the county.

Climate Change Impacts

Climate change is not expected to have direct impacts on hazardous materials incidents. However, HAZMAT incidents can be triggered by certain natural hazards, such as transportation accidents involving hazardous materials preempted by blinding downpours or severe winds. It is common for hazardous materials incidents (i.e., contamination) to occur as a secondary impact of flooding, tsunamis,

or hurricanes. Generally, if the frequency and intensity of natural hazards increases due to climate change, the frequency of HAZMAT incidents may increase as a result.

Health Risks

Description

Public health risks, such as those presented by infectious diseases, vector-borne illnesses, water-borne illnesses, and chronic diseases, are present within every community. They include commonly occurring illnesses like the common cold and influenza, as well as less common inflictions such as bacteria-caused *Escherichia coli* ("E. coli") and mosquito-transmitted Zika virus.

The degree to which communities are susceptible to or actively experiencing public health issues can impact a community's vulnerability to natural hazards, as well as its ability to respond to disasters. For instance, an infectious disease outbreak may complicate evacuations or/and mass sheltering required due to a natural hazard. Similarly, high incidents of chronic diseases may decrease mobility within a community, and natural disasters may reduce access to vital healthcare services needed by the ill.

History reveals that in the absence of information about a public threat, treatments, and vaccines, infectious diseases can be extremely deadly. For example, the 14th-century bubonic plague killed about 50 million people in Europe at a time well before modern medicine or an understanding of contagion existed. The plague did not submit for nearly 10 years, even then, continued to reemerge every decade or so for nearly 400 years.[234] The plague was largely managed through trial and error and ultimately controlled through quarantine measures, the first use of it in history. Tuberculous is considered the world's deadliest infection disease today despite available vaccines and treatments. Although it is nearly eliminated from the U.S., certain locations around the world see high infection rates and have limited capacity to manage the disease.

While major outbreaks are uncommon, public health emergencies can become stand-alone disasters that compound the threat of other natural hazards and exceed local and state capacity. There is precedent for federal assistance due to public health emergencies including West Nile Virus (2000), a mosquito-borne disease, for which a federal emergency declaration was made in New York and New Jersey,[235] and the COVID-19 pandemic, which resulted in a major disaster declaration in all states, territories, and the District of Columbia.

Maui County has experienced several acute and ongoing health risks and faces the threat of several others. While not a comprehensive list of potential health risks, the following provides a brief overview

[234] Ishack, Natasha. "The Black Death Was The Worst Pandemic In Human History, So How Did It Finally End?" All That is Interesting. 8 Apr 2020. Retrieved from: https://allthatsinteresting.com/how-did-the-black-plague-end.
[235] FEMA (2000). *President Authorizes Emergency Funds For New Jersey Virus Threat.* Retrieved from: https://www.fema.gov/news-release/2000/11/01/president-authorizes-emergency-funds-new-jersey-virus-threat.

of health risks faced by Maui County. It is not intended to be a complete list of potential public health threats.

Vector-borne Diseases

A vector-borne disease is a disease transmitted to humans from living organisms or animals.

Angiostrongyliasis (Rat Lungworm Disease)

Rat Lungworm Disease is caused by a parasitic nematode, also known as a roundworm parasite. In humans, rat lungworm affects the brain and spinal cord, impacting the brain and nervous system. Infected rats can pass larvae of the roundworm in their feces to intermediate hosts, such as slugs, snails, and freshwater crustaceans. Humans can become infected by:

- eating raw or undercooked snails, slugs freshwater shrimp, land crabs, frogs, or crayfish;
- accidently eating produce with slugs, snails, or slime; or
- drinking improperly filtered catchment water with slugs or snails.

Symptoms of rat lungworm include severe headache, stiff neck, tingling skin, low-grade fever, and nausea or vomiting.[236]

Chikungunya

According to the CDC, the Chikungunya virus is spread by mosquitos. The most common symptoms of infection are fever and joint pain, but it may also cause headache, muscle pain, joint swelling, or rash. Currently, there is no vaccine to prevent or medicine to treat chikungunya virus infection.

Dengue

Dengue fever transmitted to humans by Aedes aegypti and Aedes albopictus mosquitoes. Symptoms include headache, body aches, fever, and rash. In several cases, blood clotting problems can occur. Symptoms typically last one to two weeks. About half of cases present no symptoms. Prevention actions include avoiding mosquito bites (repellant and covering skin), and well as reducing mosquitos by emptying standing water.[237]

Hansen's Disease (Leprosy)

Hansen's disease (also known as leprosy) is an infection caused by slow-growing bacteria called *Mycobacterium leprae*. Leprosy was once feared as a highly contagious and devastating disease, but now we know it doesn't spread easily and treatment is very effective. With early diagnosis and treatment, the disease can be cured. Further, to transmit the disease, a person must be in close contact

[236] MauiReady (n.d.). Emergency Preparedness Information for Maui Residents and Visitors. Retrieved from https://mauiready.org/ratlungworm/.

[237] Hawai'i Department of Health Disease Outbreak Control Division (2016). *Dengue Outbreak 2016-15*. Retrieved from https://health.Hawai'i.gov/docd/dengue-outbreak-2015/.

with someone with untreated Hansen's disease for many months or even years. People with Hansen's disease can continue to work and lead an active life during and after treatment. Hansen's Disease can affect the nerves, skin, eyes, and lining of the nose (nasal mucosa). However, if left untreated, the nerve damage can result in crippling of hands and feet, paralysis, and blindness.[238]

Leptospirosis[239]

Leptospirosis can be contracted when a person has contact with water, soil, or urine from an infected animal. Multiple types of animals may be infected including dogs, horses, pigs, wildlife and rodents. Symptoms generally include a combination of fever, diarrhea, muscle aches, vomiting, red eyes, and jaundice. Without treatment, Leptospirosis can lead to kidney damage, meningitis (inflammation of the membrane around the brain and spinal cord), liver failure, respiratory distress, and even death. According to the CDC, people should avoid floodwater as water may contain infected animal urine. The following factors increase risk to Leptospirosis:

- Drinking from potentially contaminated water sources, including floodwater, streams, rivers, or unsafe tap water.
- Bathing or wading in floodwater or contaminated fresh water, especially when putting your head under water or if you have an open wound or scratch.
- Eating food that has been exposed to contaminated water or potentially urinated on by rodents.

Zika Virus

Zika virus is spread by *aedes* mosquitoes. While the State of Hawai'i does not currently have any cases of Zika virus, Aedes albopictus mosquitoes are found on Maui, so the virus has the potential to spread to the county by mosquito. Zika virus is also considered an infectious disease, as it can be sexually transmitted. Symptoms of Zika infection can include a fever, joint pain, rash, headache, and conjunctivitis ("pink eye"). Only about 20% of people with Zika infection have symptoms. When symptoms occur, they can last several days to a week. Human fetuses are susceptible to severe birth defects if the mother is infected with Zika virus. Preventing the spread of Zika into new areas like Maui includes the following:

- Education of residents or visitors who are diagnosed with Zika on Maui to avoid mosquito bites and to use condoms or abstain from sex for up to 6 months.
- Education of the general public about mosquito borne and sexual transmission of Zika virus, and the importance of repellent and covering skin (long pants, long sleeves, and socks) to avoid mosquito bites.

[238] Centers for Disease Control and Prevention. *Hansen's Disease (Leprosy)*. Retrieved from https://www.cdc.gov/leprosy/index.html.

[239] Centers for Disease Control and Prevention (2018). *Hurricanes, Floods and Leptospirosis.* Retrieved from: https://www.cdc.gov/leptospirosis/exposure/hurricanes-leptospirosis.html

- Reducing mosquito breeding by emptying standing water and other methods.[240]

Infectious Diseases

Infectious diseases are caused by pathogens that can be spread, directly or indirectly, from person to person. Such diseases may be seasonal (seasonal influenza) or result, in the case of new diseases, result in a global pandemic.

Coronavirus (COVID-19)

COVID-19 is a highly contagious, viral upper-respiratory illness that was first detected in China in late 2019. The virus quickly spread throughout the world and has resulted in a global pandemic ongoing at the time of this plan. As of May 7, 2020, there were just under 3.7 million cases of COVID-19 globally, resulting in over a quarter million deaths. COVID-19 symptoms include cough, difficulty breathing, fever, muscle pain, and loss of taste or smell. Severe cases may result in death, especially in individuals over the age of 65 or with underlying medical conditions, such as diabetes, lung disease, asthma, obesity, or those who are immunocompromised. COVID-19 spreads from person to person through respiratory droplets in the air or on surfaces.[241]

To prevent the continued spread of the virus, many communities around the world have used stay-at-home orders, in which residents must remain home except to utilize essential services, such as grocery stores and health care services. Many schools have closed, and workers have switched to teleworking. Business closures have caused major economic losses in many countries.

Hepatitis B

Hepatitis B is an infectious liver disease caused by the hepatitis B virus. Hepatitis B infections can be acute (short-term illness occurring with six months of contraction) or chronic (long-term illness in which serious health problems can develop). About 90% of infants infected with Hepatitis B will develop a chronic infection, compared to only about 5% of adults. Symptoms can include fever, fatigue, loss of appetite, nausea, vomiting, joint pain, and jaundice. Hepatitis B is transmitted from person to person through bodily fluids. There is no cure for Hepatitis B, but a vaccination is available to prevent against the virus.[242]

Measles[243]

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[240] MauiReady (n.d.). *Emergency Preparedness Information for Maui Residents and Visitors*. Retrieved from https://mauiready.org/zika/.

[241] Centers for Disease Control (2020). *Coronavirus disease 2019 (COVID-19)*. Retrieved from https://www.cdc.gov/coronavirus/2019-ncov/faq.html.

[242] Hawai'i Department of Health Disease Outbreak Control Division (2020). *Hepatitis B*. Retrieved from https://health.Hawai'i.gov/docd/disease_listing/hepatitis-b/

[243] Centers for Disease Control and Prevention (2020). Measles. Retrieved from: https://www.cdc.gov/measles/symptoms/complications.html.

Measles is a highly contagious respiratory disease caused by the Rubeola virus. Symptoms include high fever, rash and cough. The virus is spread through the air, primarily from coughing and sneezing. It can result in numerous complications including pneumonia and encephalitis (swelling of the brain) that can lead to seizures, deafness, brain damage or death. Approximately 1 in 5 people who contract measles will be hospitalized. Young children under the age of 5, pregnant women and those with compromised immune systems are most at risk to complications.

Prior to a vaccination, an estimated 3 to 4 million Americans were infected each year. A vaccine was developed in 1963, and most kids are vaccinated by the age of 15. The measles vaccine is usually combined with mumps and rubella, and commonly referred to as the "MMR," or combined with mumps, rubella and varicella ("MMRV"). Measles was declared eliminated (absence of continuous disease transmission for greater than 12 months) from the United States in 2000. However, in recent years the rate of vaccinations has dropped leading to a reemergence of the disease. According to the CDC, since 2010, cases reported have ranged between 55 cases in 2012 to 1,282 cases in 2019. In Hawai'i, concerns over low vaccination rates in children increase the risk of a measles outbreak. Measles vaccination rates need to be at 93% to 95% of the population to prevent measles from spreading, but in Hawai'i, only 91.5% of kindergartners have received the measles vaccine.[244]

Tuberculosis

Tuberculosis (TB) is a bacterial infection that usually attacks the lungs but can also affect other parts of the body such as the spine, kidneys, or brain. Symptoms include a cough, fever, and weight loss. There are two types of tuberculosis – latent TB infection (LTBI), in which no symptoms are presented, and TB disease. TB disease can be infectious and is spread from person to person through droplets in the air, whereas LTBI is not infectious. Most cases of TB disease are treatable and curable but can be fatal if not properly treated. In some cases, TB infections are resistant to drugs, which is referred to as drug-resistant TB.[245] A vaccine exists but is rarely administered in the U.S., given a low rate of incidence. The national incidence rate was 2.8 cases per 100,000 persons (1.3% decrease from 2017), which has been declining since tracking started in the 1930s. However, rate of incidence is declining at a lower rate in recent years.

Non-Communicable Diseases (NCDs)

NCDs are diseases that are not transmissible directly from one person to another such as autoimmune diseases, diabetes, chronic kidney disease, Alzheimer's disease, cataracts, and others. Other public health risks faced by Maui County include chronic diseases, such as diabetes, hypertension, and asthma. Substance abuse is also an issue in Maui County, including excessive drinking and abuse of opioids, methamphetamines, and other drugs.

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[244] Hawai'iNewsNow (2019). *Samoa measles outbreak triggers concerns over low vaccination rates at Hawai'i schools*. Retrieved from https://www.Hawai'inewsnow.com/2019/12/11/deadly-samoa-measles-outbreak-triggers-concerns-over-Hawai'is-low-vaccination-rates/.

[245] Centers for Disease Control (2020). *Basic TB facts*. Retrieved from https://www.cdc.gov/tb/topic/basics/default.htm.

Location

The entirety of Maui County is considered to be uniformly exposed to health risks.

Previous Occurrences

The following presents a summary of previous occurrences of the health risks described above in Maui County:

- **Angiostrongyliasis/Rat Lungworm Disease**: Maui County had no cases in 2019, and has reported one case so far in 2020 (only case in the state)[246]
- **COVID-19:** As of May 17, 2020, 116 cases of COVID-19 have been reported in Maui County, and with six deaths.[247] The COVID-19 pandemic has the potential to continue to some degree over the next several years, or until a vaccine is developed. Maui has high incidence of respiratory illnesses, such as asthma, bronchitis, and emphysema, as well as high incidence of diabetes.[248] These comorbidities make individuals more susceptible to COVID-19 and can also increase the likelihood of death for COVID-19 patients.
- **Dengue**: Maui County experienced an outbreak of dengue 15 years ago. There was also an outbreak on the Big Island in 2015-2016. According to state records, Maui County has experienced less than five cases of dengue per year in recent years.[249]
- **Hansen's Disease (Leprosy)**: From the 1860s through the 1960s, leprosy patients in Hawai'i were forcibly removed from their homes and exiled to Kalaupāpā, an isolated peninsula on the Island of Moloka'i. It is estimated the Kalaupāpā leprosy colony housed up to 8,000 patients, almost all of which are believed to have been Native Hawaiians. Although the quarantine was lifted in 1969, some patients voluntarily stayed on the colony.[250] As of November 2019, 12 patients, aged 78 to 95 years, remained at Kalaupāpā.[251]
- **Hepatitis B**: Maui County is described as having a high incidence of Hepatitis B cases.[252]
- **Tuberculosis**: Maui County has the highest rate of TB in the nation.[253]

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[246] Hawai'i Department of Health Disease Outbreak Control Division (2020). Angiostrongyliasis (Rat Lungworm). Retrieved from https://health.Hawai'i.gov/docd/disease_listing/rat-lungworm-angiostrongyliasis/#risk_in_Hawai'i.
[247] The New York Times (2020). *Hawai'i Coronavirus Map and Case Count*. Retrieved from https://www.nytimes.com/interactive/2020/us/Hawai'i-coronavirus-cases.html#county.
[248] Malama I Ke Ola Health Center. *Special Populations/Health Issues*. Retrieved from https://ccmaui.org/about/.
[249] Hawai'i Department of Health Disease Outbreak Control Division (2020). Summary of reported cases of notifiable diseases. Retrieved from https://health.Hawai'i.gov/docd/resources/reports/summary-of-reported-cases-of-notifiable-diseases/.
[250] Wong, A. (2015). *When the last patient dies*. The Atlantic. Retrieved from https://www.theatlantic.com/health/archive/2015/05/when-the-last-patient-dies/394163/.
[251] Hawai'i Department of Health (2019). R*eport to the Thirtieth Legislature, State of Hawai'i.* Retrieved from https://health.Hawai'i.gov/opppd/files/2020/01/CDPHND-Kalaupapa-Settlement-Annual-Report-2019.pdf.
[252] Malama I Ke Ola Health Center. *Special Populations/Health Issues*. Retrieved from https://ccmaui.org/about/.
[253] Malama I Ke Ola Health Center. *Special Populations/Health Issues*. Retrieved from https://ccmaui.org/about/.

- **Zika virus**: Locally acquired cases of Zika virus have not been reported in Maui County, or in the State of Hawai'i.[254]
- **Substance Abuse**: Maui County has the highest substance abuse rate in the State of Hawai'i.[255]

Extent

As the severity of health risks is difficult to determine given the varying impacts associated with different health risks. COVID-19 has possibility had the largest overall impact on Maui County in recent history when considering number of cases, deaths, and societal impacts.

Probability of Future Events

Probability of health risks within Maui County is variable. Many public health risks occur seasonally and are ongoing, such as the common cold and influenza. Major outbreaks, such as the current COVID-19 pandemic or the dengue outbreak in the early 2000s, are less common. Based on the information available regarding historic or current events, this hazard was assigned a probability of likely (10% to 90% annual chance) for all community planning areas.

Vulnerability

All current and future populations in Maui County are considered at risk to health risks. Health risks can include outbreaks of infectious illnesses, as well as rises or high incidences of chronic diseases or substance abuse. Maui County is a vacation destination for visitors around the world, making it susceptible to contagious diseases brought to the county from other parts of the world.

Building and Infrastructure Impacts (including Critical Facilities)
Buildings and infrastructure are not typically impacted by health risks but may need to be sterilized or decontaminated in some cases. During outbreaks, critical facilities such as hospitals and healthcare facilities may be overwhelmed.

Life Safety, Health, Warning, and Evacuation Impacts
Health risks directly impact life safety through deaths or injuries stemming from disease outbreaks or substance abuse (e.g., overdoses). Health risks are unlikely to result in an evacuation, but may result in quarantining, stay-at-home orders, or social distancing measures. Warnings may be issued by Maui Emergency Management or the Hawai'i Department of Health regarding measures needed to combat health risks.

Infectious diseases, such as COVID-19, create added complexity to emergency response including evacuation, sheltering and managing events from a typically crowded Emergency Operations Centers

[254] MauiReady (n.d.). *Emergency Preparedness Information for Maui Residents and Visitors*. Retrieved from https://mauiready.org/zika/.
[255] Malama I Ke Ola Health Center. *Special Populations/Health Issues*. Retrieved from https://ccmaui.org/about/.

(EOC). Public health emergencies may strain capacity of emergency personnel time and budgets to manage multiple disasters.

Public Health Impacts
Health risks have direct impacts on public health through the spread of infectious diseases or rise in substance abuse. Health risks often require action from local, state and federal public health agencies to curb the spread of disease, prevent substance abuse, or treat affected individuals. Major outbreaks may overwhelm local healthcare capabilities

Impacts to Vulnerable Populations
Based on available hazard information, health risks could affect all populations within Maui County. Populations exhibiting constraints related to household composition, socioeconomic status, access to information, housing characteristics and access to lifelines are susceptible to negative consequences as a result of health risks. Community Planning Areas that may require special considerations or support to meet the needs of vulnerable populations are described below.

Household Composition

Single-parent households and those with dependent populations, such as the very young, elderly and the disabled may have more difficulty taking preventative action or coping with health risks such as infectious diseases, as these populations often have existing health conditions that make them more susceptible to negative consequences. These populations may require special services and considerations to meet preventative care and treatment needs. Special accommodations for these populations must be considered in disaster planning processes.

In the Hāna, Lānaʻi, and Molokaʻi Community Planning Areas, greater than 20% of the population is over the age of 65. Molokaʻi and Lānaʻi also have a significant proportion of their population classified as disabled, with nearly 18% of Molokaʻi's total population and 14% of Lānaʻi's total population considered disabled. Molokaʻi and Wailuku-Kahului Community Planning Areas have the highest proportion of children under the age of 18 (25% and 24% respectively). Wailuku-Kahului has the highest percentage of single-parent households with children, at over 9%.

Socioeconomic Status

Populations experiencing socioeconomic constraints lack the necessary economic resources to adequately prepare for or recover from a natural disaster. The unemployed, low-income households, and those receiving public assistance have little

to no financial buffers that would facilitate treatment for, or recovery from significant health risks.

At least 10% or more of the populations living within the Molokaʻi, Makawao-Pukalani-Kula, Hāna, and Wailuku-Kahului Community Planning Areas are considered to be living in poverty. More than 11% of households within the Molokaʻi, Wailuku-Kahului and Hāna Community Planning Areas receive public assistance benefits. The Molokaʻi Community Planning Area has the lowest per capita income in Maui County ($21,152). Hāna has the highest unemployment rate (7.22%), and the second lowest per capita income in the county ($27,178).

Access to Information

Populations with limited access to information, such as those without telephone service or access to the internet may experience delays in receiving and acting upon information related to health risks. Additionally, those who do not speak English well, may not comprehend hazard information to the extent that enables them to make timely decisions and take precautionary or preventative actions.

On both Molokaʻi and Lānaʻi, 35% of households do not have access to the internet. In Hāna 30% of households have no internet access. Further, in Molokaʻi over 5% of the population does not have telephone service. In the West Maui, Wailuku-Kahului and Lānaʻi Community Planning Areas roughly 5% of the populations speak English less than well. West Maui has the highest percentage of Non-English speakers in all of Maui County, at nearly 6%.

Housing Characteristics

Higher density living situations such as multi-unit housing, populations residing in group living quarters or crowded housing increase susceptibility and spread of health risks and associated negative consequences.

Hāna has the highest rate of crowded housing of all the Community Planning Areas, over 18%, while Wailuku-Kahului was the highest group quarters population (1,760 total count, 2.8% overall) and the third highest rate of crowded housing, over 14%. West Maui has the highest density of multi-unit housing in the entire county (over 39%). It has the second highest rate of crowding (16%), and the second highest percentage of the population living in group quarters (1.6%). Kīhei-Mākena has the second highest percentage of housing structures with 10 or more units in the County, at nearly 37%.

Nearly a third (29%) of the housing in Lānaʻi was built before 1950. Molokaʻi and Pāʻia-Haʻikū Community Planning Areas have the second and third highest proportion of housing built before 1950 (nearly 13%).

Access to Lifelines

Populations with limited vehicle access or transportation routes, especially those living in isolated areas, are more likely to experience mobility challenges and have difficulty accessing needed supplies and services in the event of a health crisis. Additionally, those without health insurance may delay seeking out and receiving necessary health care services or emergency care.

The West Maui Community Planning Area exhibits the highest score for Access to Lifelines Vulnerability, having the second highest rate of population without health insurance (over 6%), and the second highest rate of households without a vehicle, at nearly 7%. Hāna has the second highest percentage of the population without health insurance (nearly 6%), and the lowest road density within the county. Wailuku-Kahului has the highest percentage of households without a vehicle (7%). Over 6% of Molokaʻi households also do not have access to a vehicle.

Economic Impacts

Health risks can have devasting economic impacts. Localized disease outbreaks may impact tourism, both through direct business interruptions and through the perceived danger of visiting the county. Or, in the case of a global pandemic such as COVID-19, mandatory closures and stay at home orders cause business interruptions, school closures, lost tourism and lay-offs. Further, the county may lose revenues from sales and hospitality taxes, while at the same time having to increase spending and divert resources to managing the spread of disease.

Climate Change Impacts

Climate change may have negative impacts or health risks. According to the Fourth National Climate Assessment, an increase in the incidence of vector-borne diseases such as malaria and dengue in the Pacific Islands has been linked to climate variability and is expected to increase in the future as a result of climate change.

Summary of Overall Risk

Priority Risk Index Results

The PRI results are presented in the tables below. A PRI was completed for each community planning area and the county as a whole. Results for Maui County are presented first. This information was used to rank hazards as presented in tables that follow.

Table 78. Summary of PRI Results for Maui County.

Hazard	Category/Degree of Risk					
	Probability	**Impact**	**Spatial Extent**	**Warning Time**	**Duration**	**PRI Score**
Coastal Erosion	Highly Likely	Critical	Moderate	More than 24 hours	More than 1 week	**3.0**
Dam and Reservoir Failure	Possible	Limited	Negligible	6 to 12 hours	Less than 6 hours	**1.2**
Drought	Highly Likely	Minor	Moderate	More than 24 hours	More than 1 week	**2.6**
Earthquake	Possible	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.6**
Extreme Heat	Likely	Minor	Large	More than 24 hours	Less than one week	**2.4**
Extreme Cold	Possible	Minor	Small	More than 24 hours	Less than 24 hours	**1.6**
Flood	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
High Windstorms	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
Hurricane (including Tropical Storm and Kona Storm)	Likely	Catastrophic	Large	More than 24 hours	Less than 1 week	**3.3**
Landslide	Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.9**
Tsunami	Likely	Critical	Moderate	Less than 6 hours	Less than 24 hours	**3.0**
Volcanic Hazards	Possible	Limited	Moderate	More than 24 hours	Less than one week	**2.6**
Wildfire	Likely	Critical	Moderate	12 to 24 hours	Less than one week	**2.9**
HAZMAT	Possible	Limited	Negligible	Less than 6 hours	Less than 6 hours	**1.9**
Health Risks	Likely	Limited	Small	More than 24 hours	More than 1 week	**2.4**

Table 79. Summary of PRI Results for Hāna.

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Coastal Erosion	Likely	Limited	Small	More than 24 hours	More than 1 week	**2.4**
Dam and Reservoir Failure	Unlikely	Minor	Negligible	6 to 12 hours	Less than 6 hours	**1.2**
Drought	Highly Likely	Minor	Moderate	More than 24 hours	More than 1 week	**2.6**
Earthquake	Possible	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.6**
Extreme Heat	Likely	Minor	Large	More than 24 hours	Less than one week	**2.4**
Extreme Cold	Possible	Minor	Small	More than 24 hours	Less than 24 hours	**1.6**
Flood	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
High Windstorms	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
Hurricane (including Tropical Storm and Kona Storm)	Likely	Catastrophic	Large	More than 24 hours	Less than 1 week	**3.3**
Landslide	Highly Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**3.2**
Tsunami	Possible	Critical	Moderate	Less than 6 hours	Less than 24 hours	**2.7**
Volcanic Hazards	Likely	Minor	Moderate	More than 24 hours	Less than one week	**2.2**
Wildfire	Likely	Critical	Small	12 to 24 hours	Less than one week	**2.7**
HAZMAT	Possible	Limited	Negligible	Less than 6 hours	Less than 6 hours	**1.9**
Health Risks	Likely	Limited	Small	More than 24 hours	More than 1 week	**2.4**

Table 80. Summary of PRI Results for Kīhei-Mākena.

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Coastal Erosion	Highly Likely	Limited	Moderate	More than 24 hours	More than 1 week	2.9
Dam and Reservoir Failure	Possible	Limited	Small	6 to 12 hours	Less than 6 hours	2

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Drought	Highly Likely	Minor	Moderate	More than 24 hours	More than 1 week	2.6
Earthquake	Possible	Critical	Moderate	Less than 6 hours	Less than 6 hours	2.6
Extreme Heat	Highly Likely	Minor	Moderate	More than 24 hours	Less than one week	2.5
Extreme Cold	Unlikely	Minor	Negligible	More than 24 hours	Less than 24 hours	1.1
Flood	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	3.1
High Windstorms	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	3.1
Hurricane (including Tropical Storm and Kona Storm)	Likely	Catastrophic	Large	More than 24 hours	Less than 1 week	3.3
Landslide	Likely	Critical	Small	Less than 6 hours	Less than 6 hours	2.7
Tsunami	Likely	Critical	Large	Less than 6 hours	Less than 24 hours	3.2
Volcanic Hazards	Likely	Minor	Moderate	More than 24 hours	Less than one week	2.2
Wildfire	Likely	Catastrophic	Moderate	12 to 24 hours	Less than one week	3.2
HAZMAT	Likely	Limited	Negligible	Less than 6 hours	Less than 6 hours	2.2
Health Risks	Likely	Limited	Small	More than 24 hours	More than 1 week	2.4

Table 81. Summary of PRI Results for Lānaʻi.

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Coastal Erosion	Likely	Limited	Small	More than 24 hours	More than 1 week	**2.4**
Dam and Reservoir Failure	Unlikely	Minor	Negligible	6 to 12 hours	Less than 6 hours	**1.2**
Drought	Highly Likely	Minor	Moderate	More than 24 hours	More than 1 week	**2.6**
Earthquake	Possible	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.6**
Extreme Heat	Likely	Minor	Large	More than 24 hours	Less than one week	**2.3**
Extreme Cold	Unlikely	Minor	Negligible	More than 24 hours	Less than 24 hours	**1.1**
Flood	Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**2.8**

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
High Windstorms	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
Hurricane (including Tropical Storm and Kona Storm)	Possible	Critical	Large	More than 24 hours	Less than 1 week	**2.7**
Landslide	Possible	Limited	Small	Less than 6 hours	Less than 6 hours	**2.1**
Tsunami	Possible	Critical	Small	Less than 6 hours	Less than 24 hours	**2.5**
Volcanic Hazards	Possible	Minor	Small	More than 24 hours	Less than one week	**1.8**
Wildfire	Possible	Critical	Small	12 to 24 hours	Less than one week	**2.4**
HAZMAT	Possible	Limited	Negligible	Less than 6 hours	Less than 6 hours	**1.9**
Health Risks	Likely	Limited	Small	More than 24 hours	More than 1 week	**2.4**

Table 82. Summary of PRI Results for Makawao-Pukalani-Kula.

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Coastal Erosion	Unlikely	Minor	Negligible	More than 24 hours	More than 1 week	**1.3**
Dam and Reservoir Failure	Possible	Critical	Small	6 to 12 hours	Less than 6 hours	**2.3**
Drought	Highly Likely	Minor	Moderate	More than 24 hours	More than 1 week	**2.6**
Earthquake	Possible	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.6**
Extreme Heat	Likely	Minor	Large	More than 24 hours	Less than one week	**2.4**
Extreme Cold	Possible	Minor	Small	More than 24 hours	Less than 24 hours	**1.6**
Flood	Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**2.8**
High Windstorms	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
Hurricane (including Tropical Storm and Kona Storm)	Likely	Critical	Large	More than 24 hours	Less than 1 week	**3**
Landslide	Likely	Critical	Small	Less than 6 hours	Less than 6 hours	**2.4**
Tsunami	Unlikely	Minor	Negligible	Less than 6 hours	Less than 6 hours	**1.4**

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Volcanic Hazards	Likely	Minor	Moderate	More than 24 hours	Less than one week	**2.1**
Wildfire	Likely	Critical	Moderate	12 to 24 hours	Less than one week	**2.9**
HAZMAT	Possible	Limited	Negligible	Less than 6 hours	Less than 6 hours	**1.9**
Health Risks	Likely	Limited	Small	More than 24 hours	More than 1 week	**2.4**

Table 83. Summary of PRI Results for Moloka‘i.

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Coastal Erosion	Likely	Limited	Small	More than 24 hours	More than 1 week	**2.4**
Dam and Reservoir Failure	Possible	Limited	Small	6 to 12 hours	Less than 6 hours	**2.0**
Drought	Highly Likely	Minor	Moderate	More than 24 hours	More than 1 week	**2.6**
Earthquake	Possible	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.6**
Extreme Heat	Likely	Minor	Large	More than 24 hours	Less than one week	**2.4**
Extreme Cold	Unlikely	Minor	Negligible	More than 24 hours	Less than 24 hours	**1.4**
Flood	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
High Windstorms	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
Hurricane (including Tropical Storm and Kona Storm)	Likely	Catastrophic	Large	More than 24 hours	Less than 1 week	**3.3**
Landslide	Likely	Critical	Small	Less than 6 hours	Less than 6 hours	**2.7**
Tsunami	Likely	Catastrophic	Moderate	Less than 6 hours	Less than 6 hours	**3.3**
Volcanic Hazards	Possible	Minor	Small	More than 24 hours	Less than one week	**1.8**
Wildfire	Likely	Critical	Moderate	12 to 24 hours	Less than one week	**2.9**
HAZMAT	Possible	Limited	Negligible	Less than 6 hours	Less than 6 hours	**1.9**
Health Risks	Likely	Limited	Small	More than 24 hours	More than 1 week	**2.4**

Table 84. Summary of PRI Results for Pāʻia-Haʻikū.

Hazard	Category/Degree of Risk					
	Probability	**Impact**	**Spatial Extent**	**Warning Time**	**Duration**	**PRI Score**
Coastal Erosion	Highly Likely	Limited	Small	More than 24 hours	More than 1 week	**2.7**
Dam and Reservoir Failure	Possible	Critical	Small	6 to 12 hours	Less than 6 hours	**2.3**
Drought	Highly Likely	Minor	Moderate	More than 24 hours	More than 1 week	**2.6**
Earthquake	Possible	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.6**
Extreme Heat	Likely	Minor	Large	More than 24 hours	Less than one week	**3**
Extreme Cold	Unlikely	Minor	Negligible	More than 24 hours	Less than 24 hours	**1.1**
Flood	Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**2.8**
High Windstorms	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
Hurricane (including Tropical Storm and Kona Storm)	Likely	Critical	Large	More than 24 hours	Less than 1 week	**3**
Landslide	Likely	Limited	Small	Less than 6 hours	Less than 6 hours	**2.4**
Tsunami	Possible	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.7**
Volcanic Hazards	Likely	Minor	Small	More than 24 hours	Less than one week	**2.1**
Wildfire	Likely	Critical	Small	12 to 24 hours	Less than one week	**2.7**
HAZMAT	Possible	Limited	Negligible	Less than 6 hours	Less than 6 hours	**1.9**
Health Risks	Likely	Limited	Small	More than 24 hours	More than 1 week	**2.4**

Table 85. Summary of PRI Results for Wailuku-Kahului.

Hazard	Category/Degree of Risk					
	Probability	**Impact**	**Spatial Extent**	**Warning Time**	**Duration**	**PRI Score**
Coastal Erosion	Highly Likely	Limited	Moderate	More than 24 hours	More than 1 week	**2.9**
Dam and Reservoir Failure	Possible	Critical	Small	6 to 12 hours	Less than 6 hours	**2.3**
Drought	Highly Likely	Minor	Moderate	More than 24 hours	More than 1 week	**2.6**
Earthquake	Possible	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.6**

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Extreme Heat	Highly Likely	Limited	Large	More than 24 hours	Less than one week	**3.0**
Extreme Cold	Unlikely	Minor	Small	More than 24 hours	Less than 24 hours	**1.3**
Flood	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
High Windstorms	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
Hurricane (including Tropical Storm and Kona Storm)	Likely	Catastrophic	Large	More than 24 hours	Less than 1 week	**3.3**
Landslide	Likely	Critical	Small	Less than 6 hours	Less than 6 hours	**2.9**
Tsunami	Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**3.0**
Volcanic Hazards	Likely	Minor	Small	More than 24 hours	Less than one week	**2.1**
Wildfire	Likely	Critical	Moderate	12 to 24 hours	Less than one week	**2.9**
HAZMAT	Likely	Limited	Negligible	Less than 6 hours	Less than 6 hours	**2.2**
Health Risks	Likely	Limited	Small	More than 24 hours	More than 1 week	**2.4**

Table 86. Summary of PRI Results for West Maui.

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
Coastal Erosion	Highly Likely	Limited	Moderate	More than 24 hours	More than 1 week	**2.9**
Dam and Reservoir Failure	Possible	Critical	Small	6 to 12 hours	Less than 6 hours	**2.3**
Drought	Highly Likely	Minor	Moderate	More than 24 hours	More than 1 week	**2.6**
Earthquake	Possible	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.6**
Extreme Heat	Highly Likely	Limited	Large	More than 24 hours	Less than one week	**3.0**
Extreme Cold	Unlikely	Minor	Small	More than 24 hours	Less than 24 hours	**1.6**
Flood	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
High Windstorms	Highly Likely	Critical	Moderate	12 to 24 hours	Less than 24 hours	**3.1**
Hurricane	Possible	Catastrophic	Large	More than 24 hours	Less than 1 week	**3.0**

Hazard	Category/Degree of Risk					
	Probability	Impact	Spatial Extent	Warning Time	Duration	PRI Score
(including Tropical Storm and Kona Storm)						
Landslide	Likely	Critical	Small	Less than 6 hours	Less than 6 hours	**2.6**
Tsunami	Likely	Critical	Moderate	Less than 6 hours	Less than 6 hours	**2.5**
Volcanic Hazards	Possible	Minor	Small	More than 24 hours	Less than one week	**2.1**
Wildfire	Highly Likely	Critical	Moderate	12 to 24 hours	Less than one week	**3.2**
HAZMAT	Possible	Limited	Negligible	Less than 6 hours	Less than 6 hours	**1.9**
Health Risks	Likely	Limited	Small	More than 24 hours	More than 1 week	**2.4**

Hazard Ranking

The ranking of hazards was based on the PRI results and local stakeholder input. These were then reviewed by the Maui County Steering Committee and the public. Hazard rankings are intended to be used as a planning tool, and do not impact potential funding opportunities. Rankings are presented in the table below.

Table 87. Ranking of Hazards.

	Hāna	Kīhei-Mākena	Lānaʻi	Makawao-Pukalani-Kula	Molokaʻi	Pāʻia-Haʻikū	Wailuku-Kahului	West Maui	Maui County
Coastal Erosion	*Mod*	*High*	*Mod*	*Low*	*Mod*	*High*	*High*	*High*	*High*
Dam and Reservoir Failure	*Low*	*Low*	*Low*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*
Drought	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*
Earthquake	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*
Extreme Heat	*Mod*	*Low*	*Mod*	*Mod*	*Mod*	*High*	*High*	*High*	*Mod*
Extreme Cold	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*	*Low*

Flood	*High*	*High*	*High*	*High*	*High*	*High*	*High*	*High*	*High*
High Windstorms	*High*	*High*	*High*	*High*	*High*	*High*	*High*	*High*	*High*
Hurricane (including Tropical Storm and Kona Storm)	*High*	*High*	*High*	*High*	*High*	*High*	*High*	*High*	*High*
Landslide	*High*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*High*	*Mod*	*High*
Tsunami	*Mod*	*High*	*Mod*	*Low*	*High*	*High*	*High*	*Mod*	*High*
Volcanic Hazards	*Mod*	*Mod*	*Low*	*Mod*	*Low*	*Mod*	*Mod*	*Mod*	*Mod*
Wildfire	*Mod*	*High*	*Mod*	*High*	*High*	*High*	*High*	*High*	*High*
HAZMAT	*Low*	*Mod*	*Low*	*Low*	*Mod*	*Low*	*Mod*	*Low*	*Low*
Health Risks	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*	*Mod*

Key Findings on Vulnerability

In summary, all of the hazards addressed in this plan pose a threat to Maui County, including the assets and populations within. There are several factors that influence vulnerability, including building construction type, date of construction, social vulnerability, time of occurrence, location, and capacity to respond. The greatest hazards of concern to Maui County are flood, high wind, hurricane and tropical storms, landslides, and tsunamis.

Based on the risk and vulnerability assessment analysis and input from the community, key findings for each hazard include:

- **Coastal Erosion:**
  - Coastal roads and highways in Maui County are severely impacted by coastal erosion. Of note, Honoapiilani Highway in West Maui, Halama Street and South Kīhei Road in Kīhei-Mākena, and Kamehameha V Highway on Molokaʻi are impacted by coastal erosion.
  - Coastal erosion is taking a toll on Maui County beaches, which in turn can have negative impacts on tourism. Hardening coastlines to protect existing structures and roads may result in significant loss of Maui County beaches if they are not able to migrate inland due to hardening or armoring.
  - Sea level rise will continue to exacerbate rates of coastal erosion in the future.
- **Dam and Reservoir Failure:**
  - While dam failure is a low frequency hazard in Maui County, it is considered high consequence given number of dams classified as high hazard within the county (meaning a failure or mis-operation will probably cause loss of human life).
- **Drought:**

  - Drought conditions have been prevalent in Maui County every year over the last 20 years. Drought will likely increase due to climate change impacts, which threatens water supply and increases the likelihood of saltwater intrusion and wildfires.
- **Earthquake:**
  - Maui County is susceptible to damaging earthquakes. Recently, the 2006 Kiholo Bay (6.7M) and Mahukona (6.0M) earthquakes caused landslides and rockfalls, resulting in $28.1 million in damages.
- **Extreme Cold:**
  - Most extreme cold events impact the summit of Haleakalā, which houses telecommunications equipment. Icy conditions on the summit can disrupt telecommunications and broadcasting and cause dangerous traffic conditions when residents and visitors flock to the summit to see the snow.
- **Extreme Heat:**
  - Due to climate change, average temperatures in Maui County are projected to increase 2-3°F by the mid-21st century and 5-6°F by the late-21st century under a high emissions scenario. Maui County had one of its worst heat waves in recorded history in 2019.
  - Extreme heat events will likely disproportionately affect Maui County's most vulnerable populations, such as the elderly, those in substandard housing, and those without access to air conditioning.
- **Flood:**
  - **Inland flooding**: Maui County's existing stormwater infrastructure is aging, and generally not equipped to handle current and future levels of stormwater runoff, especially as rainfall events intensify with climate change and continued developed adds impervious cover.
  - **Inland flooding**: Road closures due to flash flooding and flooding at gulches is common in Maui County. Of note, Piilani Highway, Hāna Highway, and Ulaino Road in Hāna, Maunaloa Highway on Molokaʻi, and Honoapiilani Highway in West Maui experience frequent closures.
  - **Inland flooding**: Flooding in the Iao Valley along the Wailuku River has historically been problematic. The worst recent event was a September 2016 event that resulted in $15 million in damages and a disaster declaration for the county.
  - **Coastal Flooding**: Sea level rise contributed to coastal erosion and shoreline change. It also pushes high wave flooding and King Tide flooding farther inland.
  - **Coast Flooding:** Roads in sea level rise hazards areas (based on data from PacIOOS) include Honoapiilani Highway (near Lahaina), Lower Honoapiilani Road near Kahana (county-owned), North and South Kīhei Road, Hāna Highway in Pāʻia-Haʻikū, and Maunaloa Highway on Molokaʻi.
  - **Coastal Flooding:** Sea level rise and other forms of coastal flooding contribute to saltwater intrusion into groundwater sources, stormwater infrastructure, and freshwater rivers and streams.

- **High Windstorm**
  - Maui County experiences several significant high windstorm events per year, includes those associated with storms (thunderstorms, Kona lows, tropical storms, and hurricanes) and trade winds.
  - Impacts include power outages, downed trees blocking roads, and damage to buildings (i.e., roofs being torn off).
- **Hurricane and Tropical Storms (including Kona storms)**
  - Storm surge is often the greatest threat to life and property during a hurricane or tropical storm.
  - In 2018, Hurricane Lane dumped record-breaking rainfall (up to 25 inches in eastern Maui) and caused flooding, landslides, and washed-out roads. In West Maui, winds from Hurricane Lane fanned wildfires.
  - Also, in 2018, Tropical Storm Olivia became the first hurricane or tropical storm to make landfall in Maui County in recorded history, making landfall on both the Island of Maui and the Island of Lānaʻi. Olivia caused widespread power outages, flooding, landslides, and prompted evacuations in Maui County.
  - Hurricanes and tropical storms will likely become more frequent in the central Pacific due to climate change. Warmer ocean temperatures may contribute to the rise, as will the projected doubling of El Niño and La Niña extremes in the 21st century compared to the 20th century. Hurricane formation in the central Pacific is heightened during El Niño years.
  - Kona storms have similar impacts as hurricanes in Maui County. Kona storms form during the cool season when a low-pressure system is cut off from the jet stream. In recent years, a Kona storm in 2007 had significant impacts in Maui County, causing debris flows and flooding that resulted in destroyed homes, swift water rescues, and road damage.

- **Landslides**
  - Rockfalls, mudslides, and debris flows are common in Maui County, and typically occur during intense rainfall events.
  - Piilani, Honoapiilani, and Hāna Highways are most notable for landslide closures in the county.
  - Damage to roads or bridges can last for months or years and can often cut off residents that rely on a singular route. For instance, in 2006 500 Maui residents were isolated due to a landslide resulting in a bridge closure at Paihi.
  - Landslide occurrences are likely to increase as intense rainfall events increase with climate change. Wildfire burn areas are also more susceptible to landsliding.
- **Tsunami**
  - Tsunami is one the deadliest hazards to threat Maui County.

  - The worst tsunami threat in Maui County is from an earthquake in the Aleutian Islands in Hawai'i (considered an "extreme tsunami").
  - The most notable tsunamis in Maui County occurred in 1946 (highest wave heights, most deadly with 14 deaths), 1960 (destroyed structures and resulted in a disaster declaration), and 2011 (most costly, with $6.4 million in damages).
  - Sophisticated warning systems are in place, but locally generated tsunamis may leave very little time for residents to evacuate, especially vulnerable populations.
- **Volcanic**
  - Eruptions of Haleakalā are rare, Maui County may experience vog events from eruptions on neighboring islands.
- **Wildfire**
  - Wildfires occur annually in Maui County and can impact all community planning areas. However, West Maui has the highest prevalence of wildfire events. Drier leeward areas are more susceptible to wildfires than windward areas that receive moisture from trade winds.
  - Wildfires will likely become more frequent as warming occurs and drought frequency increases.
- **Hazardous Materials Incidents**
  - Historically, mobile and fixed-site hazardous materials events have had a low frequency of occurrence in Maui County. Both report mobile hazardous materials incidents occurred in the Wailuku-Kahului community planning area, Maui Island's most urbanized area.
- **Health Risks**
  - Maui County's tropical climate makes county vulnerable to mosquito-borne diseases
  - The county's tourism industry means the county receives visitors from all over the world, increasing its vulnerability to infectious diseases. Similarly, the county's reliance on tourism makes the county economically vulnerable to pandemics that reduce leisure travel, such as the COVID-19 pandemic.

Chapter 5. Capability Assessment

The purpose of conducting a capability assessment is to determine the ability of a local jurisdiction to implement a comprehensive mitigation strategy, and to identify opportunities for enhancing specific mitigation policies, programs, or projects. As in any planning process, it is important to try to establish which mitigation goals and actions are feasible based on an understanding of the organizational capacity of those agencies or departments tasked with their implementation. A capability assessment helps to determine which types of mitigation actions are practical and likely to be implemented based on a local government's existing authorities, policies, programs, and resources available to support such implementation.

A capability assessment has two primary components: an inventory of a local jurisdiction's relevant plans, ordinances, programs, or activities already in place; and an analysis of its current capacity and resources to carry them out. A careful examination of local capabilities will detect any existing gaps, shortfalls, or weaknesses associated with ongoing government activities that could hinder proposed mitigation activities and possibly even exacerbate hazard vulnerability. A capability assessment also highlights the positive mitigation measures already in place or being implemented at the local community level, which should be leveraged and continue to be supported and enhanced through future mitigation efforts.

The capability assessment serves as a foundational component of the planning process, including the development of an effective hazard mitigation strategy. Coupled with the risk and vulnerability analysis (Chapter 4), the capability assessment helps identify and target meaningful mitigation actions for incorporation into the mitigation strategy. It not only helps establish the goals for Maui County to pursue under this plan, but also ensures that those goals and the mitigation actions that follow are realistically achievable under current local conditions.

Methodology

This capability assessment for Maui County builds upon the assessment completed as part of the previous plan update. As part of that process the planning team had performed an inventory and analysis of existing authorities and capabilities in 2015, the results of which were summarized in a series of informational tables. These tables have been updated for the 2020 plan and are organized in this section according to the following primary types of capabilities:

- Planning and Regulatory
- Administrative and Technical
- Financial
- Education and Outreach
- NFIP and CRS

To help with the updated capability assessment for Maui County, in-person interviews and a series of survey instruments were used with County staff. These surveys included general questionnaires on the County's primary types of capabilities as identified above, in addition to a National Flood Insurance Program (NFIP) Survey and Safe Growth Survey and as described below.

National Flood Insurance Program (NFIP) Survey

The NFIP Survey was designed to help gather information from Maui County's Floodplain Manager to describe the current status of its participation in the NFIP, including existing floodplain management programs and continued compliance with federal requirements and standards. The NFIP contains specific regulatory measures that enable government officials to determine where and how growth occurs relative to identified flood hazards. In return for meeting minimum regulatory standards, communities make the purchase of flood insurance through the NFIP available to its property owners. Participation in the NFIP is voluntary but is promoted by FEMA as a critical means to not only make flood insurance available to community residents, but also to implement and sustain an effective, long-term hazard mitigation program aimed at reducing future flood losses.

Safe Growth Survey

As part of the planning process, key staff from the County's Planning Department were asked to complete a Safe Growth Survey. This unique survey instrument was drawn from a technique recommended by FEMA and the American Planning Association (APA) to help better evaluate the extent to which Maui County is positioned to grow safely relative to its natural hazards. The survey covered several distinct topic areas including the following:

- General Plan
    - Land Use
    - Transportation
    - Environmental Management
    - Public Safety
- Zoning Ordinance
- Subdivision Regulations
- Capital Improvement Program and Infrastructure Policies

The Safe Growth Survey was used to provide some measure of how adequately existing planning mechanisms and tools for Maui County were being used to promote hazard mitigation. In addition, the survey instrument was aimed at furthering the integration of hazard risk management into the local community planning framework through potentially new mitigation actions as it relates to those plans, policies or programs already in place or under development. It is anticipated that the Safe Growth Survey will be used again by the County during future plan updates to help measure progress over time and to continue identifying possible mitigation actions relating to future growth and community development practices, and how such actions may better be incorporated into local planning mechanisms.

Review and Incorporation of Existing Plans

> *A4. Does the plan describe the review and incorporation of existing plans, studies, reports, and technical information? (Requirement 201.6(b)(3))*

Following completion of the aforementioned surveys, the planning team conducted a more detailed review of existing plans, policies, and other relevant documents to gain a better understanding of their potential effects on hazard vulnerability and risk reduction. This included but was not limited to the following list of key plans, studies, reports, and technical information:

- *Maui County General Plan 2030, including:*
  - *Countywide Policy Plan (2010)*
  - *Maui Island Plan (2012)*
- *Maui County Community Plans:*
  - *Hāna (1994)*
  - *Kahoʻolawe (1995)*
  - *Kīhei – Makena (1998)*
  - *Lānaʻi (2016)*
  - *Makawao - Pukalani – Kula (1996)*
  - *Moloka'i (2018)*
  - *Pāʻia – Haʻikū (1995)*
  - *Wailuku – Kahului (2002)*
  - *West Maui (2019 Draft)*
- *Maui County Operating and Capital Budget (2020)*
- *Maui County Transportation Improvement Program (2019–2022)*
- *Maui County Wildfire Protection Plans:*
  - *Moloka'i Community Wildfire Protection Plan (2016)*
  - *South Maui Community Wildfire Protection Plan (2016)*
  - *Upcountry Maui Community Wildfire Protection Plan (2016)*
  - *Western Maui Community Wildfire Protection Plan (2014)*
- *Maui County Zoning Ordinance (Title 19 of County Code, last updated in 2018)*
- *Guidance for Disaster Recovery Preparedness in Hawai'i (2019)*
- *Hawai'i Sea Level Rise Vulnerability and Adaptation Report (2017)*
- *State of Hawai'i Natural Disaster Economic Recovery Strategy (2014)*
- *State of Hawai'i Hazard Mitigation Plan (2018)*
- *Title 19 Zoning Code Audit Report (2018)*

Planning and Regulatory Capabilities

C1. Does the plan document each jurisdiction's existing authorities, policies, programs and resources and its ability to expand on and improve these existing policies and programs? (Requirement 201.6(c)(3))

a. Does the plan document each jurisdiction's existing authorities, policies, programs and resources?

b. Does the plan document each jurisdiction's ability to expand on and improve these existing policies and programs?

Planning and regulatory capabilities include those based on Maui County's implementation of ordinances, policies, local laws and State statutes, and plans and programs that relate to guiding and managing future growth and development, in addition to those related to emergency preparedness, response, and recovery. Table 88 provides a listing and brief summary of these relevant capabilities.

Table 88. Planning and Regulatory Capability

Planning/Regulatory Tool	Local Authority	Citation / Comments
Codes, Ordinances and Requirements		
Building Code	Yes	Maui County Code, Title 16: Buildings and Construction – Chapter 16.26B – Building Code, International Building Code 2006 as amended (last updated Ord. No. 3928, § 3, 2012) *Comments: The current code is outdated and was identified as a significant concern by the planning team for ongoing/new construction. The County must amend and adopt the current State Building Code (2018 IBC, 2018 IRC, and 2018 IEBC, with amendments) by August 31, 2021 as its local county code; however, this will also require more training and capacity building for the County's inspectors. Another issue identified by the planning team was that adopting the new codes will make construction more expensive, making it somewhat of a controversial issue for Maui County due to already higher costs of shipping construction materials to the island.*
Zoning Code	Yes	Maui County Code, Title 19 – Zoning, Article 1. Interim Zoning Provisions (Ord. No. 3661, § 2, 2009), Article II. Comprehensive Zoning Provisions (last updated Ord. No. 4933, § 1, 2018) *Comments: Originally adopted in 1960 and maintained through numerous targeted amendments. The County will soon do a complete rewrite of Title 19 as recommended following a*

		comprehensive audit performed in 2018, with potentially new standards related to climate adaptation. See Safe Growth Survey for additional information.
Subdivisions	Yes	Maui County Code Title 18 – Subdivisions (last updated Ord. No. 4053, § 1, 2013) *Comments: Regulations provide for conservation/cluster subdivisions but do not currently allow density transfers where hazard areas exist.*
Stormwater Management	Yes	Maui County Code, Title 18, Chapter 20.135 – Post-construction stormwater quality best management practices (Last updated Ord. No. 4053, § 34, 2013); Title 16, Chapter 26B.3900 – Post-construction Stormwater Quality Best Management Practices (last updated Ord. No. 3928, § 3, 2012) *Comments: County has noted that drainage plans are inconsistent, and future plans will have significant areas.*
Post-Disaster Recovery	Yes	Hawai'i Revised Statues Title 10. Public Safety and Internal Security, 127; Title 13. Planning and Economic Development, 209
Real Estate Disclosure	Yes	Hawai'i Revised Statues Title 28. Property, 508D; Special Flood Hazard Area and Tsunami Inundation Area Disclosure *Comments: The Hawai'i Association of Realtors provides a standard form to members which includes disclosure of hazard-related risks and damages from past events.*
Growth Management	Yes	Hawai'i Revised Statues Title 13. Planning and Economic Development, 223 and 226
Site Plan Review	Yes	Maui County Code, Title 12 – Landscape Planting and Beautification (last updated Ord. 2268 § 2, 1993); Title 16 – Buildings and Construction, Chapter 16.26B Building Code (last updated Ord. No. 3928, § 3, 2012) *Comments: Includes new procedures relating to flood zones and shoreline setbacks to account for sea level rise.* *County to help facilitate additional mitigation measures based on more vulnerability assessments.*
Public Health and Safety	Yes	Maui County Code, Title 8 – Health and Safety
Environmental Protection	Yes	Maui County Code, Title 20 – Environmental Protection; Hawai'i Revised Statues Title 19. Health, 344
Climate Emergency Proclamation	Yes	Resolution 19-209 – Acknowledging a Climate Emergency and Committing to an Immediate Just Transition and Emergency Mobilization Effort to Restore a Safe Climate. *Comments: Establishes the County Council's recognition of ""a climate emergency, which threatens humanity and the natural world" and commitment to a "Just Transition" to a safe climate. It also committed the County to issue a Climate Change Directive to*

		all County departments and agencies (see below) and to develop a Climate Action Plan and Resilience Strategy, among other measures.
Climate Change Directive	Yes	The Climate Change Directive requires all departments and agencies under the Mayor's jurisdiction to take several actions to address, minimize risks from, and adapt to the impacts of climate change and sea level rise. *Comments: Actions include but are not limited to viewing climate change and the need for mitigation and adaptation as an urgent matter, and to work cooperatively to develop and implement land use policies, hazard mitigation actions, and design and construction standards that mitigate and adapt to the impacts of climate change and sea level rise.*
Climate Change Adaptation	Yes	Maui County Climate Action and Resilience Committee – established by County Council in December 2019. *Comments: This new committee will address issues related to sea level rise, deforestation, pollution, energy issues, and protecting the natural environment.*
Statewide Climate Adaptation Policy	No	Section 226-109, Hawai'i Revised Statutes – amends the Hawai'i State Planning Act to require consideration of climate change in land use, capital improvement, and program decisions made by State agencies and all four counties.
Climate Change Mitigation and Adaptation	No	The Hawai'i Climate Change Mitigation and Adaptation Commission was created in 2017 and meets on a quarterly basis. The Commission is tasked with developing vulnerability and adaptation reports relating to the effects of sea level rise and additional duties relating to both climate change mitigation and adaptation.
Sea Level Rise	No	Hawai'i Sea Level Rise Vulnerability and Adaptation Report – published in December 2017. This report provides the first state-wide assessment on Hawai'i's vulnerability to sea level rise. It includes recommendations to reduce exposure and sensitivity to sea level rise and to increase capacity to adapt. *Comments: By proclamation, the Maui County Mayor has directed County Departments to use this report in their plans, programs, and capital improvement decisions and to mitigate impacts to infrastructure and critical facilities.*
Planning Documents		
General or Comprehensive Plan	Yes	General Plan 2030: Countywide Policy Plan, Maui Island Plan, Community Plans (9). *Comments: Recent amendments/updates include emphasizing a diversified economy and the protection of natural and cultural resources. See Safe Growth Survey for additional information.*

Capital Improvement Plan	Yes	Maui County Code Title 3, Chapter 3.04.040 – Capital Program (last updated Ord. 1731 § 1 (part), 1988: Ord. 1438 § 2 (part), 1984) *Comments: The CIP addresses public infrastructure projects that include a permanent improvement or betterment as distinguished from ordinary repair or current maintenance. See Safe Growth Survey for additional information.*
Floodplain Management Plan	Yes	Maui County's 2020 Multi-Hazard Mitigation Plan will continue to serve as a CRS-credited Floodplain Management Plan.
Stormwater Plan	Yes	Maui Storm Water Management Program Plan; prepared in accordance with Hawai'i Administrative Rules, Chapter 11-55 Appendix K for Kahului, Maui – File No. HI 14KE352
Habitat Conservation Plan	Yes	Approved Habitat Conservation Plans online at: http://dlnr.Hawai'i.gov/wildlife/hcp/approved-hcps/ Draft Habitat Conservation Plans online at: http://dlnr.Hawai'i.gov/wildlife/hcp/draft-hcps/
Economic Development Plan	Yes	Maui General Plan 2030, Economic Development Elements; Hawai'i Comprehensive Economic Development Strategy, 2010
Shoreline Management Plan	Yes	Hawai'i Coastal Zone Management Program; Ocean Resources Management Plan, July 2013; Shoreline Access Inventory Update, March 2005; Beach Management Plan, June 2008
Community Wildfire Protection Plan (CWPP)	Yes	Currently CWPPs are in place for Moloka'i, South Maui, Upcountry, and Western Maui. *Comments: The CWPPs primarily focus on identifying and prioritizing the areas and methods for hazardous fuel reduction treatments and other measures to reduce the ignitability of structures throughout the planning areas.*
Climate Change	No	Fourth National Climate Assessment, Volume II: Impacts, Risks, and Adaptation in the United States – Hawai'i and U.S. Affiliated Pacific Islands, 2018; Climate Change Impacts in Hawai'i: A summary of Climate Change and Its Impacts to Hawai'i Ecosystems and Communities, 2014
Response/Recovery Planning		
Emergency Operations Plan	Yes	County of Maui Emergency Operations Plan, 2009
Threat & Hazard Identification & Risk Assessment (THIRA)	No	Maui County's THIRA is maintained by the State (HIEMA).
Catastrophic Hurricane Framework	Yes	County of Maui Catastrophic Hurricane Response Framework, 2014
Post-Disaster Recovery Plan	No	Post-Disaster Reconstruction Guidelines and Protocols for Conservation of Coastal Resources and Protection of Coastal Communities; Natural Disaster Economic Recovery Strategy, December 2014

Guidance for Disaster Recovery Preparedness in Hawai'i	No	This project works with state and county government to establish resilience-focused recovery practices before a disaster hits to enable communities to recover quickly while also adapting to sea level rise and protecting sensitive coastal environments through a guidance document, model resources, and outreach.

Administrative and Technical Capabilities

Administrative and technical capabilities include those associated with Maui County's existing staff and personnel resources and their skills and tools that can be used for mitigation planning and to implement specific mitigation actions. It also refers to the ability of Maui County to access and coordinate these resources effectively. Table 89 provides a listing and brief summary of these relevant capabilities.

Table 89. Administrative and Technical Capability

Staff/Personnel Resources	Available?	Department/Agency
Hazard mitigation specialists	Yes	Maui County Emergency Management Agency (Hazard Mitigation Officer)
Hazard mitigation planning committee	Yes	Hazard Mitigation Plan Steering Committee
Planners or engineers with knowledge of land development and land management practices	Yes	Maui County Planning Department; Development Services Administration, Maui County Department of Public Works
Engineers or professionals trained in building or infrastructure construction practices	Yes	Development Services Administration, Maui County Department of Public Works
Planners or engineers with an understanding of natural hazards	Yes	Maui County Planning Department
Staff with training in benefit/cost analysis	Yes	Maui County Emergency Management Agency
Surveyors	Yes	Engineering Division, Maui County Department of Public Works
Personnel skilled or trained in GIS applications	Yes	Maui County GIS Program – Geographic Analysis and Cartographic Services
Scientist familiar with natural hazards in local area	Yes	Pacific Disaster Center
Emergency manager	Yes	Maui County Emergency Management Agency; Pacific Disaster Center
Floodplain manager	Yes	Maui County Planning Department
Grant writers and/or resource development specialists	Yes	Emergency Management Officer, Maui County Emergency Management Agency

Financial Capabilities

Financial capabilities refer to the fiscal resources that Maui County has access to or is eligible to us to fund hazard mitigation actions, including but not limited to capital projects.

Table 90 provides a listing and brief summary of these relevant capabilities.

Table 90. Financial Capability

Financial Resources	Accessible/Eligible to Use?	Comments
General Fund	Yes	The General Fund accounts for all financial resources except those required to be accounted for in another fund. General funds are used to provide the most basic of county services: police, fire, parks, culture, economic development, and general government.
Special Revenue Funds	Yes	Maui County's Special Revenue Funds were established to account for the proceeds of specific revenue sources that are legally restricted or committed to expenditure for specified purposes. They include the Highway Fund, Sewer Fund, Grant Revenue Fund, Bikeway Fund, and Solid Waste Fund.
Capital Improvement Project Funds	Yes	This fund accounts for the financial resources to be used for the acquisition or construction of various major capital facilities and other public infrastructure needs of the county including government facilities, roads, sewer systems, parks, drainage systems, and more. There are many factors that determine how a capital project is funded and administered each fiscal year, but they are all outlined in the County's six-year Capital Improvement Program (CIP) plan.
Enterprise Funds	Yes	Revenue from these funds are generally limited to expenses for the operation, maintenance and capital improvement projects of the Department of Water Supply.
Agency Funds	Yes	These funds are used to account for other monies collected in an agency capacity and include motor vehicle registration fees collected on behalf of the State of Hawai'i and taxes withheld from employee pay.

Debt Service Funds	No	The Debt Service Fund accounts for the accumulation of resources necessary to pay principal and interest payments on general long-term debt obligations and is shown in the county's financial statements.
Emergency Fund	Yes	The Emergency Fund was established in FY-2005 for the purpose of building fund balances that will allow the County to recover funds more quickly or more effectively in the event of a natural disaster or state emergency.
Incur Debt through Private Activity Bonds	No	Debt financing can include general obligation bonds, revenue bonds, lease/purchase agreements, special obligation bonds, or any other financing instrument allowed under Hawai'i Statutes. Maui County's Debt Policy confines long-term borrowing to capital assets or equipment that cannot be financed from current financial resources. Debt is only to be incurred when necessary and utilizes pay-as-you go financing to the extent possible.
Development Impact Fees for Homebuyers or Developers	Yes	Impact fees are generally designed to mitigate the impact of new development on infrastructure and public facility systems. Impact fees are one-time payments made by the development, though fees are typically passed on to either the seller of land or homebuyers to pay for the cost of infrastructure caused by new development.
Special Taxing Districts	Yes	Special Taxing Districts can be established to help fund regional infrastructure projects. The purpose of these Districts is to create a predictable revenue stream that can pay for all or a portion of the debt service associated with large capital projects.
Federal, State, and other Non-County Sponsored Grant Programs	Yes	The County is eligible and continues to leverage a variety of Federal and State grant funding sources to support the implementation of hazard mitigation actions. This includes but is not limited to FEMA's Hazard Mitigation Assistance (HMA) and similar programs administered by the State.

Education and Outreach Capabilities

Education and outreach capabilities refer to the educational outreach and engagement methods already in place for Maui County that could be used to implement hazard mitigation activities and communicate hazard-related information. Table 91 provides a listing and brief summary of these relevant capabilities.

Table 91. Education and Outreach Capability

Program/Organization	Yes/No	Comments
Local citizen groups or non-profit organizations focused on environmental protection, emergency preparedness, access and functional needs populations, etc.	Yes	Maui County's Citizen Corps Council drives local citizen participation by coordinating Citizen Corps programs, developing community action plans, assessing possible threats, and identifying local resources. The County's Community Emergency Response Team (CERT) Program educates people about disaster preparedness for hazards that may impact their area and trains them in basic disaster response skills, such as fire safety, light search and rescue, team organization, and disaster medical operations.
Ongoing public education or information program (e.g., responsible water use, fire safety, household preparedness, environmental education)	Yes	The "Maui Ready" website helps people in Maui County—residents and visitors alike—learn how to be prepared for and stay safe from natural disasters and health hazards. MEMA sponsors many public education and outreach programs and also maintains a Disaster Preparedness Guide to inform the public about how to prepare for a disaster and cope with the aftermath. The Planning Department's Flood Information website provides detailed information about flood risk and risk reduction measures.
Natural disaster or safety-related school programs	Yes	The County has been working with school complexes to develop a hazard awareness component for middle and high school curriculums (ongoing action/not completed).
StormReady®	Yes	Participating community since 2001
TsunamiReady®	Yes	Participating community since 2004
Firewise USA®	Yes	Participating sites include Kahikinui, Kula; Launiupoko, Lahaina; Paniolo Hale, Maunaloa; and Waiohuli, Kula
Public-private partnership initiatives addressing disaster-related issues	Yes	Examples include Maui Voluntary Organizations Active in Disaster (VOAD) and the Pacific Disaster Center (PDC). Maui VOAD consists of nonprofits, faith-based, and community organizations, as well as government and private sector partners that voluntarily choose to provide some form of disaster-related services throughout the county. Members attend monthly meetings at the PDC in Kīhei. The PDC is an applied science, information and technology center, working to reduce disaster risks and impacts on life, property, and economies worldwide. Although PDC serves a global audience

		it is headquartered in Maui County and serves as a unique resource to increase local disaster management capacity.

NFIP and CRS Capabilities

> *C2. Does the plan address each jurisdiction's participation in the NFIP and continued compliance with NFIP requirements, as appropriate? (Requirement 201.6(c)(3)(ii))*

The National Flood Insurance Program (NFIP) provides federally backed flood insurance in exchange for communities enacting floodplain regulations. Participation and good standing under NFIP are prerequisites for community residents to obtain policies through the NFIP and for local jurisdictions to be eligible for federal grant funding under the Robert T. Stafford Act. Maui County has participated in good standing with the NFIP since 1981 and continues to adopt regulations that meet the NFIP requirements. As of this plan writing, there are more than 12,000 NFIP policies in force in Maui County with total coverage of more than $2.6 billion and over $7.4 million in total annual premiums. Table 92 provides a brief summary of the County's current NFIP compliance.

Table 92. NFIP Compliance

What local department is responsible for floodplain management?	**Department of Planning**
Who is your floodplain administrator? (position)	County of Maui Floodplain Manager
Are any certified floodplain managers on staff in your jurisdiction?	Yes
What is the date of adoption of your flood damage prevention ordinance?	Title 19, Chapter 19.62 (Ord. 2223 § 1 (part), 1993: Ord. 1145 § 2 (part), 1981)
When was the most recent Community Assistance Visit or Community Assistance Contact?	11/24/2015 *(last CRS Verification Visit held on 4/7/2020)*
Does your jurisdiction have any outstanding NFIP compliance violations that need to be addressed?	No
• **If so, please state what they are.**	N/A
Do your flood hazard maps adequately address the flood risk within your jurisdiction?	Yes
• **If no, please state why.**	N/A
Does your floodplain management staff need any assistance or training to support its floodplain management program?	Having more County staff trained on NFIP in general would be helpful
• **If so, what type of assistance/training is needed?**	See responses to NFIP Survey for more details

The Community Rating System (CRS) is a voluntary, incentive-based program that recognizes and rewards floodplain management activities that exceed the minimum standards of the NFIP. Communities participating in CRS receive discounted premium rates for all resident NFIP policyholders to reflect the reduced flood risk resulting from community actions. Maui County joined the CRS in 1995 and currently participates as a Class 7 community, resulting in a 15 percent reduction in flood insurance premiums for properties within Special Flood Hazard Areas (SFHAs) and a 5 percent reduction for properties outside of SFHAs. In total these discounts result in a total of nearly $1 million in annual savings on premiums paid by NFIP policyholders. The County is committed to maintaining its current CRS participation and is aiming to improve to a CRS Class 6 community in the coming years.

In addition to the basic NFIP and CRS information provided above, the County's Floodplain Manager provided many more specifics on the administration of these programs in response to the NFIP Survey. Table 93 provides a brief summary of this additional information on the County's current NFIP, CRS and other local floodplain management capabilities. Complete and detailed responses to the survey were also used by the planning team during the development of the mitigation strategy, particularly as it relates to the County's continued compliance with NFIP and CRS requirements and the review of possible new flood mitigation activities to include in the updated plan.

Table 93. NFIP Survey

Examples of Maui County's "higher regulatory standards" that exceed NFIP minimum requirements.
• **Freeboard of 1 foot (BFE + 1') for new and substantial improvement construction in all SFHAs except zone AO** • **Cumulative substantial improvement requirements (10-year lookback period)** • **Enclosure limits (usable solely for vehicular parking, building access, or storage)**
Additional floodplain management provisions that are integrated into other plans or processes that the County uses to guide development**.**
• **Multiple goals, objectives, policies and actions are identified in the Maui Island Plan, including incentives that minimize development in flood hazard areas.**
Additional floodplain management activities that Maui County performs that exceed minimum standards of the NFIP.
• **CRS credit is provided for furnishing inquirers with basic flood zone information from the community's latest Flood Insurance Rate Map (FIRM). Credit is also provided for the community furnishing additional FIRM information, flood depth data and special flood related hazards (coastal erosion and tsunami zones). The service is publicized annually, and records are maintained.** • **CRS credit is provided for general outreach projects that include evacuation route signs, no dumping signs and "Subject to Flooding" signs. These projects are disseminated annually.** • **A wide range of flood hazard data and information is displayed on the community's "Flood Information" website at https://www.mauicounty.gov/2170/Flood-Information. Documents relating to floodplain management are also available in the reference section of the Wailuku Public Library.**

- **The County enforces additional regulations for stormwater management, soil and erosion control, and water quality.**

Existing impediments and/or improvements needed to run an effective floodplain management program in the community.

- **A lack of dedicated staff for the flood program and high turnaround has been an impediment to running a smoother program. The County has had multiple people over the past few years step in and be in charge of the flood program, and lack of a consistent team organizing and managing its activities has led to many inefficiencies and unaddressed gaps in performance. Currently, the County's Floodplain Administrator manages most of the flood permit reviews, most flood-related public inquiries, the majority of NFIP/CRS administrative work (recertifications, audits), as well as any other flood-related issues (variances, outreach, attending the state NFIP conference, etc.). Having a dedicated team of 2 or 3 NFIP-trained individuals working solely on the flood program would provide for enough staff hours to deal with pending items (the substantial backlog of flood permits), while also having time to make improvements and prepare in advance for future audits.**
- **On a larger institutional level, the flood program should technically be in the Department of Public Works (DPW), where it originally once was. Since DPW is responsible for granting building permits and conducting building inspections, it makes more sense for the County's flood ordinance to be enforced by them as part of the work they are already conducting (reviewing building plans, on-site inspections, etc.). This would lead to better program integration and increased collaboration for code enforcement across floodplain management and building permit procedures.**
- **There is an issue of departments working in silos and not collaborating on meeting common sustainable development goals. For example, there are activities that the Stormwater Management division at DPW does (i.e. MS4) that could count for CRS credit if tracked adequately, but they are not often aware of this and may not see it as their responsibility. Similarly, there are watershed management programs that the Department of Water Supply supports that could count for CRS credit, but since the flood program exists within Planning, they might not want to take on any more responsibilities to track the data required for that credit.**
- **On the technological level, the County is currently using an extremely outdated permit tracking system called Kiva made by Accela. All of the work done on any permit is tracked on Kiva (creating the permit, reviewing, comments, scope, inspections, approval dates, etc.). However, this software is extremely old and awkward and is no longer supported by Accela due to their being more modern alternatives. The County is currently in the process of transitioning to a newer digital platform called MAPPS, which will help with database management and organizational efficiencies on a project basis (linking flood permits with corresponding building permits, etc.).**

Additional actions that Maui County should take related to continued compliance with the NFIP.

- **Having more rigorous permit procedures (i.e. written-out protocols for all flood permit inspectors to follow when receiving a new permit, making comments, approving permits, etc.) would help achieve more internal consistency within the department. As of now, some flood permits get approved, but the permit inspector may not upload the digital files to the County's**

network or forget to physically sign the approval page for proper recordkeeping. This is the lowest hanging fruit, since we can make those changes internally without having to wait on expensive new software or collaboration with other departments.

- **Working with DPW and their building inspectors to make sure that they DO NOT approve a final building inspection until flood program staff have reviewed the final elevation certificate for NFIP compliance (verify that finished 1st floor elevation is at BFE+1 and flood vents/breakaway walls have been adequately placed).**
- **Moving to the MAPPS digital platform would help us tremendously on the administrative side, since browsing and organizing old flood permit records currently is very time-consuming.**
- **As higher hanging fruit, having DPW coordinate with ISO on the Building Code Effectiveness Grading Schedule (BCEGS) and/or incorporate flood ordinance language into the County's administration of the building code would be highly beneficial. This may not happen any time soon, and probably will take the flood program being transferred to DPW before they consider it, but it is a major component that needs to be addressed at some point.**

Additional potential actions related to NFIP compliance may include:

- **Improve methods for requesting and reviewing finished construction information for Elevation Certificates (i.e. have Public Works building inspectors demand the final EC prior to final inspection approval).**
- **Develop a checklist for review of building/development permit plans and for inspection of development in floodplains.**
- **Establish a goal to have each plan reviewer and building inspector attend a related training periodically (for example, ASFPM's Annual National Conference, chapter conferences, webinars, etc.), contingent on available funding for travel and training costs.**
- **Sponsor a periodic NFIP workshop for local surveyors and builders, depending on available staff hours and ability to organize a community meeting.**
- **Encourage or require more County staff positions to obtain and maintain Certified Floodplain Manager (CFM) certification, ideally having 2-3 dedicated CFMs optimizing the flood program.**
- **Maintain a map of areas that flood frequently (e.g., areas where repetitive loss properties are located) and prioritize those areas for inspection immediately after the next flood. If outside FEMA special flood hazard areas, consider requiring existing NFIP regulatory standards (compliance with existing ordinance) through overlay zoning, etc.**
- **Hold more informative sessions for newly elected officials and new appointees to planning commissions and appeals/variance boards, to provide an overview of floodplain management, the importance of participating in the NFIP, and the implications of failing to enforce the requirements of the program or failing to properly handle variance requests.**
- **Obtain FEMA's Substantial Damage Estimator and attend training to be prepared to use it when damage occurs; and develop mutual aid agreements with other jurisdictions to augment local inspection personnel after major disasters.**

- **Conduct a more thorough review of other regulatory programs and planning tools, such as the Maui Island Plan, Community Plans and Zoning Code, and report on opportunities to improve consistency with the objectives of floodplain management.**
- **Send information about the flood hazard and promote the availability of flood insurance through regularly scheduled mailings (such as the dissemination of handouts with annual property tax notices, utility bills, etc.).**

Safe Growth Survey

The results of the Safe Growth Survey are summarized in Table 94. This includes describing how strongly Maui County's Department of Planning staff agrees or disagrees with 25 "Safe Growth Statements" as they relate to current plans, policies, and programs for guiding future community growth and development, according to the following rating scale:

1=Strongly Disagree 2=Somewhat Disagree 3=Neutral 4=Somewhat Agree 5=Strongly Agree

Table 94. Summary of Safe Growth Survey Results

GENERAL PLAN	Average Rating				
Land Use					
1. The general plan includes a future land use map that clearly identifies natural hazard areas.	1	2	3	**4**	5
2. Current land use policies discourage development and/or redevelopment within natural hazard areas.	1	2	3	**4**	5
3. The general plan provides adequate space for expected future growth in areas located outside of natural hazard areas.	1	2	3	4	**5**
Transportation					
4. The transportation element limits access to natural hazard areas.	1	**2**	**3**	4	5
5. Transportation policy is used to guide future growth and development to safe locations.	1	**2**	**3**	4	5
6. Transportation systems are designed to function under disaster conditions (e.g., evacuation, mobility for fire/rescue apparatus, etc.).	1	**2**	3	4	5
Environmental Management					
7. Environmental features that serve to protect development from hazards (e.g., wetlands, riparian buffers, etc.) are identified and mapped.	1	2	3	**4**	5
8. Environmental policies encourage the preservation and restoration of protective ecosystems.	1	2	**3**	**4**	5
9. Environmental policies provide incentives to development that is located outside of protective ecosystems.	**1**	**2**	3	4	5
Public Safety					
10. The goals and policies of the general plan are related to and consistent with those in the Hazard Mitigation Plan.	1	2	**3**	4	5

11. Public safety is explicitly included in the plan's growth and development policies.	1	2	**3**	**4**	5
12. The monitoring and implementation section of the plan covers safe growth objectives.	1	2	**3**	**4**	5
ZONING ORDINANCE	**Average Rating**				
13. The zoning ordinance conforms to the general plan in terms of discouraging development and/or redevelopment within natural hazard areas.	1	**2**	3	4	5
14. The ordinance contains natural hazard overlay zones that set conditions for land use within such zones.	**1**	2	3	4	5
15. Rezoning procedures recognize natural hazard areas as limits on zoning changes that allow greater intensity or density of use.	1	2	**3**	4	5
16. The ordinance prohibits development within, or filling of, wetlands, floodways, and floodplains.	1	2	3	**4**	**5**
SUBDIVISION REGULATIONS	**Average Rating**				
17. The subdivision regulations restrict the subdivision of land within or adjacent to natural hazard areas.	1	**2**	**3**	4	5
18. The regulations provide for conservation subdivisions or cluster subdivisions in order to conserve environmental resources.	1	2	3	**4**	5
19. The regulations allow density transfers where hazard areas exist.	**1**	2	3	4	5
CAPITAL IMPROVEMENT PROGRAM AND INFRASTRUCTURE POLICIES	**Average Rating**				
20. The capital improvement program limits expenditures on projects that would encourage development and/or redevelopment in areas vulnerable to natural hazards.	1	**2**	3	4	5
21. Infrastructure policies limit the extension of existing facilities and services that would encourage development in areas vulnerable to natural hazards.	1	2	**3**	4	5
22. The capital improvements program provides funding for hazard mitigation projects identified in the Hazard Mitigation Plan.	1	2	**3**	4	5
OTHER	**Average Rating**				
23. Small area or corridor plans recognize the need to avoid or mitigate natural hazards.	1	2	**3**	**4**	5
24. The building code contains provisions to strengthen or elevate new or substantially improved construction to withstand hazard forces.	1	2	**3**	**4**	5
25. Economic development and/or redevelopment strategies include provisions for mitigating natural hazards or otherwise enhancing social and economic resiliency to hazards.	1	2	**3**	**4**	5

Summary and Conclusions

Maui County has some strong capabilities and resources to mitigate the effects of natural hazards, particularly as it relates to existing planning and regulatory measures that are designed to ensure new and/or substantially improved construction is built to be more resilient to potential hazards. Some specific opportunities to improve, expand, or enhance these measures are provided in the comments provided in Table 93 and were highlighted in response to the Safe Growth Survey as summarized in Table 94. Perhaps most notably this includes adopting the updated State Building Code (2018 IBC, 2018 IRC, and 2018 IEBC, with amendments) as its local code, which the County expects to do later in 2021. It also includes better integrating hazard risk management into the County's transportation policies and systems, and the adoption of new regulations or incentives to prevent or discourage new development from being located within known hazard zones and/or protective natural ecosystems. For example, the County should further explore the use of natural hazard overlay zones that set conditions for land use within such zones or amending its subdivision regulations to allow density transfers where hazard areas exist.

While the County's planning and regulatory capacity is considered fairly strong, the lack of adequate staff capacity in some areas in addition to available financial resources may hinder its ability to more aggressively pursue and implement hazard mitigation actions and projects. As noted above and through the NFIP Survey, this includes some inadequate staff capacity and program integration for optimal code enforcement with regard to the County's building code and flood damage prevention ordinance. Similar challenges in other areas were expressed by the planning team, including agency stovepipes and jurisdictional challenges which have promoted a lack of coordination and communication, resulting in disconnects between efforts.

Despite these issues, the County has strong administrative capacity in other areas through its existing staff and partnerships with other organizations. Also, while the County's financial resources to support hazard mitigation actions is limited, it has been successful in obtaining outside financial and technical assistance through federal and state grant programs, which should continue so long as those programs continue to exist. Through actions identified in this plan the County will seek to increase its internal capacity to manage community-wide hazard mitigation programs in the future. For example, this includes potentially re-organizing and/or expanding the number of staff in support of the County's ongoing floodplain management activities.

The County has been successful in implementing a variety of public safety and other hazard-related public education and awareness programs, a trend that continued through its efforts to prepare this plan. Maui County Emergency Management Agency provides public outreach to inform residents and visitors about personal preparedness for a wide range of hazards in addition to statewide guidance documents and tools for hazard mitigation and disaster recovery. The Planning Department's Flood

Information website provides links to numerous sources dedicated to risk communication and individual flood preparedness and mitigation, as well as real time data on current rain gage data, stream flow data, and current sea levels. The County's participation in national hazard preparedness and prevention programs such as FEMA's CRS program, the National Weather Service's StormReady® and TsunamiReady® initiatives, and the National Fire Protection Association's Firewise USA® program are also strong indicators of this capability. That said, education and outreach initiatives for many of Maui County's remote communities are more difficult where communications are a challenge, particularly during and after hazard events.

Finally, while Maui County has maintained its compliance with the NFIP and CRS for many years, there are some specific opportunities to enhance and better integrate many of its current activities. These activities were considered as part of the development of the mitigation strategy and will continue to be discussed as the County seeks to improve its current CRS rating from a Class 7 to a Class 6 community.

Overall, Maui County is well positioned to mitigate risks from natural hazards, and it is believed that through the implementation of this plan and other efforts it will continue to do so in a deliberate and meaningful manner. This will be accomplished through many of the existing capabilities and resources described in the section, and the County's ability to improve and expand on them as noted herein.

Chapter 6. Mitigation Strategy

The hazard mitigation strategy is the culmination of work presented in the planning area profile, the risk assessment, and the capability assessment. It is also the result of Steering Committee meetings, public and stakeholder engagement, and site visits.

Mission and Goal Statements

> *C3. Does the plan include goals to reduce/avoid long-term vulnerabilities to the identified hazards? (Requirement §201.6(c)(3)(i))*

As part of the plan update process, the Steering Committee reviewed the goals and objectives of the 2015 plan. After several meetings and discussions, the committee decided to revise the goal statements to more accurately reflect the current priorities of the County. They also developed a mission statement for the plan to function as a vision for plan implementation. The objectives were removed. The previous plan had 13 objectives and while the objectives as statements make sense and reflect the interest of the County, they don't seem to improve implementation of the plan or work as a measure of plan success.

The mission statement is shown below:

Protect people, the environment, the local economy, and infrastructure from natural hazards and climate change.

Mitigation *goals* represent broad statements that are achieved through the implementation of more specific mitigation *actions*. These actions include both hazard mitigation policies (such as land use regulations) and hazard mitigation projects (such as structure or infrastructure projects). The 2015 plan included six goal statements. These were reviewed and revised.

The Steering Committee considered current County priorities identified in the County's General Plan (cover shown) and the County of Maui Community Plans. They also reviewed the State of Hawai'i Hazard Mitigation Plan and other State of Hawai'i County plans while drafting the goal statements. The Steering Committee felt strongly about including climate change and adaptation into this updated version of the Hazard Mitigation Plan. The five goal statements they developed are consistent with the State of Hawai'i Hazard Mitigation Plan and with County of Maui priorities.

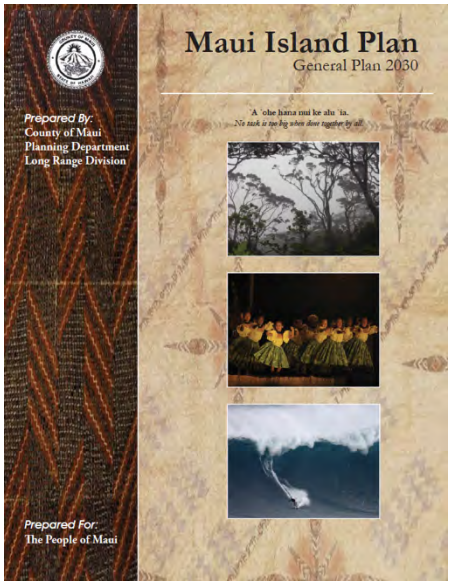

Figure 292. Maui Island Plan

The five goal statements for the 2020 Hazard Mitigation Plan are shown in the table below. Each goal statement includes a category or summary word that represents the key concept in the goal statement. Later in this chapter, each mitigation action has been connected to a goal statement with the appropriate category listed.

Table 95. 2020 Mitigation Goal Statements

Goal Categories	Goals
People	Protect the life, health, safety and welfare of Maui County residents and visitors.
Resilience	Promote the long-term resilience of the County's economic, environmental, historical and cultural resources.
Property	Protect and adapt property and infrastructure from the impacts of natural hazards and climate change.
Education	Improve awareness and mitigation of risks associated with natural hazards and climate change.
Implementation	Enhance the implementation of this Hazard Mitigation Plan through active involvement and plan integration across all County Departments.

A Comprehensive Range of Mitigation Actions

C4. Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects for each jurisdiction being considered to reduce the effects of hazards, with emphasis on new and existing buildings and infrastructure? (Requirement §201.6(c)(3)(ii))

a. Does the plan identify and analyze a comprehensive range of specific mitigation actions and projects to reduce the impacts from hazards?

b. Does the plan identify mitigation actions for every hazard posing a threat to each participating jurisdiction?

> *c. Do the identified mitigation actions and projects have an emphasis on new and existing buildings and infrastructure?*

The mission statement and goals established for this plan are broad in scope. Mitigation actions are more specific and identify an activity or process that is intended to reduce or eliminate risk to natural hazards in alignment with the mission statement and goals.

2015 Mitigation Actions

One of the first steps in developing a list of mitigation actions was to review the previous plan's list of mitigation actions. The Planning Team guided the Steering Committee through a careful review of each of the previous mitigation actions.

The 2015 Maui County Hazard Mitigation Plan identified 62 initiatives for implementation during the 2015-2020 performance period. During the 2020 plan update process, each of these initiatives were reviewed by the Steering Committee to confirm their current status and overall progress toward implementation. Steering committee members determined whether or not the initiatives were (a) completed, (b) completed and to be continued, (c) partially completed, (d) delayed, or (e) cancelled. All incomplete initiatives were reviewed to determine if they should be carried over to the 2020 plan or removed from the plan due to a change in priorities, capabilities, feasibility, or other reasons.

In total, 4 of the previous mitigation initiatives were completed in the performance period of the 2015 plan, 11 were completed and to be continued (i.e., as an ongoing capability or similar follow-on action), 17 were partially completed, 23 were delayed, and 7 were cancelled. Of the 62 initiatives from the 2015 plan, 35 were carried over to the 2020 plan. Many of these were updated to clarify the specific intent of the action, and in some cases, they were combined with other actions to minimize duplication of effort. Table 96 summarizes the initiatives as identified in the 2015 plan, along their implementation status at the time this update was prepared, whether they have been carried over into the 2020 plan, and if so, their newly assigned action number for reference.

Table 96. 2015 Mitigation Actions Status

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
AH-1	High	Update and maintain an inventory of critical facilities and lifelines including County buildings.	Yes	Completed + To Be Continued	This action has become a capability. MEMA has expanded its focus on hardening these facilities and lifelines including public shelters, water and wastewater facilities, etc.	NO - explanation provided at left	N/A
AH-2	Medium	Relocate and/or retrofit vulnerable critical facilities in high hazard areas. Harden these facilities to withstand future natural hazard events. Prioritized facilities include but are not limited to the following: • Pukoo Fire Station – Molokaʻi or other facilities identified in the 2015 Molokaʻi, Lānaʻi Community Plan • MECO power plant • Kaunakakai Wastewater Treatment Facility • Kahului-Wailuku Wastewater Reclamation Facility • Honoapiilani Highway • Wailuku Base Yard • NASKA DWS Base Yard	Yes	Partially Completed / In Progress	Backup power generation for the Wailuku Base Yard. HMGP awarded. MECO is determining the viability of building an alternate Power Generation Plant outside of the hazard area. Backup power generation for the Lahaina Wastewater Treatment Plant HMGP application in process.	YES - updated/revised description provided at right, if applicable	26
AH-3	Medium	Acquire residential and privately owned structures in high hazard areas, including but not limited to those known to be or subject to repetitive damages.	No	Cancelled	Action cancelled because properties in high hazard areas are currently considered too expensive for acquisition to be a viable mitigation alternative.	NO - explanation provided at left	N/A

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
AH-4	High	Evaluate existing shelter and other critical facilities needs for redundant power generation. Obtain and install permanent backup power sources for critical facilities and infrastructure not addressed in other proposed projects, and for specific facilities serving functional needs and vulnerable populations. Use of solar or green energy will be considered, where feasible. Initial facilities may include but are not limited to: • War Memorial Gymnasium • Hannibal Tavares Community Center • Velma Santos Community Center • Kīhei Community Center (solar off grid?) • Maui High School • Baldwin High School • King Kekaulike High School • Lahainaluna High School • Hāna High and Elementary School • Lānaʻi High and Elementary School • Molokaʻi High School • Walter Cameron Center	Yes	Partially Completed / In Progress	All facilities were evaluated. Hannibal Tavares Community Center and Kīhei Community Center redundant power generation installed. Future projects identified, subject to funding. Backup power generation for Lahaina Civic Center HMGP application in process. This action will carry over through a revised action for the updated plan.	YES - updated/revised description provided at right, if applicable	30

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
AH-5	High	Acquire portable emergency generators for identified critical facilities. Initial facilities may include but are not limited to: • Maui Food Bank • War Memorial Gymnasium • Hannibal Tavares Community Center • Velma Santos Community Center • Kīhei Community Center • Maui High School • Baldwin High School • King Kekaulike High School • Lahainaluna High School • Hāna High and Elementary School • Lānaʻi High and Elementary School • Molokaʻi High School • Walter Cameron Center	Yes	Partially Completed / In Progress	Mobile generator HMGP application in process for Central Maui area. This action will carry over through a revised action for the updated plan.	YES - updated/revised description provided at right, if applicable	30
AH-6	High	Develop a Maui, Lānaʻi and Molokaʻi island-wide evacuation routes plan. Create a public awareness campaign to educate the public on evacuation routes and expectations.	Yes	Partially Completed / In Progress	Evacuation zones, routes, plans, and maps have been prepared for multiple hazards and locations. The proposed public awareness campaign will be integrated into other County public outreach and education efforts on emergency preparedness and disaster mitigation.	NO - explanation provided at left	N/A

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
AH-7	High	Work with telecommunications providers to provide more reliable and continued services during natural hazard events.	Yes	Completed + To Be Continued	This action has become a capability. The State of Hawai'i has opted into FirstNet and will begin exploring options through the designated service provider AT&T. Strong relationships are already established with local telecommunications providers and MPD Radio Shop.	NO - explanation provided at left	N/A
AH-8	High	Work with school complexes to develop a hazard awareness component for middle and high school curriculums.	Yes	Completed + To Be Continued	This action has become a capability. For example, the Department of Health led initiative to elementary schools of vector-borne illnesses.	NO - explanation provided at left	N/A
AH-9	High	Develop and formalize MOUs for emergency barge and ferry service for reaching communities isolated and impacted from disaster. Specifically, Hāna, Moloka'i and Lāna'i.	No	Delayed	Progress has yet to be made on this action, but it will carry over as a revised action for the updated plan.	YES - updated/revised description provided at right, if applicable	4
AH-10	High	Continue to include hazard mitigation initiatives in future Capital Improvements Planning and include hazard mitigation goals and objectives into the General and Community Plans. Consider all hazard mitigation initiatives when developing the	Yes	Completed + To Be Continued	This action has become a capability. The County of Maui Budget Office established a line item to provide matching funds for grant projects and the Hazard Mitigation Steering Committee meets regularly to discuss potential CIP projects	NO - explanation provided at left	N/A

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
		County 6-year budget and 20-Year Plan.			that can leverage federal HMGP, PDM, and FMA grant funding.		
AH-11	High	Develop and annually maintain an updated list of emergency shelters for Maui, Lānaʻi and Molokaʻi. Identify lead operators for each shelter. Ensure list is included in the Maui County Civil Defense Emergency Operations Plan and synchronized to lists in the National Shelter System.	Yes	Completed + To Be Continued	This action has become a capability. The County's emergency shelter list is routinely updated and kept current, including information on POCs. The County's Emergency Operations Plan also includes list of other potential emergency shelter locations.	NO - explanation provided at left	N/A
AH-12	High	Develop a system (process) for capturing historical data related to hazard events throughout the Maui County and disseminating this information to the relevant planning partners.	Yes	Completed	This action has become a capability. Historical data from hazard events are captured. Data is available to partners upon request.	NO - explanation provided at left	N/A
AH-13	High	Promote and implement existing education and outreach programs on all hazards such as HHARP, CERT, American Red Cross, etc. that build hazard understanding and awareness, and offer tools and information resources to guide mitigation, preparedness, response and recovery.	Yes	Completed + To Be Continued	This action has become a capability. HHAARP is ongoing for the West Maui Community. CERT continues to expand training throughout Maui County. ARC continues to review and exercise plans and continues to provide training opportunities to volunteers.	NO - explanation provided at left	N/A
CE-1	Medium	Realign Honoapiilani Highway outside of coastal hazard area – Initiate a planning process	Yes	Partially Completed / In Progress	A West Maui Transportation Working Group was established and will strategize	YES - updated/revised	35

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
		with HDOT; Document planning process steps and timeline; Develop environmental documents showing alternative alignments; Acquire/purchase any additional land needed for realignment; Implement construction for realignment.			possible solutions. County of Maui land purchase along Honoapiilani Highway. The Honoapiʻilani Highway Realignment project was identified in the Hele Mai Maui Long-Range Transportation Plan 2040, exemplifying how such investments can foster new ways of improving resilience in the transportation network.	description provided at right, if applicable	
CE-2	Medium	Identify vulnerable coastal roads that are susceptible to destruction from natural hazards, plan for elevating or realigning portions of those roadways and implement identified projects. Identified roads include but are not limited to North Kīhei Road, South Kīhei Road, and Kamehameha V Highway on Molokaʻi.	No	Delayed	Progress has yet to be made on this action, but it will carry over through revised actions for the updated plan.	YES - updated/revised description provided at right, if applicable	21 and 26
CE-3	High	Expand Beach and Dune Restoration Projects – Identify and prioritize erosion hotspots for mitigation via beach nourishment; Pursue State/County funding for beach nourishment; Work with State regulatory agencies to	Yes	Partially Completed / In Progress	The Planning Department is coordinating with stakeholders at several regions around Maui where development and ecosystems has been severely impacted by coastal erosion, including but not limited to Kahana	YES - updated/revised description provided at right, if applicable	14

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
		streamline permitting for beach nourishment.			Beach and Napili Bay in West Maui, Halama Street and Maalaea Bay Beach in South Maui, and other sites on the north shore. The County has provided some funding for beach restoration feasibility studies and is currently attempting to facilitate the establishment of Community Facilities Districts (CFDs) as a financing tool. On the permitting side, the State of Hawai‘i DLNR OCCL has been pursuing an update of a statewide programmatic Environmental Assessment for Small Scale Beach Restoration (SSBR) to streamline review and permitting some beach restoration projects.		
CE-4	High	Expand Dune Restoration Projects - Develop and/or update dune restoration guidance. Provide dune restoration training. Develop an outreach initiative to encourage or establish new dune restoration volunteers/stewards. Install ADA compliant dune walkovers in identified locations.	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan.	YES - updated/revised description provided at right, if applicable	15

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
CE-5	Medium	Study and/or pilot offshore wave attenuation devices, such as breakwaters, that cause waves to break in open water instead of at the beach.	No	Delayed	Progress has yet to be made on this action, but it will carry over through revised actions for the updated plan.	YES - updated/revised description provided at right, if applicable	14 and 36
CE-6	Medium	Support University of Hawaiʻi sea level rise mapping for all islands that is based on dynamic sea level mapping (increased water level due to sea level rise plus waves or storm surge) rather than "flood the bathtub" mapping.	No	Cancelled	No action taken as there has been plenty of sea level rise mapping done by other entities, including the State of Hawaiʻi which by proclamation the Maui County Mayor has directed County departments to use in their plans, programs, and capital improvement decisions.	NO - explanation provided at left	N/A
CE-7	Medium	Consider sea level rise impacts on existing and future developments by conducting or commissioning community based vulnerability assessments.	Yes	Completed	Maui County participated in the Interagency Climate Adaptation Committee (ICAC) to develop a statewide Sea Level Rise and Vulnerability Assessment and Adaptation Report completed, December 2017. This report provides new data for exposure of development to flooding, wave inundation, and erosion from sea level rise.	NO - explanation provided at left	N/A
CE-8	High	Develop a 5-Year Strategic Plan for integrating coastal erosion mitigation projects into each community plan and County FY budget.	Yes	Partially Completed / In Progress	This level of detail (down to specific mitigation projects) is not appropriate for community plans; however the CP process does now	NO - explanation provided at left	N/A

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
					include a technical resource paper detailing status and trends related to sea level rise and coastal erosion. CPs also include a chapter on coastal resilience with policies and actions related to coastal erosion. On the budget side, it would be nice to have a CIP budget for erosion mitigation. The County Council did last year create a new SMA revolving fund that can in theory be used for some shoreline mitigation/restoration activities, but it hasn't been applied anywhere yet.		
CE-9	High	Continue to support a public awareness campaign for residents in and around coastal erosion zones showing what they can do to minimize the impact of coastal erosion. Update as appropriate the UH Sea Grant guidebook titled Purchasing Coastal Real Estate in Hawaiʻi.	Yes	Completed + To Be Continued	This action has become a capability. MEMA conducted a public awareness campaign targeted to properties along the coastline subject to coastal erosion from king tide events.	NO - explanation provided at left	N/A
CE-10	Low	Expand University of Hawaiʻi shoreline erosion studies to include Molokaʻi and Lānaʻi and continue to update studies for Maui.	No	Delayed	The County would need to fund UH (Coastal Geology Group) to complete these studies. These foundational erosion studies are important	YES - updated/revised description provided at right, if applicable	48

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
					(especially for Moloka‘i) to also support the additional SLR modeling we have for the other islands.		
DR-1	High	As required, support structural and non-structural elements related to the certification and/or re-certification of Kaunakakai levee in federal programs (e.g. United States Army Corps of Engineers Public Law 84-99).	Yes	Completed	Portions of the Kaunakakai levee have been recertified by FEMA by a Letter of Map Revision, Case No. 16-09-0721P, effective March 14, 2017.	NO - explanation provided at left	N/A
DR-2	High	Develop a public outreach awareness campaign targeting residents located within a dam inundation area. Include information about what to do in an emergency, community Q&A, and where to receive information.	Yes	Partially Completed / In Progress	This action has become a capability. DLNR will publish Dam Inundation Maps. MEMA will work on the public messaging campaign to complement the publication.	NO - explanation provided at left	N/A
DR-3	Low	Regularly exercise the current emergency action plan focusing on evacuation with participation from police, public/private dam owners and state/federal dam operators.	No	Cancelled	No longer deemed an appropriate action for the hazard mitigation plan.	NO - explanation provided at left	N/A
D-1	High	Update the Water Use and Development Plan (WUDP) for all Maui County Islands with a comprehensive monitoring, repair, and replacement strategy.	No	Delayed	No longer deemed an appropriate action for the hazard mitigation plan.	NO - explanation provided at left	N/A

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
D-2	High	Encourage drought-tolerant landscape design such as incorporating drought-tolerant or xeriscaping practices into landscape ordinances to reduce dependence on irrigation, and provide incentives for xeriscaping.	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan.	YES - updated/revised description provided at right, if applicable	19
D-3	Low	Coordinate with industry stakeholders to develop alternative sources of irrigation water including wastewater reuse, recycled stormwater runoff, and brackish well water.	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan.	YES - updated/revised description provided at right, if applicable	43
D-4	High	Explore options and necessary code and regulation changes to allow greywater reuse systems for irrigation and toilet flushing.	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan.	YES - updated/revised description provided at right, if applicable	1
E-1	Medium	Reduce potential damage to critical facilities (including schools, shelters, etc.) and infrastructure from future seismic events through structural retrofits.	No	Cancelled	This action has been deemed less relevant and not a priority for Maui County to pursue through the hazard mitigation plan.	NO - explanation provided at left	N/A
E-2	Medium	Conduct an engineering survey on all bridges to ensure structural stability during a natural disaster. Implement all structural improvement identified/recommended from survey. Prioritize the implementation of structural improvements to bridges	Yes	Partially Completed / In Progress	DPW conducts assessments on all bridges of 20 feet span at least every 2 years. There are 47 bridges in the National inventory (Maui County), mainly in the East Maui Area. Additional bridges are located on South Kīhei Road and Pulehu Road.	YES - updated/revised description provided at right, if applicable	22

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
		serving potential isolated communities (e.g. East Maui).					
FL-1	Medium	Flood proof wastewater treatment facilities located in flood hazard areas.	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan in combination with FL-2.	YES - updated/revised description provided at right, if applicable	20
FL-2	Medium	Flood proof water treatment facilities located in flood hazard areas.	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan in combination with FL-1.	YES - updated/revised description provided at right, if applicable	20
FL-3	Medium	Inspect, and if necessary, repair stormwater drainage swales and culverts. Implement a program to regularly remove blockages from drains and channels.	Yes	Cancelled	The implementation of this action is beyond the County's existing staff capabilities. The County does not currently receive any credit for drainage system maintenance through the CRS program (Activity 540).	NO - explanation provided at left	N/A
FL-4	Low	Increase drainage and absorption capabilities with detention and retention basins, relief drains, and spillways. Implement a program to regularly remove blockages from basins, drains and spillways.	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan.	YES - updated/revised description provided at right, if applicable	45
FL-5	Medium	Where appropriate, support retrofitting, purchase, or relocation of structures located in hazard-prone areas to protect structures from future	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan in combination with FL-9.	YES - updated/revised description provided at right, if applicable	27

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
		damage with repetitive loss and severe repetitive loss properties as priority.					
FL-6	High	Remain in good standing and in compliance with the NFIP.	Yes	Completed + To Be Continued	This action has become a capability. The County of Maui participates in the NFIP, as such, we are audited annually to ensure that we are compliant with current FEMA standards.	NO - explanation provided at left	N/A
FL-7	High	Continue to participate in the CRS program and continually identify opportunities to improve CRS class.	Yes	Completed + To Be Continued	The County of Maui participates in the CRS program and is recertified annually, as well as every 5 years to verify we are still implementing CRS-credited activities. In 2018 the County's CRS rating improved from Class 8 to Class 7.	YES - updated/revised description provided at right, if applicable	16
FL-8	High	Identify key planning, public works, and/or emergency management personnel who could benefit from advanced knowledge as a Certified Floodplain Manager.	Yes	Completed	Invited staff from DPW - DSA and Engineering division to our annual Floodplain Managers Conference in August.	NO - explanation provided at left	N/A
FL-9	Low	Develop a Flood Acquisition/Elevation Plan that may be used to identify and prioritize acquisitions and elevation of RL/SRL properties.	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan in combination with FL-5.	YES - updated/revised description provided at right, if applicable	27
FL-10	Medium	Identify and place operational stream gauges where needed.	Yes	Partially Completed / In Progress	The September flood damaged the Wailuku River stream gauge. MEMA has	YES - updated/revised	24 and 25

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
					identified that it is critical for another measuring device be installed. The USGS indicated that another measuring device will be installed once the river has stabilized (approximately 3 - 5 years). This action will carry over through revised actions for the updated plan by taking the approach of managing water.	description provided at right, if applicable	
FL-11	High	Identify potential areas for open space that could double as detention basins during major flooding events.	Yes	Partially Completed / In Progress	Local NGOs have been working on this. For example, the West Maui Ridge to Reef program has developed several watershed management plans that included similar strategies, as a result a NFWF grant was awarded recently to develop plans for a retention basin at Kaopala. There is also a more recent watershed management plan for South Maui.	YES - updated/revised description provided at right, if applicable	17
FL-12	High	Seek community information on possible hazardous waste sites, not identified by the LEPC. Investigate, and use remediation when needed.	No	Cancelled	No longer deemed an appropriate action for the hazard mitigation plan.	NO - explanation provided at left	N/A

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
FL-13	High	Harden the Island Petroleum Fuel Pipeline at the Molokaʻi Kaunakakai Wharf in a trench with grating cover.	Yes	Partially Completed / In Progress	MEMA is working with Par Hawaiʻi to harden the Molokaʻi Fuel Pipeline through either the HMGP or PDM grant program.	YES - updated/revised description provided at right, if applicable	5
HW-1	Medium	Encourage retrofit of identified critical facilities and infrastructure through mechanisms such as: a) Improve roof coverings (e.g., no pebbles, remove ballast roof systems). b) Install hurricane shutters or other protective measures. c) Anchor roof-mounted heating, ventilation, and air conditioning units. d) Retrofit buildings with load-path connectors to strengthen structural frames. e) Harden traffic lights and other traffic control lights.	No	Delayed	Progress has yet to be made on this action, but it will carry over through new and revised actions for the updated plan.	YES - updated/revised description provided at right, if applicable	5, 20, 24, 26, 30, and 45
HW-2	High	Encourage (and if funding is available implement) the following types of modification or retrofits to residential buildings: a) Install hurricane shutters, safe rooms, reinforced garage doors or other protective measures b) Replace existing non-ductile infrastructure with ductile	Yes	Partially Completed / In Progress	MEMA continues to encourage residents to retrofit homes to minimize risk to structures. Distribute the Homeowners Book to Prepare for Natural Hazards published by the University of Hawaiʻi Sea Grant.	YES - updated/revised description provided at right, if applicable	6

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
		c) Retrofit building with load-path connectors to strengthen structural frames d) Inspect and retrofit roofs, gable end walls to adequate standards to provide wind resistance					
HW-3	High	Develop a public outreach initiative that illustrates the benefits of steel utility poles for communities that opted out of new poles.	No	Delayed	No longer deemed an appropriate action for the hazard mitigation plan.	NO - explanation provided at left	N/A
L-1	Medium	Install concrete foundations for rockfall barrier fences in areas prone to landslides and rockfalls. Ensure foundations are designed to include rock anchors for overturning.	Yes	Partially Completed / In Progress	Inventory is available for East Maui areas that are prone to rockfall areas. Keanae area was addressed in 2015.	YES - updated/revised description provided at right, if applicable	23
L-2	Medium	Improve drainage opportunities along steeps areas that are prone to fail due to soil saturation.	Yes	Partially Completed / In Progress	Areas addressed include Kahakuloa and Nuanualoa (slope stabilization projects). Future CIP project: Kahekili Slope Repair project.	YES - updated/revised description provided at right, if applicable	24
L-3	Medium	Identify areas at risk for rockfall and acquire/install netting to minimize impact.	Yes	Completed + To Be Continued	Areas at risk for rockfall were identified, including Kalepa (East Maui). This action will carry over as an action for the updated plan in combination with L-1.	YES - updated/revised description provided at right, if applicable	23
TC-1	Medium	Harden emergency shelters throughout the planning area to ensure that they are able to withstand Category 3 hurricane	Yes	Partially Completed / In Progress	MEMA submitted ranked emergency shelters throughout Maui County for State of Hawai‘i Hurricane	YES - updated/revised description provided at right, if applicable	30

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
		force wind speeds (111-129 mph).			Sheltering Retrofit Program. Moloka'i High School is currently funded for retrofit. This action will carry over as an action for the updated plan in combination with HW-1.		
TC-2	Medium	Conduct engineering surveys on the ability of emergency shelters and potential emergency shelters to withstand hurricane force wind speed.	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan in combination with HW-1.	YES - updated/revised description provided at right, if applicable	30
TC-3	High	Develop joint MOUs with private sheltering facilities to continue working together towards a common emergency sheltering goal for tropical cyclone evacuation.	No	Cancelled	No longer deemed an appropriate action for the hazard mitigation plan.	NO - explanation provided at left	N/A
TC-4	Medium	Prioritize and pursue activities identified as unmet needs in the project led by Maui County planning department titled Post Disaster Reconstruction Guidelines and Protocols project.	Yes	Partially Completed / In Progress	Building on the Maui project, work has continued under Sea Grant leadership through a 2016 NOAA Regional Coastal Resilience Grant award. As a result, we recently published (2019) Guidance for Disaster Recovery Preparedness in Hawai'i which provides planning frameworks and model ordinances. The next step is for the County of Maui	YES - updated/revised description provided at right, if applicable	28

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
					to use those tools to continue moving actions forward.		
T-1	Medium	Install signage delineating tsunami evacuation routes and tsunami hazard zones (entering/leaving).	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan in combination with TC-4.	YES - updated/revised description provided at right, if applicable	28
T-2	High	Develop an outreach plan on the development and distribution of tsunami awareness materials. Develop and distribute educational materials regarding information about tsunamis and what to do if a tsunami is imminent (i.e. what to do, where to go, etc.).	Yes	Completed + To Be Continued	This action has become a capability. Tsunami awareness materials were identified and developed for distribution, and MEMA participates annually in Tsunami Awareness Month (April) to promote these and other outreach materials.	NO - explanation provided at left	N/A
VH-1	High	Develop a public outreach program for both residents and visitors informing them about VOG - what it is and how to protect yourself.	No	Delayed	No longer deemed an appropriate action for the hazard mitigation plan.	NO - explanation provided at left	N/A
VH-2	High	Work with the University of Hawai‘i - VOG Measurement and Prediction Project (VMAPP) to develop danger levels and trigger points for Maui County VOG exposure, and track high level, measurable VOG patterns in Maui County. Install air quality monitoring instruments that allow for the measurement of sulfur dioxide.	No	Delayed	No longer deemed an appropriate action for the hazard mitigation plan (air quality never gets too bad).	NO - explanation provided at left	N/A

2015 Index	Implementation Priority*	Mitigation Initiative Description	Action Taken?	Current Status	Status Description/Comments	Keep for Updated Plan?	2020 Action # (if applicable)
W-1	Medium	Retrofit at-risk County structures with ignition-resistant materials.	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan in combination with additional recommended mitigation strategies.	YES - updated/revised description provided at right, if applicable	33
W-2	Medium	Implement mitigation action items as identified in the Western Maui Community Wildfire Protection Plan (CWPP). Implement mitigation action items from Molokaʻi CWPP and Central Maui CWPP once the plans are finalized.	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan.	YES - updated/revised description provided at right, if applicable	34
W-3	High	Revitalize the Firewise Program.	No	Delayed	Progress has yet to be made on this action, but it will carry over as an action for the updated plan.	YES - updated/revised description provided at right, if applicable	10

Possible Mitigation Actions

After determining which of the 2015 mitigation actions would be carried forward to the 2020 Hazard Mitigation Plan, the Steering Committee worked to identify additional actions. A wide range of potential mitigation actions were considered. The Planning Team presented the Steering Committee with a list of the four types of mitigation actions as shown in the figure below. While this is not a complete list it did serve as a way to spark the imagination and consideration of different mitigation actions.

Local Plans and Regulations

- Comprehensive plans
- Land use ordinances
- Subdivision regulations
- Development review
- Building codes and enforcement
- NFIP Community Rating System
- Capital improvement programs
- Open space preservation
- Stormwater management regulations and master plans

Structure and Infrastructure Projects

- Acquisitions and elevations of structures in flood-prone areas
- Utility undergrounding
- Structural retrofits
- Floodwalls and retaining walls
- Detention and retention structures
- Culverts

Natural Systems Protection

- Sediment and erosion control
- Stream corridor restoration
- Forest management
- Conservation easements
- Wetland restoration and preservation

Education and Awareness Programs

- Radio or television spots
- Websites with maps and information
- Real estate disclosure
- Presentations to school groups or neighborhood organizations
- Mailings to residents in hazard-prone areas

Figure 293. Four Types of Mitigation Actions.

The Steering Committee considered how to mitigate risk to the problems identified in the risk assessment, for instance flooding and erosion, high winds, and wildfires. They also considered mitigating risk to existing and future buildings and infrastructure. Finally, they focused on addressing problems that

were brought up in the stakeholder engagement meetings, public meetings, and site visits. Several of these problems, in no particular order, were:

- Land use planning, building codes, and permitting
- Infrastructure, especially roads
- Sheltering and public preparedness
- Critical facility location and capacity

A list of mitigation actions that relate to each of the fifteen hazards considered is included in Appendix D. Many actions address risks posed by several hazards.

The Steering Committee addressed current and future buildings and infrastructure when developing the mitigation actions. Land on Maui is assessed at such a high value, buying property is not typically considered a realistic mitigation action in the County, although it has been done. Development continues throughout the County especially along the coast and specifically in Kīhei where new homes are being built as well as the new Kīhei High School campus.

The Steering Committee considered several issues related to State owned or operated buildings or infrastructure. For instance, critical facilities and their capacity to withstand hurricanes or tsunami. Many critical facilities are school buildings and the State of Hawaiʻi Department of Education manages all public-school buildings. The County does not have the authority to retrofit these structures but does have the capacity to collaborate with the State regarding their needs and concerns. The Steering Committee discussed roadways in detail. Several main roads on the islands are State owned and in need of retrofit due to sea-level rise or beach erosion. Similarly, to school buildings, the County intends to work with State of Hawaiʻi Department of Transportation to make their needs and concerns known. Mitigation Action #12, "Coordinate with the State to adapt State Highway Route 450 in Moloka'i at MM 15-16 (east side experiencing major erosion and undermining in the last few years).

Figure 294. Pipeline on Moloka'i.

Some privately owned critical facilities pose problems to the County. For instance, the pipeline on Molokaʻi owned by Par Hawaiʻi (picture shown) is in poor condition and at risk to earthquake, tsunami, sea level rise and flooding. This pipeline is privately owned. The Steering Committee discussed

alternative fueling systems and back-up power as a way to mitigate the risks posed to the pipeline. Mitigation Action #5, "Identify alternative locations for emergency supply of diesel, gas, and propane on Moloka'i for a minimum of 30 days." In addition, the Maui Electric substation on Maui, is located in a tsunami inundation zone. The substation is privately owned. The Steering Committee included an action from the Maui Island Plan that relates directly to this and other critical facilities, "Mitigation Action #26, "Identify critical infrastructure, lifelines, roads, and populations that are vulnerable to coastal hazards, and encourage strategic retreat, relocation or retrofit."

Mitigation Action Plan

> *C5. Does the plan contain an action plan that describes how the actions identified will be prioritized (including cost benefit review), implemented, and administered by each jurisdiction? (Requirement §201.6(c)(3)(iv)); (Requirement §201.6(c)(3)(iii))*
>
> *a. Does the plan explain how the mitigation actions will be prioritized (including cost benefit review)?*
>
> *b. Does the plan identify the position, office, department, or agency responsible for implementing and administering the action, potential funding sources and expected timeframes for completion?*

The Steering Committee considered a broad range of potential mitigation actions that addressed risk to each of the islands. A significant change from the 2015 Hazard Mitigation Plan is that eight County departments have mitigation actions included. Previously, the Maui Emergency Management Agency was responsible for all mitigation actions. This presented an undue burden and did not lead to implementation success. The 2020 Planning Process thoroughly engaged multiple County departments leading them to more fully participate in the mitigation plan. This plan includes 50 mitigation actions.

An online Mitigation Action Tracker was developed for the County to track the development and implementation of each mitigation action. The Mitigation Action Tracker is a Google Sheet that includes a column for the "essential details" for each mitigation action. These are:

- Supporting Agency(ies)
- Cost
- Funding Sources
- Timeline
- Hazards Addressed
- Mitigation Goal
- CRS Category

The Mitigation Action Tracker includes separate tabs showing pre-sorted actions so the Steering Committee can view actions sorted by hazard, department lead, priority, and relevant goal statement.

When determining cost an estimate was used according to the following categories:

- Very High over $500,000
- High $100,000 - $500,000
- Medium $25,000 - $100,000
- Low under $25,000

Prioritization of Mitigation Actions

Actions were prioritized by each department based on agreed upon metrics discussed by the Steering Committee. These metrics are shown in the figure below:

High Priority

•Large benefit that warrants cost and time
•Mitigates risk to multiple hazards

Medium Priority

•Some benefit to people and property
•Somewhat cost effective

Low Priority

•Not a significant benefit to people or property
•Only addresses one or two hazards
•Requires an impractical amount of funding

Figure 295. Prioritization Metrics.

Allowing each department to prioritize their list of mitigation actions removed the opportunity for departments to argue about whose actions have the highest priority. The metrics allowed the highest priority actions for the County to rise to the level of "high." The County of Maui has 19 High priority actions, 23 Medium priority actions, and 8 Low priority actions.

2020 Mitigation Actions

All of the actions are designed to achieve goals established by the County of Maui, and this Hazard Mitigation Plan. These actions mitigate risk and adapt to climate change. Table 95 below shows the number of mitigation actions related to each goal statement. Several mitigation actions could be attributed to multiple goal statements but for planning purposes one was chosen. A complete list of mitigation actions attributed to each goal statement is shown in Appendix D.

Table 97. Number of Mitigation Actions for Each Goal Statement.

Mitigation Goal	# of Actions
People	9
Resilience	12
Property	17
Education	3
Implementation	9

Eight different departments have mitigation actions in the plan. A handful of mitigation actions have two departments collaborating on one mitigation action. The table below indicates how many actions these departments are responsible for implementing. A complete list of actions for each department is included in Appendix D.

Table 98. Number of Mitigation Actions for Each Department.

Responsible Department	# of Actions
Department of Environmental Management	5
Department of Public Works	7
Department of Water Supply	5

Emergency Management Agency	16
Fire Prevention Bureau	3
Maui County Council	1
Mayor's Office	6
Planning Department	13

Each mitigation action relates directly to one of four Community Rating System (CRS) category. These categories are:

1. Emergency Services
2. Natural Resource Protection
3. Public Education and Awareness
4. Property Protection

The number of mitigation actions for each CRS category is shown in the table below.

Table 99. Number of Mitigation Actions for each CRS Category.

CRS Categories	# of Mitigation Actions
Emergency Services	7
Natural Resource Protection	5
Public Information	4
Preventive	19
Property Protection	9
Structural Projects	6

All of the mitigation actions are shown below with all of their corresponding "essential details." Table 100 shows an example of how each mitigation action is shown.

Table 100. Example Table for Each Mitigation Action.

Action # based on priority order	**Action Description**	
Action Priority Each action was prioritized as low, medium or high priority.	**Lead Department**	County Department(s) responsible for leading the implementation effort.
	Supporting Agency(ies)	This may include County Departments, State Agencies, Nonprofit organizations, utilities or other agencies who may support the implementation of the mitigation action.
	Cost	An estimated cost is included for each mitigation action. This cost is based on the range explained above and includes Very High, High, Medium, or Low.
	Funding Sources	Each action includes a possible funding source identified by the lead department. Additional funding source options are included later in this chapter.
	Timeline	FEMA requires that all actions be suitable for implementation within a five-year period. Each action includes an estimated starting month and year and an estimated ending month and year.
	Hazards Addressed	Each mitigation action includes the list of hazards (based on the 15 included in this plan) it works to mitigate risk from.

	Mitigation Goal	The plan includes 5 goal statements and each mitigation action is directly related to one of those. However, some actions do support multiple actions.
	CRS Category	Each mitigation action directly relates to one of four CRS Categories, Emergency Services, Natural Resource Protection, Public Education and Awareness, and Property Protection.

Below, in priority order and sorted by lead department, are the fifty mitigation actions for 2020.

1	**Explore options and necessary code and regulation changes to allow greywater reuse systems for irrigation and toilet flushing.**	
High	**Lead Department**	Department of Environmental Management, Department of Water Supply
	Supporting Agency(ies)	Maui Farm Bureau, Department of Parks & Recreation, HDOA Agricultural Resource Management
	Cost	Low
	Funding Sources	EPA CWSRF; Staff Time
	Timeline	September 2020 - October 2021
	Hazards Addressed	Drought
	Mitigation Goal	Resilience
	CRS Category	Preventive

2	**Adopt the most current building codes to mitigate risk associated with flooding.**	
High	**Lead Department**	Department of Public Works
	Supporting Agency(ies)	Mayor's Office, Planning Department
	Cost	Low
	Funding Sources	Staff Time
	Timeline	September 2020 - October 2022
	Hazards Addressed	Flood
	Mitigation Goal	Property
	CRS Category	Preventive
3	**Develop a water conservation ordinance to include xeriscaping regulations to promote water conservation (Maui Island Plan Action 6.3.2)**	
High	**Lead Department**	Department of Water Supply
	Supporting Agency(ies)	Mayor's Office, Emergency Management Agency
	Cost	Low

	Funding Sources	County Budget and Staff Time
	Timeline	September 2020 - October 2023
	Hazards Addressed	Drought
	Mitigation Goal	Resilience
	CRS Category	Natural resource protection
4	**To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.**	
High	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	Planning Department, Department of Transportation
	Cost	Low
	Funding Sources	Staff Time
	Timeline	September 2020 - October 2024
	Hazards Addressed	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks

	Mitigation Goal	People
	CRS Category	Emergency services
5	**Identify alternative locations for emergency supply of diesel, gas, and propane on Moloka'i for a minimum of 30 days.**	
High	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	Island Petroleum Fuel Pipeline
	Cost	Medium
	Funding Sources	Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis
	Mitigation Goal	People
	CRS Category	Emergency services
6	**Share funding sources for building retrofits or other modifications with owners of residential buildings to mitigate the effects of high winds. Encourage the use of load path connectors, hurricane shutters, safe rooms, reinforced garage doors, replacement of non-ductile infrastructure, strengthen structural frames, inspect and retrofit roofs, gable end walls for wind resistance.**	

High	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	Department of Public Works, UH Sea Grant
	Cost	Low
	Funding Sources	FEMA BRIC and HMGP; Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	High Windstorm, Hurricane
	Mitigation Goal	Property
	CRS Category	Property Protection
7	**Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.**	
High	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	Planning Department
	Cost	Medium
	Funding Sources	County Budget and Staff Time

	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks
	Mitigation Goal	People
	CRS Category	Emergency services
8	**Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.**	
High	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	Planning Department, Department of Public Works
	Cost	Low
	Funding Sources	County Budget and Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks

	Mitigation Goal	Implementation
	CRS Category	Preventive
9	**The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.**	
High	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	Mayor's Office, Planning Department
	Cost	Low
	Funding Sources	County Budget and Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks
	Mitigation Goal	Resilience
	CRS Category	Preventive

10	**Support the revitalization and expansion of the Firewise USA program to additional communities.**	
High	**Lead Department**	Fire Prevention Bureau
	Supporting Agency(ies)	Emergency Management Agency, West Maui Fire Task Force, Moloka‘i Wildfire Task Force, MCDA, HWMO
	Cost	Low
	Funding Sources	Staff Time; USFS SFA; NFPA
	Timeline	September 2020 - October 2025
	Hazards Addressed	Wildfire
	Mitigation Goal	Property
	CRS Category	Property Protection
11	**Establish an alternative route to and from West Maui for use during disasters.**	
High	**Lead Department**	Mayor's Office
	Supporting Agency(ies)	Planning Department, Department of Public Works
	Cost	Very High

	Funding Sources	County Budget and Staff Time; Hawai‘i DOT
	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks
	Mitigation Goal	People
	CRS Category	Emergency services
12	**Coordinate with the State to adapt State Highway Route 450 in Moloka’i at MM 15-16 (east side experiencing major erosion and undermining in the last few years).**	
High	**Lead Department**	Mayor's Office and Council
	Supporting Agency(ies)	Department of Transportation, Department of Public Works, Hawai‘i DOT
	Cost	Very High
	Funding Sources	Staff Time; Hawai‘i DOT
	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Flood
	Mitigation Goal	Property

	CRS Category	Property Protection
13	**Support cross-departmental collaboration and planning in resilience and climate action efforts.**	
High	**Lead Department**	Mayor's Office, Department of Environmental Management
	Supporting Agency(ies)	Emergency Management Agency, Planning Department
	Cost	Low
	Funding Sources	Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks
	Mitigation Goal	Implementation
	CRS Category	Preventive
14	**Expand Beach and Dune Restoration Projects 1) Identify and prioritize erosion hotspots for mitigation via beach nourishment where applicable. 2) Pursue Federal/State/County funding for beach nourishment and restoration (including pre-positioning for post-disaster financial assistance). 3) Work with State regulatory agencies to streamline permitting for beach restoration. 4) Promote living shoreline projects instead of shoreline hardening**	

	where feasible. 5) Protect/restore coral reefs as they provide a barrier for erosion, high surf/coastal flooding and tsunamis.	
High	**Lead Department**	Planning Department
	Supporting Agency(ies)	Department of Parks & Recreation, Department of Environmental Management
	Cost	Very High
	Funding Sources	NOAA Coastal Resilience Grant and NMFS Ecosystem Restoration Grant; FWS Coastal Program; Hawai‘i DLNR Beach Fund; Hawai‘i Tourism Authority; County Budget
	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Flood, Hurricane, Tsunamis
	Mitigation Goal	Resilience
	CRS Category	Natural resource protection
15	Update dune restoration guidance. Provide dune restoration training. Develop an outreach initiative to encourage or establish new dune restoration volunteers/stewards. Install ADA compliant dune walkovers in identified locations.	
High	**Lead Department**	Planning Department
	Supporting Agency(ies)	Department of Parks & Recreation, Hawai‘i Department of Land and Natural Resources, UH-Sea Grant

	Cost	High
	Funding Sources	NOAA Coastal Resilience Grant; NMFS Ecosystem Restoration Grant; Hawai'i DLNR Beach Fund; Hawai'i Tourism Authority; County Budget
	Timeline	September 2020 - October 2023
	Hazards Addressed	Coastal Erosion, Flood, Hurricane, Tsunamis
	Mitigation Goal	Resilience
	CRS Category	Natural resource protection
16	**Participate in the CRS program and identify opportunities across all relevant County departments and programs to improve current CRS class.**	
High	**Lead Department**	Planning Department
	Supporting Agency(ies)	Department of Public Works, Emergency Management Agency
	Cost	Low
	Funding Sources	Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Flood

	Mitigation Goal	Implementation
	CRS Category	Preventive
17	**Conduct a multivariate GIS analysis to identify and categorize open spaces for the County of Maui to purchase and preserve based on highest ROI for hydrological capacity and positive impact on flood mitigation.**	
High	**Lead Department**	Planning Department
	Supporting Agency(ies)	Department of Public Works, Department of Parks and Recreation, Department of Land and Natural Resources
	Cost	Low
	Funding Sources	Staff Time
	Timeline	September 2020 - October 2021
	Hazards Addressed	Flood
	Mitigation Goal	Resilience
	CRS Category	Preventive
18	**Adopt internal protocols for how to intake, process, approve and file all new FDPs in order to ensure consistent and clear records for upcoming CRS audits. Having a more thorough digital record of approved FDPs will facilitate the Floodplain Manager achieving a greater score during the CRS Audits.**	

High	**Lead Department**	Planning Department
	Supporting Agency(ies)	Department of Public Works (DSA) for building permits
	Cost	Low
	Funding Sources	County Budget and Staff Time
	Timeline	September 2020 - March 2021
	Hazards Addressed	Flood
	Mitigation Goal	Implementation
	CRS Category	Preventive
19	**Encourage Low Impact Development (LID) approach to site development and stormwater management through development of best practices guide.**	
High	**Lead Department**	Planning Department, Department of Water Supply
	Supporting Agency(ies)	Department of Public Works, Emergency Management Agency
	Cost	Medium
	Funding Sources	FEMA BRIC and HMGP; EPA CWSRF and 319 Funding; County Budget

	Timeline	September 2020 - October 2025
	Hazards Addressed	Drought, Extreme Heat, Flood
	Mitigation Goal	Resilience
	CRS Category	Natural resource protection
20	**Flood proof water and wastewater treatment facilities located in flood hazard areas and identified as vulnerable to future damage or disruption. This includes but is not limited to the Kaunakakai Wastewater Treatment Facility.**	
Medium	**Lead Department**	Department of Environmental Management
	Supporting Agency(ies)	Emergency Management Agency, Maui Floodplain Manager
	Cost	Very High
	Funding Sources	EPA CWSRF; FEMA BRIC and HMGP
	Timeline	September 2020 - October 2025
	Hazards Addressed	Flood
	Mitigation Goal	Property
	CRS Category	Structural Projects

21	**Develop a strategy to mitigate risk to coastal roads.**	
Medium	**Lead Department**	Department of Public Works
	Supporting Agency(ies)	Department of Transportation, Department of Parks & Recreation, Emergency Management Agency
	Cost	High
	Funding Sources	FEMA BRIC and HMGP; Hawai'i DOT; Staff Time
	Timeline	September 2020 - October 2023 (for Planning, then ongoing for implementation)
	Hazards Addressed	Coastal Erosion, Flood, Hurricane, Tsunamis
	Mitigation Goal	Property
	CRS Category	Structural Projects
22	**Prepare an inventory of non-NBIS bridges using GIS and create a framework for an inspections schedule to help ensure that all bridges are assessed for their structural stability during a natural disaster, and to identify and prioritize the implementation of improvements for long-term resiliency (with an emphasis on bridges serving potentially isolated communities (e.g., East Maui).**	
	Lead Department	Department of Public Works

Medium	**Supporting Agency(ies)**	Department of Transportation, Hawai'i DOT
	Cost	Medium
	Funding Sources	FEMA BRIC, HMGP and PA 406; Hawai'i DOT; Staff Time
	Timeline	September 2020 - October 2024
	Hazards Addressed	Earthquake, Flood
	Mitigation Goal	Property
	CRS Category	Property Protection
23	**Identify and inventory areas at risk using GIS to landslides and rockfalls and mitigate risk to these areas. Specific areas to address include Kalepa (East Maui), Kahakuloa (Central/West Maui), and Hāna Highway (in/downslope of high landslide susceptibility areas or that have experienced past rockfalls).**	
Medium	**Lead Department**	Department of Public Works
	Supporting Agency(ies)	Department of Management/GIS
	Cost	Medium
	Funding Sources	FEMA BRIC and HMGP; Staff Time

	Timeline	September 2020 - October 2025
	Hazards Addressed	Landslide
	Mitigation Goal	Property
	CRS Category	Property Protection
24	**Improve drainage and slope stabilization along steeps areas that are prone to fail due to soil saturation, including the Kahekili Slope Repair project and other locations identified as priorities for hazard risk reduction. These include projects that protect critical facilities and infrastructure such as Pi'ilani Highway (through East Maui) and Kahekili Highway (through Kahakuloa). Develop a GIS data layer for hazard areas.**	
Medium	**Lead Department**	Department of Public Works
	Supporting Agency(ies)	Department of Parks and Recreation
	Cost	High
	Funding Sources	FEMA BRIC, HMGP and FMA; NRCS EWP; Hawai‘i DLNR; Staff Time
	Timeline	September 2020 - October 2021
	Hazards Addressed	Landslide
	Mitigation Goal	Property

	CRS Category	Structural Projects
25	**Replace aging stormwater infrastructure at the end of its life cycle with new infrastructure designed to future, more extreme events (i.e., above code).**	
Medium	**Lead Department**	Department of Public Works
	Supporting Agency(ies)	Department of Environmental Management
	Cost	High
	Funding Sources	EPA CWSRF; FEMA BRIC, HMGP and FMA
	Timeline	September 2020 - October 2025
	Hazards Addressed	Flood, Hurricane
	Mitigation Goal	Property
	CRS Category	Structural Projects
26	**Identify critical infrastructure, lifelines, roads, and populations that are vulnerable to coastal hazards, and encourage strategic retreat, relocation or retrofit. Maui Island Plan 3.1.2.a**	
	Lead Department	Emergency Management Agency

Medium	**Supporting Agency(ies)**	Planning Department, Department of Public Works, Department of Transportation, Facility Owners
	Cost	Very High
	Funding Sources	FEMA BRIC, HMGP, FMA, and PA 406; NOAA Coastal Resilience Grants
	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Flood, Hurricane, Tsunamis
	Mitigation Goal	Property
	CRS Category	Property Protection
27	**Where appropriate and feasible, provide technical assistance and administer financial support to willing property owners for the completion of projects to protect structures located in hazard-prone areas from future damage, with repetitive loss and severe repetitive loss properties as priority.**	
Medium	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	Homeowners, County Council
	Cost	Low
	Funding Sources	FEMA BRIC, HMGP and FMA; County funds (or property owner) for cost -share; Staff Time

	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Flood, Hurricane, Tsunami
	Mitigation Goal	Property
	CRS Category	Structural Projects
28	**Implement the guidance and tools identified in the 2019 Guidance for Disaster Recovery Preparedness in Hawai'i, which was supported by Maui County. (https://seagrant.soest.Hawai'i.edu/wp-content/uploads/2019/07/HI_Disaster_Recovery_Preparedness_Guidance_Final_26June2019.pdf)**	
Medium	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	UH Sea Grant, HI-EMA
	Cost	High
	Funding Sources	Staff Time; NOAA Coastal Resiliency Grant
	Timeline	September 2020 - October 2021
	Hazards Addressed	Coastal Erosion, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire
	Mitigation Goal	People

	CRS Category	Preventive
29	**Obtain FEMA's Substantial Damage Estimator and attend training to be prepared to use it when damage occurs; and develop mutual aid agreements with other jurisdictions to augment local inspection personnel after major disasters.**	
Medium	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	Department of Public Works, Planning Department
	Cost	Medium
	Funding Sources	FEMA and Staff Time
	Timeline	September 2020 - October 2023
	Hazards Addressed	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis, Wildfire
	Mitigation Goal	Implementation
	CRS Category	Preventive
30	**Conduct a detailed needs assessment and capital planning/feasibility study for additional emergency shelters for both residents and visitors. This includes retrofitting existing public facilities and structures to withstand up to a Category 3 hurricane (e.g., high school gym on Moloka'i).**	

Medium	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	American Red Cross
	Cost	Very High
	Funding Sources	Staff Time; FEMA BRIC and HMGP
	Timeline	September 2020 - October 2025
	Hazards Addressed	Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire
	Mitigation Goal	People
	CRS Category	Preventive

31	**Implement the Teen CERT Hero Project and promote the culture and resiliency of youth in Maui County.**	
Medium	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	Emergency Management Agency, Mayor's Office
	Cost	Low
	Funding Sources	FEMA and Staff Time

	Timeline	September 2020 - October 2022
	Hazards Addressed	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks
	Mitigation Goal	People
	CRS Category	Public information
32	**Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.**	
Medium	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	Mayor's Office, Department of Public Works
	Cost	Medium
	Funding Sources	County Budget and Staff Time
	Timeline	September 2020 - October 2022
	Hazards Addressed	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks

	Mitigation Goal	Implementation
	CRS Category	Preventive
33	**Research, promote, and support the implementation of wildfire mitigation practices for Wildland Urban Interface (WUI) and other areas identified as high risk but not covered by a current Community Wildfire Protection Plan (CWPPs). Practices may include but not be limited to the following: • Retrofit at-risk County structures with ignition-resistant materials • Initiating programs aimed at reducing fuel loads (removing non-native grasses and shrubs with native/fire-resistant species) • Prevent wildfire burn areas from being replanted with non-native vegetation • Implementing defensible space and firebreaks in rural developments through existing codes and development standards**	
Medium	**Lead Department**	Fire Prevention Bureau
	Supporting Agency(ies)	Department of Land and Natural Resources, Hawai‘i Wildfire Management Organization, Moloka‘i and West Maui Fire Task Force
	Cost	Medium
	Funding Sources	FEMA BRIC and HMGP; USFS SFA; Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Wildfire
	Mitigation Goal	Property
	CRS Category	Property Protection

34	**Support the Hawai'i Wildfire Management Organization, the Maui Wildfire Coordinating Group, local fire task forces, and other stakeholder organizations with the implementation of mitigation action items as identified in all current Community Wildfire Protection Plans (CWPPs).**	
Medium	**Lead Department**	Fire Prevention Bureau
	Supporting Agency(ies)	Fire & Public Safety, Maui Farm Bureau, Watershed Partners, Department of Land and Natural Resources, Division of Forestry and Wildlife
	Cost	Medium
	Funding Sources	FEMA BRIC and HMGP; USFS SFA; Staff Time
	Timeline	September 2020 - October 2023
	Hazards Addressed	Wildfire
	Mitigation Goal	Property
	CRS Category	Property Protection
35	**Develop a Master Plan for the use of County owned land along the Honoapiilani Highway.**	
	Lead Department	Mayor's Office

Medium	**Supporting Agency(ies)**	Planning Department, Department of Parks & Recreation, Emergency Management Agency
	Cost	Medium
	Funding Sources	FEMA BRIC and HMGP; HUD CDBG; Hawai‘i DOT; Staff Time
	Timeline	September 2020 - October 2023 (for Planning, then ongoing for implementation)
	Hazards Addressed	Coastal Erosion, Flood, Hurricane, Tsunamis
	Mitigation Goal	Resilience
	CRS Category	Preventive
36	**Mitigate the impacts of saltwater intrusion, exacerbated by flooding and/or erosion from Sea Level Rise, on utilities, ecosystems and other public facilities.**	
Medium	**Lead Department**	Mayor's Office
	Supporting Agency(ies)	Department of Water Supply, Department of Environmental Management, Department of Parks & Recreation
	Cost	Very High
	Funding Sources	FEMA BRIC and HMGP; NOAA Coastal Resilience Grants; USACE Section 14

	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Flood
	Mitigation Goal	Property
	CRS Category	Property Protection
37	**Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.**	
Medium	**Lead Department**	Mayor's Office
	Supporting Agency(ies)	Emergency Management Agency, Planning Department, Department of Environmental Management
	Cost	Medium
	Funding Sources	County Budget and Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks
	Mitigation Goal	Implementation

	CRS Category	Preventive
38	**Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.**	
Medium	**Lead Department**	Mayor's Office
	Supporting Agency(ies)	Emergency Management Agency, Planning Department
	Cost	Medium
	Funding Sources	County Budget and Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks
	Mitigation Goal	Resilience
	CRS Category	Emergency services
39	**Increase the number of NFIP-trained staff members, including those who are Coastal Zone Management planners, working to support the County's floodplain management program to build administrative capacity and increase performance efficiencies. Have each plan reviewer and building inspector attend a training or workshop related to floodplain**	

	management. Sponsor a periodic NFIP workshop for local surveyors and builders. Encourage or require more County staff positions to obtain and maintain Certified Floodplain Manager (CFM) certification, ideally having 2-3 dedicated CFMs optimizing the flood program.	
Medium	**Lead Department**	Planning Department
	Supporting Agency(ies)	Mayor's Office, FEMA Training Center, Association of State Floodplain Managers (ASFPM)
	Cost	Low
	Funding Sources	County Budget; FEMA Emergency Management Institute
	Timeline	September 2020 - October 2022
	Hazards Addressed	Flood
	Mitigation Goal	Implementation
	CRS Category	Preventive
40	**Conduct information sessions regarding the NFIP for public officials and appointees of the Flood Management Program with an emphasis on the importance of the County's participation in the NFIP and the impact of failing to enforce requirements.**	
Medium	**Lead Department**	Planning Department
	Supporting Agency(ies)	County Council

	Cost	Staff time
	Funding Sources	County Budget and Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Flood
	Mitigation Goal	Education
	CRS Category	Public information
41	**Maintain NFIP Compliance. Continue to maintain good standing and compliance under the NFIP through implementation of floodplain management programs that, at a minimum, meet the NFIP requirements: enforce the flood damage prevention ordinance, participate in floodplain identification and mapping updates, provide public assistance/information on floodplain requirements and impacts.**	
Medium	**Lead Department**	Planning Department
	Supporting Agency(ies)	County Council, Department of Public Works
	Cost	Low
	Funding Sources	County Budget and Staff Time
	Timeline	September 2020 - October 2025

	Hazards Addressed	Flood
	Mitigation Goal	Implementation
	CRS Category	Preventive
42	**Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)**	
Medium	**Lead Department**	Planning Department, Emergency Management Agency
	Supporting Agency(ies)	Mayor's Office, Department of Public Works, Department of Water Supply (collaborate with some of their events?)
	Cost	Low
	Funding Sources	County Budget and Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire
	Mitigation Goal	Education
	CRS Category	Public information

43	**Coordinate with industry stakeholders to develop alternative sources of irrigation water including wastewater reuse, recycled stormwater runoff, and brackish well water.**	
Low	**Lead Department**	Department of Environmental Management, Department of Water Supply
	Supporting Agency(ies)	Maui Farm Bureau, Department of Parks & Recreation, HDOA Agricultural Resource Management
	Cost	High
	Funding Sources	EPA CWSRF; Staff Time
	Timeline	2 Years
	Hazards Addressed	Drought
	Mitigation Goal	Resilience
	CRS Category	Preventive
44	**Increase water storage and development of additional capacity in Upcountry Maui and other areas susceptible to drought and encourage efficiency in conservation programs. Maui Island Plan 3.1.2 -Action 10**	
Low	**Lead Department**	Department of Environmental Management, Department of Water Supply

	Supporting Agency(ies)	Planning Department, Department of Public Works
	Cost	High
	Funding Sources	FEMA BRIC and HMGP; EPA CWSRF and 319 Funding; County Budget
	Timeline	September 2020 - October 2025
	Hazards Addressed	Drought
	Mitigation Goal	Resilience
	CRS Category	Natural resource protection
45	**Implement the mitigation actions identified in the existing and future drainage master plans.**	
Low	**Lead Department**	Department of Public Works
	Supporting Agency(ies)	Planning Department
	Cost	Very High
	Funding Sources	EPA CWSRF; FEMA BRIC and HMGP
	Timeline	September 2020 - October 2025

	Hazards Addressed	Flood
	Mitigation Goal	Property
	CRS Category	Structural Projects
46	**Identify permanent and temporary facilities that could be used as cooling centers for vulnerable populations as extreme heat events become more intense/more frequent.**	
Low	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	American Red Cross, Department of Parks & Recreation
	Cost	Low
	Funding Sources	Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Extreme Heat
	Mitigation Goal	People
	CRS Category	Emergency services
47	**Promote the availability of flood insurance to property owners in areas subject to flooding but not located within FEMA-mapped special flood hazard areas, with an emphasis on the ability to purchase for lower premium rates (via preferred risk policies).**	

Low	**Lead Department**	Emergency Management Agency
	Supporting Agency(ies)	Planning Department
	Cost	Low
	Funding Sources	County Budget and Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Flood
	Mitigation Goal	Education
	CRS Category	Public information
48	**Provide funding support to the University of Hawaiʻi (Coastal Geology Group) to complete shoreline erosion studies to include Molokaʻi and Lānaʻi and continue to update studies for Maui.**	
Low	**Lead Department**	Planning Department
	Supporting Agency(ies)	Emergency Management Agency
	Cost	High

	Funding Sources	FEMA BRIC; NOAA Coastal Resilience Grant; USACE; County Budget
	Timeline	September 2020 - October 2025
	Hazards Addressed	Coastal Erosion
	Mitigation Goal	Resilience
	CRS Category	Preventive
49	**Propose an amendment to the Zoning Code to prohibit building schools, daycare centers or other facilities that serve vulnerable populations, in tsunami evacuation zones.**	
Low	**Lead Department**	Planning Department
	Supporting Agency(ies)	Emergency Management Agency
	Cost	Staff time
	Funding Sources	Staff Time
	Timeline	September 2020 - October 2024
	Hazards Addressed	Tsunami
	Mitigation Goal	Property
	CRS Category	Preventive

50	**Establish an ad-hoc mobile application allowing "on-the-ground" recorded observations of flooding from citizens to create a high-resolution GIS layer of flooding spanning all county parcels.**	
Low	**Lead Department**	Planning Department
	Supporting Agency(ies)	Department of Public Works, Department of Water Supply, Department of Environmental Management, Emergency Management Agency, Department of Parks & Recreation, Division of Forestry and Wildlife, Department of Land and Natural Resources, County GIS
	Cost	Staff time
	Funding Sources	County Budget and Staff Time
	Timeline	September 2020 - October 2025
	Hazards Addressed	Flood
	Mitigation Goal	People
	CRS Category	Emergency services

Integrating the Mitigation Plan into other Planning Mechanisms

(include progress – how the plan has been implemented to date)

> *C6. Does the plan describe a process by which local governments will integrate the requirements of the mitigation plan into other planning mechanisms, such as comprehensive or capital improvement plans, when appropriate? (Requirement §201.6(c)(4)(ii))*

> *a. Does the plan identify the local planning mechanisms where hazard mitigation information and/or actions may be incorporated?*
>
> *b. Does the plan describe each community's process to integrate the data, information, and hazard mitigation goals and actions into other planning mechanisms?*
>
> *c. The updated plan must explain how the jurisdiction(s) incorporated the mitigation plan, when appropriate, into other planning mechanisms as a demonstration of progress in local hazard mitigation efforts.*

Possible Funding Sources

This section identifies some of the key external funding sources for hazard mitigation and similar risk reduction activities that are available to Maui County to support plan implementation in the years ahead. As Maui County pursues the execution of mitigation actions identified in this plan it will look toward these traditional federal and state funding sources as well as other new or emerging funding sources to support long-term resilience and adaptation to natural hazards and climate change.

Federal Funding Sources

Federal Emergency Management Agency

The Federal Emergency Management Agency (FEMA) makes grant funding available for a range of mitigation activities via several Hazard Mitigation Assistance (HMA) programs, each of which is administered by the State. These grant programs provide funding for eligible mitigation activities that reduce disaster losses and protect life and property from future disaster damages. They are not intended to fund repair, replacement, or deferred maintenance activities but are rather designed to assist in developing long-term, cost-effective improvements that will reduce risk to natural hazards. FEMA also encourages the incorporation of methods to mitigate the impacts of climate change into eligible HMA funded risk reduction activities. Local jurisdictions are eligible to apply for funding through the State as subgrantees, and assistance with application development and project eligibility criteria are available through MEMA. The brief descriptions below provide an overview of grant programs that are currently available and/or soon to be made available to Maui County.

- Building Resilient Infrastructure and Communities (BRIC)
  BRIC is a new FEMA hazard mitigation program designed to replace the agency's former HMA Pre-Disaster Mitigation (PDM) grant program, aiming to categorically shift the federal focus away from reactive disaster spending and toward research-supported, proactive investment in community resilience. It is a result of recent amendments made to Section 203 of the Robert T. Stafford Disaster Relief and Emergency Assistance Act (Stafford Act) by Section 1234 of the

Disaster Recovery Reform Act of 2018 (DRRA). BRIC will support states, local communities, tribes, and territories as they undertake hazard mitigation projects reducing the risks they face from natural hazards. The BRIC program's guiding principles are supporting communities through capability- and capacity-building; encouraging and enabling innovation; promoting partnerships; enabling large projects; maintaining flexibility; and providing consistency. Beginning in Fall 2020, FEMA anticipates BRIC funding projects that demonstrate innovative approaches to these types of activities with an added focus on infrastructure projects and community lifelines. Projects that bring multiple funding sources or in-kind resources from a range of private and public sector stakeholders or offer multiple benefits to a community in addition to the benefit of risk reduction will also be greatly emphasized.

- Flood Mitigation Assistance (FMA) Program
  The FMA program was created as part of the National Flood Insurance Reform Act (NFIRA) of 1994 (42 U.S.C. 4101) with the goal of reducing or eliminating claims under the National Flood Insurance Program (NFIP). FEMA provides FMA funds to assist states and communities with implementing measures that reduce or eliminate the long-term risk of flood damage to buildings, manufactured homes, and other structures insurable under the NFIP. The long-term goal of FMA is to reduce or eliminate claims under the NFIP through mitigation activities. One limitation of the FMA program is that it is generally used to provide mitigation for structures that are insured or located in Special Flood Hazard Areas (SFHAs). Federal funding for this nationally-competitive grant program is generally an annual allocation (subject to Congressional appropriation).

- Hazard Mitigation Grant Program (HMGP)
  The HMGP is authorized under Section 404 of the Stafford Act. The HMGP provides grants to states and local governments to implement long-term hazard mitigation measures after a major disaster declaration. The purpose of the HMGP is to reduce the loss of life and property due to natural disasters and to enable mitigation measures to be implemented during the immediate recovery from a disaster. A key purpose of the HMGP is to ensure that any opportunities to take critical mitigation measures to protect life and property from future disasters are not lost during the recovery and reconstruction process following a disaster. HMGP is typically available only in the months subsequent to a federal disaster declaration, as funding amounts are determined based on a percentage of the funds spent on FEMA's Public and Individual Assistance programs. Because the State administers HMGP directly, application cycles will need to be closely monitored by Maui County after major federal disaster declarations are approved for Hawai'i.

- Public Assistance 406 Mitigation (PA 406)
  Section 406 of the Stafford Act provides FEMA with the authority to fund cost-effective mitigation measures under the Public Assistance (PA) program for repairs, restoration, and replacement of eligible damaged facilities following a major disaster declaration. PA 406 grant funding, also commonly referred to as "406 Mitigation," is disaster specific and only applies to

disaster applicants that have already been approved for PA. 406 Mitigation work must be cost-effective, applied to the parts of the facility that were actually damaged by the disaster, and reduce future damages to the facility. Only FEMA has the discretion to determine eligibility and approve proposed 406 hazard mitigation projects prior to funding. Also, duplication of hazard mitigation funding is not allowed so 406 Mitigation funding cannot be used to meet the non-federal cost share of the other federal grants.

- Fire Prevention & Safety Grants (FP&S)
  Fire Prevention and Safety (FP&S) Grants are part of FEMA's Assistance to Firefighters Grants (AFG) and support projects that enhance the safety of the public and firefighters from fire and related hazards. The primary goal is to reduce injury and prevent death among high-risk populations. Under recent funding cycles priority has been given to community-appropriate comprehensive risk assessments and risk reduction planning. These assessments and planning projects focus on the whole community (versus individual home risk reduction/mitigation) and include risk assessments for Wildland-Urban Interface (WUI) areas, Community Wildfire Protection Plans (CWPPs), and wildfire education and awareness programs. Fuel reduction demonstrations, in a targeted location as part of an awareness and education effort, are also considered. Another stated priority are projects that focus on first time or reinstatement of code adoption and code enforcement, including WUI codes for communities with an identified WUI-wildfire risk.

- Emergency Management Preparedness Grant (EMPG) Program
  Separate from the above HMA programs, the EMPG program plays an important role in the implementation of the National Preparedness System by supporting the building, sustainment, and delivery of core capabilities essential to achieving the National Preparedness Goal of a secure and resilient nation. Pending the availability of funds, MEMA, through an annual sub-grant application process, makes EMPG funding available to all communities in Hawai'i through their local emergency management department. This is a reimbursement-based grant program with a goal to assist local emergency management departments in building and maintaining an all-hazards emergency preparedness system. Communities may use EMPG funds towards planning; organizational support; equipment; training; and exercises.

U.S Department of Housing and Urban Development

The U.S. Department of Housing and Urban Development (HUD) provides Community Development Block Grant (CDBG) funding for projects that achieve local community and economic development objectives. Although administered by the Department of Housing and Community Development (DHCD), eligible activities must still meet national program objectives that include benefiting low and moderate-income persons, eliminating slum and blight, or addressing an urgent need.

- Community Development Block Grant (CDBG) Program
  The CDBG program provides financial assistance to eligible municipalities in order to develop viable communities by providing affordable housing and suitable living environments, as well as expanding economic opportunities, principally for persons of low and moderate income. It is possible that the CDBG funding program could be applicable for floodproofing and elevating residential and nonresidential buildings, depending on eligibility of those buildings relative to the program requirements. Other possible activities may include stormwater drainage improvements, the use of low impact development or green infrastructure to minimize hazard risks, and more.

- Community Development Block Grant – Disaster Recovery (CDBG-DR) Program
  Through CDBG-DR, HUD provides flexible grants to help cities, counties, and states recover from Presidentially declared disasters, especially in low-income areas, subject to availability of supplemental appropriations. The CDBG-DR program is designed to meet the unmet needs of communities most impacted by disasters including the costs of repairs, reconstruction, and new construction that insurance, FEMA, and any other sources of funding does not cover. In response to Presidentially declared disasters, Congress may appropriate additional funding for the CDBG-DR program to rebuild the affected areas and provide crucial seed money to start the recovery process. Since CDBG-DR assistance may fund a broad range of activities, including those related to disaster recovery but also long-term risk reduction, Maui County could use these funds to help communities and neighborhoods become more resilient in ways that otherwise may not be possible due to limited resources.

National Oceanic and Atmospheric Administration (NOAA)

- Coastal Resilience Grants
  NOAA is committed to helping coastal communities address increasing risks from extreme weather events, climate hazards, and changing ocean conditions. To that end, NOAA's National Ocean Service is providing funding through competitive grant awards through the Regional Coastal Resilience Grants program. Awards are made for project proposals that advance resilience strategies, often through land and ocean use planning; disaster preparedness projects; environmental restoration; hazard mitigation planning; or other regional, state, or community planning efforts. Successful proposals demonstrate regional coordination among project stakeholders, leverage resources (such as funds, programs, partnerships, and others), and create economic and environmental benefits for coastal communities. Project results are evaluated using clear measures of success, with the end goal being improved preparation, response, and recovery. Eligible applicants include nonprofit organizations; institutions of higher education; regional organizations; private (for profit) entities; and local, state, and tribal governments. Award amounts typically range from $500,000 to $1 million for projects lasting up to 36 months. Cost sharing through cash or in-kind matches is expected. Applicants must conduct projects benefiting coastal communities in one or more of the 35 U.S. coastal states or territories.

- National Tsunami Hazard Mitigation Program (NTHMP)
  As directed by Congress, NOAA provides financial assistance to NTHMP partner states, including Hawai'i. These grants are the primary funding source for projects that further the efforts of the NTHMP and NOAA's TsunamiReady program. With this assistance, NTHMP partner states have been able to substantially improve the products and services they provide to coastal communities in a cost-effective way. Examples of fundable projects include inundation maps, evacuation plans and maps, technical training and public education programs, outreach projects, preparedness and mitigation workshops, planning guidance, evacuation drills, signs, and maintenance of warning infrastructure (e.g., sirens).

Natural Resources Conservation Service

The U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS) provides technical assistance to individual landowners, groups of landowners, communities, and soil and water conservation districts on land use and conservation planning, resource development, stormwater management, flood prevention, erosion control and sediment reduction, detailed soil surveys, watershed/river basin planning and recreation, and fish and wildlife management. Financial assistance is available to reduce flood damage in small watersheds and to improve water quality. Two major programs are described below.

- Emergency Watershed Protection (EWP) Program
  Through the EWP program, the NRCS can help communities address watershed impairments that pose imminent threats to lives and property. Most EWP work is for the protection of threatened infrastructure from continued stream erosion. NRCS may pay up to 75% of the construction costs of emergency measures. The remaining costs must come from local sources and can be made in cash or in-kind services. No work done prior to a project agreement can be included as in- kind services or part of the cost share. EWP projects must reduce threats to lives and property; be economically, environmentally, and socially defensible; be designed and implemented according to sound technical standards; and conserve natural resources.

- Watersheds and Flood Prevention Operations

  This program element contains two separate and distinct programs, "Watershed Operations" and "Small Watersheds." The purpose of these programs is to cooperate with state and local agencies, tribal governments, and other federal agencies to prevent damages caused by erosion, floodwater, and sediment and to further the conservation, development, utilization, and disposal of water and the conservation and utilization of the land. The objectives of these programs are to assist local sponsors in assessing conditions in their watershed, developing solutions to their problems, and installing necessary measures to alleviate the problems. Measures may include land treatment and structural and nonstructural measures. Federal cost

sharing for installation of the measures is available. The amount depends upon the purposes of the project.

U.S. Army Corps of Engineers

The U.S. Army Corps of Engineers (USACE) provides 100% funding for floodplain management planning and technical assistance to states and local governments under several flood control acts and the Floodplain Management Services (FPMS) Program. Specific programs used by USACE for mitigation are listed below.

- Section 205 – Small Flood Damage Reduction Projects
  This section of the 1948 Flood Control Act authorizes USACE to study, design, and construct small flood control projects in partnership with nonfederal government agencies. Feasibility studies are 100% federally funded up to $100,000 with additional costs shared equally. Costs for preparation of plans and construction are funded 55% with a 35% nonfederal match. In certain cases, the nonfederal share for construction could be as high as 50%. The maximum federal expenditure for any project is $7 million.

- Section 14 – Emergency Streambank and Shoreline Protection
  This section of the 1945 Flood Control Act authorizes USACE to construct emergency shoreline and stream bank protection works to protect public facilities such as bridges, roads, public buildings, sewage treatment plants, water wells, and nonprofit public facilities such as churches, hospitals, and schools. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is $1.5 million.

- Section 208 – Clearing and Snagging Projects
  This section of the 1954 Flood Control Act authorizes USACE to perform channel clearing and excavation with limited embankment construction to reduce nuisance flood damages caused by debris and minor shoaling of rivers. Cost sharing is similar to Section 205 projects above. The maximum federal expenditure for any project is $500,000.

- Section 205 – Floodplain Management Services
  This section of the 1950 Flood Control Act, as amended, authorizes USACE to provide a full range of technical services and planning guidance necessary to support effective floodplain management. General technical assistance efforts include determining the following: site-specific data on obstructions to flood flows, flood formation, and timing; flood depths, stages, or floodwater velocities; the extent, duration, and frequency of flooding; information on natural and cultural floodplain resources; and flood loss potentials before and after the use of floodplain management measures. Types of studies conducted under FPMS include floodplain delineation, dam failure, hurricane evacuation, flood warning, floodway, flood damage reduction, stormwater management, floodproofing, and inventories of flood prone structures. When funding is available, this work is 100% federally funded.

In addition, USACE also provides emergency flood assistance (under Public Law 84-99) after local and state funding has been used. This assistance can be used for both flood response and post-flood response. Corps assistance is limited to the preservation of life and improved property; direct assistance to individual homeowners or businesses is not permitted. In addition, USACE can loan or issue supplies and equipment once local sources are exhausted during emergencies.

United States Forest Service (USFS) State Fire Assistance Program

Established in 1978, the State Fire Assistance (SFA) program is the primary federal mechanism that provides states and communities financial and technical assistance for wildland fire management. It remains a fundamental building block for state forestry agencies nationwide. SFA serves to help states and local communities with wildland firefighting response, capacity building, fire prevention education, and wildland fire mitigation. SFA funds are provided directly to state forestry organizations but may be passed through to other organizations approved by the state to conduct special projects including fire departments, local governments, educational institutions, and non-profit organizations. Projects include supporting state-coordinated hazard mitigation activities in the WUI focused on reducing property loss, decreasing fuels hazards, increasing public awareness, developing fire plans, and sponsoring citizen-driven solutions in rural communities. Grants provided under the SFA program are on a 50-50 cost-share basis and allow state and local matching funds to leverage the federal investment.

U.S. Department of the Interior, Fish and Wildlife Service (FWS) Coastal Program

The Coastal Program is a voluntary, incentive-based program that provides direct technical assistance and financial assistance in the form of cooperative agreements to coastal communities and landowners to restore and protect fish and wildlife habitat on public and private lands. Coastal Program staff coordinate with project partners, stakeholders, and other Service programs to identify geographic focus areas and develop habitat conservation priorities within these focus areas. Geographic focus areas are where the Coastal Program directs resources to conserve habitat for federal trust species. Project work plans are developed strategically, in coordination with partners, and with substantial involvement from Service field staff. Projects must advance FWS's mission, promote biological diversity, and be based upon sound scientific biological principles. Program strategic plans inform the types of projects funded inform the types of projects funded under this opportunity.

State Funding Sources

The State of Hawai'i provides funding to support a variety of mitigation activities, including earmarking funds for its own hazard mitigation projects, providing grant monies to counties and non-governmental organizations, supporting ongoing programs that further mitigation goals, and using state monies or in-kind contributions as matching funds for federal grants. These state funding sources may include but are

not limited to the following as specified and described in the State of Hawai'i 2018 Hazard Mitigation Plan.[256]

Department of Accounting and General Services (DAGS)

- Land Acquisition Program
  The Public Works Division of DAGS plans, coordinates, organizes, directs, and controls a variety of engineering and architectural services for the State including land acquisition. Funds for land acquisition are appropriated by the legislature through the Capital Improvement Program. Land acquisition is conducted in partnership with the Department of Land and Natural Resources (DLNR) Land Division.

- Shelter Upgrade Program
  The Public Works Division of DAGS takes the lead in implementing sheltering upgrades for public facilities to withstand disasters. Funds for shelter upgrades are appropriated by the legislature through the Capital Improvement Program.

Department of Budget and Finance (DBF)

- Capital Improvements Budgets
  Project appropriation proposals submitted by state and county agencies are reviewed, prioritized, and evaluated to ensure conformity with statewide planning goals and objectives and executive priorities, and an estimate of the operational costs for each proposed capital improvement project is provided to the governor for consideration for possible inclusion in the executive capital improvement project budget that is to be presented to the legislature. The department also reviews, analyzes, and reports on state and county capital improvement project appropriation proposals that extend over wide geographical areas of the State and that have significant impacts upon economic development, land use, environmental quality, construction employment, and executive policy directions. Act 286 (HRS § 226-109) adopting Climate Change Adaptation Priority Guidelines as a policy of the Hawai'i State Planning Act (see Table C.1-7 below) mandates that all county and state agency actions consider climate change adaptation in capital improvement.

Department of Health (DOH)

- Department of Health All-Hazards Training and Exercise Program
  Facilitates training and exercises for the entire department to ensure the department's ability to respond to and support recovery from public health emergencies

- Hospital Preparedness Program
  Supports the continuity of healthcare system operations during emergencies that exceed the

[256] State of Hawai'i 2018 Hazard Mitigation Plan, p. 5-12.

day-to-day capacity of health and emergency response systems through the development and sustainment of a regional health care coalition that incentivizes healthcare organizations to work together to maintain essential capabilities of statewide healthcare services.

Department of Land and Natural Resources (DLNR)

- Fire Management Program

  DLNR's Division of Forestry and Wildlife (DOFAW) is statutorily mandated by the Land Fire Protection Law, Chapter 185, Hawai'i Revised Statutes, to take measures for the prevention, control, and extinguishment of wildfires on lands managed by DOFAW, which accounts for 26% of the land statewide. DOFAW is also required to cooperate for these purposes with county fire departments and federal agencies to an additional 32% which is determined by Mutual Aid Agreements and Memoranda of Agreement or Understanding. DOFAW supports prevention, pre-suppression, and suppression activities, including mitigation, such as maintaining fire and fuel breaks/access roads, reducing and/or converting hazard fuels through the green breaks, living breaks, managed grazing, and as necessary, prescribed burns. DOFAW is also the State Liaison to the Firewise USA program, which encourages residents to work with neighbors to reduce home ignition potential and increase home survivability leading to the prevention of wildfire disasters.

- Legacy Lands Conservation Program
  The State of Hawai'i dedicates a portion of its annual revenue from real estate conveyance taxes to the Land Conservation Fund. Each year the State Legislature provides the Legacy Land Conservation Program with some of the money held in the Fund. The Legacy Land Conservation Program distributes this money through a competitive grants process–for purchasing land and conservation easements and for paying the debt service on state financial instruments (such as bonds)–for the protection of land that shelters exceptional, unique, threatened, and endangered resources.

- Watershed Partnership Program
  The Watershed Partnerships Program provides technical and financial support for the implementation of watershed management plans. The Watershed Partnerships Program is funded by the Natural Area Reserve Special Fund, established by HRS §195-9. These funds come from a portion of the conveyance tax, which is levied each time real estate property is bought or sold. The mission of the program is to "increase the effective management and protection of mauka watershed areas by raising the capacity of watershed partnerships, facilitating sharing of watershed management expertise, building public support for protecting watershed values, and developing sustainable funding sources." Watershed protection measures relevant to mitigation goals include recharging water supplies, controlling erosion and runoff, mitigating flooding, and mitigating the impacts of climate change.

- Natural Area Partnership Program
  The Natural Area Partnership Program (NAPP) was established in 1991 by the state Legislature and the Governor authorizing the DLNR to "provide state funds for the management of private lands that are dedicated to conservation." Lands and waters that might qualify include areas with intact native Hawai'ian ecosystems, essential habitat for endangered species, and areas within the protective (P) subzone of the Conservation District.

- Natural Area Reserves System
  The statewide Natural Area Reserves System (NARS) was established to preserve in perpetuity specific land and water areas which support communities, as relatively unmodified as possible, of the natural flora and fauna, as well as geological sites, of Hawai'i. The system presently consists of 21 reserves on five islands, encompassing 123,810 acres of the State's most unique ecosystems. The Strategic Plan for Hawai'i's Natural Area Reserves System (2008) includes objectives and sub-objectives that support mitigation goals, such as "employ appropriate fire management strategies."

Hawai'i Emergency Management Agency (WSSPC)

- Western States Seismic Policy Council
  Hawai'i is a member of the WSSPC, which develops seismic policies and shares information to promote programs intended to reduce earthquake related losses. WSSPC also hosts a Tsunami Center and continues to support several mitigation initiatives in the state including Hawai'i Hazards Awareness and Resilience Program (HHARP), printing 3,000 copies of the Natural Hazards Preparedness Wheel, and general outreach initiatives.

Hawai'i State Legislature

- Hawai'i State Legislature Grant-in-Aid (GIA) Program
  The Pursuant to Chapter 42F, Hawai'i Revised Statutes (HRS), the Legislature may award state funds on an annual basis as a grant by an appropriation to a specified recipient, to support the activities of the recipient and permit the community to benefit from those activities. These activities may include hazard mitigation. An appropriation for a grant shall be disbursed by a contract between the state agency designated the expending agency for the appropriation by the legislature, and the recipient of the grant. During the Regular Legislative Session of 2016, the Hawai'i State Legislature appropriated $158,000 as a grant to Hawai'i Wildfire Management Organization (HWMO) to support wildfire prevention and hazardous fuel reduction measures, including:
    - Create all-agency unified wildfire prevention messaging, related materials, and a public awareness campaign to maximize public protection and preparedness; and

- Develop cross-boundary fuel reduction priorities, maps, and projects for all four counties in the State of Hawai‘i. DLNR-DOFAW was the designated expending agency for the grant to HWMO.

Other Potential Funding Sources

A wide array of other potential funding sources may be available to support mitigation activities within the State of Hawai'i. These include but are not limited to the following additional sources that state agencies have previously indicated are being used or pursued to support mitigation activities. More detailed information on how these funds are being used is available in the State of Hawai'i 2018 Hazard Mitigation Plan.[257]

- Clean Water Act Section 319 Funding, U.S. EPA
- Coastal and Estuarine Land Program, NOAA
- Coastal Zone Enhancement Program (Section 309) Funding, NOAA
- Conservation Reserve Enhancement Program, Farm Service Agency
- Forest Legacy Program, U.S. Forest Service
- Forest Stewardship Program, U.S. Forest Service
- Hospital Preparedness Program, U.S. Department of Health & Human Services
- National Earthquake Hazards Reduction Program
- Silver Jackets Interagency Program, U.S. Army Corps of Engineers
- State and Private Forestry Branch, U.S. Forest Service
- Weatherization Assistance Program, U.S. Department of Energy
- Wildland Urban Interface Grant Program, U.S. Forest Service

[257] State of Hawai'i 2018 Hazard Mitigation Plan. Appendix C: Capability Assessment Supplement and Appendix G: Mitigation Strategy Supplement.

Chapter 7. Plan Implementation and Maintenance

The Plan Implementation and Maintenance chapter meets the requirements of the steps outlined in CRS Step 10 and 44 CFR Section 201.6(c)(4). These steps include the following:

- A section describing how Maui County will implement the recommendations of this plan over its 5-year performance period
- A process by which Maui County will incorporate the requirements of the mitigation plan into other planning mechanisms, such as general or capital improvement plans, when appropriate
- A section describing the method and schedule of monitoring, evaluating, and updating the mitigation plan over the 5-year cycle
- A discussion on how the community will continue public participation in the plan maintenance process.

Maui County did integrate elements of the 2015 Hazard Mitigation Plan into other planning mechanisms such as the Community Plans. In addition, a 2018 Progress Report was developed by Maui Emergency Management Agency for the purpose of ensuring a continuing and responsive planning process to keep the Hazard Mitigation Plan dynamic and responsive to the needs and capabilities of Maui County.[258] The Progress Report included a summary of the plan's progress:

- 18 out of 62 initiatives (62%) reported ongoing action toward completion.
- 8 out of 62 initiatives (13%) reported as being complete.
- 36 out of 62 initiatives (58%) reported no action taken.

The Progress Report included a list of Hazard Mitigation Working Group members. This group was renamed the Steering Committee for the 2020 planning process. In addition, a list of public outreach events was included such as the continuation of the Hawai'i Hazards Awareness and Resilience Program (HAARP) for Lahaina residents and the Disaster Preparedness Expo that MEMA hosted. The Progress Report also listed six major hazard events that occurred in 2018 and mentioned the increase risk of landslides due to the wildfires that reduced the amount of vegetation holding hillsides. The report included a detailed Initiative Action Plan Matrix that listed the progress and comments for each of the plan's 63 mitigation actions. This matrix was used to begin the process of reviewing the mitigation actions toward development of this plan.

This chapter details the formal process that will ensure that the Maui County Hazard Mitigation Plan remains an active and relevant document and that the County maintains its eligibility for pre- and post-disaster mitigation grant funding. The chapter includes a schedule for monitoring and evaluating the plan annually and producing an updated plan every 5 years. The plan's format allows sections to be reviewed and updated when new data become available, resulting in a plan that will remain current and

[258] Maui County Hazard Mitigation Plan Annual Progress Report, Maui Emergency Management Agency, 2019.

relevant. Table 101 below lists the timeframe for the most essential elements to implementing and maintaining the Hazard Mitigation Plan.

Table 101. Plan Implementation Schedule.

Plan Element	Responsible Party and Planning Approach	Timeframe
Continued Public Involvement	Hazard Mitigation Officer, Maui Emergency Management Agency assumes ultimate responsibility.	Ongoing
Monitoring Plan Implementation	Hazard Mitigation Officer, Maui Emergency Management Agency assumes ultimate responsibility. The Hazard Mitigation Officer will distribute a questionnaire (Bi-Annual Progress Report included in Appendix E) to all departments identified as mitigation action leads to gather their feedback regarding progress made over a six-month period. This information will be added to the Hazard Mitigation Action Tracker. Departments identified as the lead for specific mitigation actions are responsible for monitoring the implementation of those actions. They will report progress twice a year to the Hazard Mitigation Officer. The Floodplain Administrator completes an annual Flood Program Report for the Community Rating System (CRS) program which will capture some information regarding public involvement and flood mitigation actions. This report will be included with the Annual Progress Report described below. The Steering Committee will meet twice a year at a minimum. At each meeting they will review Hazard Mitigation Plan implementation and effectiveness. The Hazard Mitigation Officer will facilitate these meetings.	Steering Committee meets twice a year to review progress and discuss grant/funding opportunities. Flood Program Report for CRS completed annually.

Evaluating Plan Effectiveness	Hazard Mitigation Officer, Maui Emergency Management Agency assumes ultimate responsibility. Annually, the Hazard Mitigation Officer will generate Progress Report that includes progress made toward implementing mitigation actions, hazard occurrences and impacts, and public outreach and engagement. The report will also include how hazard mitigation plan goals were incorporated into other County plans. The Steering Committee will meet to review the Progress Report. This report will be used toward development of the 5-year plan update.	Annual Progress Report
Updating the Plan	Hazard Mitigation Officer, Maui Emergency Management Agency assumes ultimate responsibility. The Hazard Mitigation Plan will undergo a formal update, at a minimum of every five years from the date of plan approval, per federal regulations (44 CFR Section 201.6.d(3)). The Hazard Mitigation Plan may be updated more frequently if necessary. The following events may cause an update: • A presidential disaster declaration • A hazard event that causes extreme impact including deaths or displacement • A revision to the County's General Plan	5-Year Update for FEMA Review

Monitoring the Implementation and Effectiveness of the Hazard Mitigation Plan

A6. Is there a description of the method and schedule for keeping the plan current (monitoring, evaluating and updating the mitigation plan within a 5-year cycle? (Requirement 201.6(c)(4)(i))

a. Does the plan identify how, when, and by whom the plan will be monitored (how will implementation be tracked) over time?

b. Does the plan identify how, when, and by whom the plan will be evaluated (assessing the effectiveness of the plan at achieving stated purpose and goals) over time?

c. Does the plan identify how, when, and by whom the plan will be updated during the 5-year cycle?

The effectiveness of the hazard mitigation plan depends on its implementation and the incorporation of its action items into existing local plans, policies and programs. Together, the action items in the Plan provide a framework for activities that Maui County can implement over the next 5 years. The Planning Team and the Steering Committee have established a mission statement and goals as well as prioritized mitigation initiatives that will be implemented through existing plans, policies, and programs.

Hazard Mitigation Officer

The Maui Emergency Management Agency and specifically the Hazard Mitigation Officer will have lead responsibility for overseeing the plan implementation and maintenance strategy; however, plan implementation and evaluation will be a shared responsibility among all agencies identified as lead agencies in the mitigation action plan.

The Steering Committee has included a mitigation action to hire a Capital Improvement Project Coordinator for the purpose of identifying funding opportunities for the mitigation actions included in the plan. In addition, this person would be considered the Plan Implementation Lead. In the meantime, the Hazard Mitigation Officers serves as the Plan Implementation Lead. The Plan Implementation Lead will:

- Organize and lead the Steering Committee.
- Work with the Steering Committee to identify and develop opportunities for implementation of mitigation actions.
- Monitor grant funding opportunities for mitigation actions and coordinate with lead agencies to apply for grant funds.

Steering Committee

The hazard mitigation Steering Committee is a total volunteer body that oversaw the development of the Plan and made recommendations on key elements of the Plan, including the implementation and maintenance strategy. The Steering Committee will remain a viable body involved in key elements of the Plan implementation and maintenance strategy. The Hazard Mitigation Officer has the responsibility to keep Steering Committee members engaged and to invite new members as needed to represent all key and interested stakeholders. This committee should strive to include representation from stakeholders in the planning area as well as identified lead agencies.

The Steering Committee will meet a minimum of twice a year to review the implementation and evaluation of the Hazard Mitigation Plan. It is the responsibility of Steering Committee members to attend meetings and participate in the implementation, evaluation, and maintenance of the Hazard Mitigation Plan. The Hazard Mitigation Officer will host these meetings. Prior to each meeting, they will distribute the Bi-Annual Progress Report questionnaire to each member. Each meeting will include four agenda topics:

1. Identification and refinement of mitigation actions based on current need.
2. Funding opportunities, what is available and how to access funding.
3. Strategies for incorporating the mitigation actions and strategy into existing planning mechanisms and programs.
4. Review of input for the Annual Progress Report.

Future plan updates will be overseen by Steering Committee, so keeping the group intact will provide a head start on future updates.

Annual Progress Report

The Hazard Mitigation Officer will develop an Annual Hazard Mitigation Plan Progress Report. The Annual progress reporting is credited under CRS Step 10. The Annual Progress Report is based on data collected from the Steering Committee in the Bi-Annual Progress Reports they completed, and information contained in the Mitigation Action Tracker. When the Steering Committee meets, they will review the following items for inclusion in the Annual Progress Report:

- Summary of any hazard events that occurred during the performance period and the impact these events had on the planning area
- Review of mitigation success stories
- Review of public involvement and plans for continued involvement
- Brief discussion about why targeted strategies were not completed
- Reevaluation of the action plan to determine if the timeline for identified projects needs to be amended (such as changing a long-term project to a short-term project because of new funding)
- Recommendations for new projects
- Changes in or potential for new funding options (grant opportunities)
- Impact of any other planning programs or initiatives that involve hazard mitigation.

The planning team has created a template for preparing a Bi-Annual Progress Report (see Appendix E). The Hazard Mitigation Officer will prepare the Annual Progress Report and share it with the County in the following ways:

- Posted on the Maui County Hazard Mitigation Plan webpage.
- Provided to the local media through a press release.
- Presented to the Maui County Council and Mayor to inform them of the progress of mitigation initiatives implemented during the reporting period.
- Provided as part of the CRS annual re-certification package. The CRS requires an annual recertification to be submitted by October 1 of every calendar year for which the community has not received a formal audit. To meet this recertification timeline, the planning team will strive to complete progress reports between June and September each year.

Updating the Plan

Maui County intends to update the hazard mitigation plan on a 5-year cycle from the date of initial plan adoption (CRS Step 10). This cycle may be accelerated to less than 5 years based on the following triggers:

- A federal disaster declaration that impacts the planning area
- A hazard event that causes loss of life
- A comprehensive update of the Maui Countywide Policy Plan portion of the general plan.

The update will, at a minimum, include the following elements:

- The update process will be convened through a steering committee.
- The hazard risk assessment will be reviewed and, if necessary, updated using best available information and technologies.
- The action plan will be reviewed and revised to account for any initiatives completed, dropped, or changed and to account for changes in the risk assessment or new policies identified under other planning mechanisms (such as the general plan).
- The draft update will be sent to appropriate agencies and organizations for comment.
- The public will be given an opportunity to participate in the planning process.
- The Maui County Mayor will adopt the updated plan.

Continued Public Involvement

> *A5. Is there discussion of how the community will continue public participation in the plan maintenance process? (Requirement 201.6(c)(4)(iii))*

The public will continue to be apprised of the plan's progress through the hazard mitigation plan website (https://www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan) which will include the Annual Progress Report and other planning related announcements. The website will not only house the final plan, it will become the one-stop shop for information regarding the plan and plan implementation. The Hazard Mitigation Officer intends to develop a web-based version of the plan for the purposes of interacting with the public and plan stakeholders. This proposal is under review by the Hawai'i Emergency Management Agency.

Upon initiation of future update processes, a new public involvement strategy will be initiated based on guidance from the Steering Committee. This strategy will be based on the needs and capabilities of Maui County at the time of the update. At a minimum, this strategy will include the use of local media outlets within the planning area.

Communities likely to experience isolation, such as Molokaʻi, Hāna, and Lānaʻi will continue to hold public disaster preparedness meetings. The Hazard Mitigation Officer will support these groups and attend meetings as possible. The Hazard Mitigation Officer will support public meetings in all planning areas that relate to hazard mitigation, such as development of Community Plans, by providing meeting leaders with hazard mitigation information and attending meetings whenever possible. Steering Committee meetings will provide an opportunity for the Hazard Mitigation Officer and key County stakeholders to determine how best to support common goals. These meetings also provide a chance for facilitating the integration of the Hazard Mitigation Plan into other planning mechanisms and County programs.

Acronyms

NAME	Description
ACS	US Census American Community Survey
APA	American Planning Association
ATSDR	Agency for Toxic Substances and Disease Registry
BCEGS	Building Code Effectiveness Grading Schedule
BFE	Base Flood Elevation
BPR	Bottom Pressure Recorder
CDC	Centers for Disease Control and Prevention
CERT	Community Emergency Response Team
CFs	Critical Facilities
CFM	Certified Floodplain Manager
CMG	USGS Coastal & Marine Geology
CRS	Community Rating System
CVI	Coastal Vulnerability Index
CWPP	Community Wildfire Protection Plan
DART	Deep-ocean Assessment and Reporting of Tsunami
DEM	Digital Elevation Model
DFIRM	Digital Flood Insurance Rate Map
DLNR	Hawai'i Department of Land and Natural Resources
DMA	Disaster Mitigation Act
DR	Disaster Declaration Number
DRC	Disaster Recovery Center
ENSO	El Niño–Southern Oscillation
EO	Executive Order

NAME	Description
EOC	Emergency Operations Center
EPA	Environmental Protection Agency
FEMA	Federal Emergency Management Agency
FERC	Federal Energy Regulatory Commission
FIRM	Priority Risk Index
GDP	Gross Domestic Product
GIS	Geographic Information Systems
HAARP	Hawaii Hazards Awareness and Resilience Program
HEMA	Hawaii Emergency Management Agency
HAZMAT	Hazardous Materials
HCI	Hydrochloric Acid Gas
HMA	Hazard Mitigation Assistance
IPCC	Intergovernmental Panel on Climate Change
LiMWA	Limit of Moderate Wave Action
LTBI	Tuberculosis – latent TB infection
LTR	Long Term Recovery
MEMA	Maui Emergency Management Agency
MMI	Modified Mercalli Intensity
MMR	Measles, Mumps, Rubella
MMRV	Measles, Mumps, Rubella, Varicella
MPH	Miles Per Hour
NBI	National Bridge Inventory
NCD	Non-Communicable Disease
NCEI	National Centers for Environmental Information
NEHRP	National Earthquake Hazards Reduction Program

NAME	Description
NFIP	National Flood Insurance Program
NID	National Inventory of Dams
NOAA	National Oceanic and Atmospheric Administration
NWI	National Wetland Inventory
NWS	National Weather Service
PacIOOS	Pacific Islands Ocean Observing System
PDA	Preliminary Damage Assessment
PDC	Pacific Disaster Center
PGA	Peak horizontal ground acceleration
PHMSA	Pipeline and Hazardous Materials Safety Administration
PPE	Personal protective equipment
PRI	Priority Risk Index
PRI	Priority Risk Index
RL	Repetitive Loss
RPC	Representative Concentration Pathway
SA	Spectral Acceleration
SFHA	Special Flood Hazard Areas
SHELDUS	Spatial Hazard Events and Losses Database
SILVIS	Spatial Analysis for Conservation and Sustainability
SLOSH	Sea, Lake, and Overland Surges from Hurricanes
SLR	Sea level rise
SRL	Severe Repetitive Loss
SVI	Social vulnerability index
TB	Tuberculosis
THIRA	Threat & Hazard Identification & Risk Assessment

NAME	Description
TRI	Toxic Release Inventory
USACE	U.S. Army Corps of Engineers
USDA	U.S. Department of Agriculture
USFWS	U.S. Fish and Wildlife Service
USGS	United States Geological Survey
USGS	U.S. Centers for Disease Control and Prevention
VEI	Volcanic Explosivity Index
VOAD	Voluntary Organizations Active in Disaster
WSO	Weather Service Office
WUI	Wildland-Urban Interface

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Hawaiian Spelling of Names

ʻAiea

aloha

e komo mai

Haʻikū

Hālawa

Haleakalā

Hāliʻimaile

Hāna

Hanapēpē

Hawaiʻi

Hilo

Honokaʻa

Honokōwai

Honolulu

Hoʻolehua

Hui Mālama

ʻIolani

Kaʻahumanu

Kāʻanapali

Kāhala

Kahoʻolawe

Kahului

Kailua

Kalaupāpā

Kaluaʻaha

Kaluakoʻi

Kamaʻāina

Kamakou

Kamehameha

Kanaio

Kāneohe

Kapuāiwa

Kaumālapaʻu

Kaunakakai

Keʻanae

Kēōkea

Kīhei

Kīpahulu

Kōkua

Kualapuʻu

Kula

Lahaina

Lāʻie

Lānaʻi

Lānaʻihale

Launiupoko

Līhuʻe

Liliʻuokalani

Māʻalaea

Māhele

Mahinahina

Mākena

Mālamalama

Maluna aʻe o nā lāhuia pau ke ola ke kānaka

Mānele

Mānoa

Maui

Mauna Kahalawai

Maunaloa

Molokaʻi

Nāpili

Niʻihau

Oʻahu

ʻohana

Pāhoa

Pāʻia

Papahānaumokuākea

Pele

Poʻokela

Pukalani

Pūlama Lānaʻi

Pūʻōhala

Puʻu Kukui

Puʻu Moaulanui

Puʻunēnē

ʻUalapuʻe

Ulupalakua

Wahiawa

Waialua

Waiheʻe

Waikapū

Waimānalo

Waimea

Waikīkī

Wailuku

Appendix

Appendix A: Planning Process Supporting Materials

Work Plan

Work Plan
County of Maui
Hazard Mitigation
Plan Update

December 2, 2019

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PURPOSE

The purpose of this project is to develop an updated County of Maui Hazard Mitigation Plan for approval by the Hawaii Emergency Management Agency (Hawaii) and the Federal Emergency Management Agency (FEMA). Plan development will include a public outreach and engagement strategy that includes all areas of the County. It will also include an updated risk and vulnerability assessment and an updated hazard mitigation strategy.

Maui County seeks to use the plan update process to maintain its current credit for floodplain management planning under FEMA's Community Rating System (CRS). This will ensure that the hazard mitigation plan will continue to double as a creditable "floodplain management plan" under CRS Activity 510. This approach will be to help Maui County to maintain its current CRS rating of Class 7.

RESPONSIBLE PARTIES

Developing the updated Hazard Mitigation Plan requires a team-based approach led by the County of Maui Emergency Management Agency. The County will work directly with a Planning Team that consists of County Leaders and key members of the Consulting Team. A Steering Committee will be formed that includes county stakeholders to guide the development of the plan. The Steering Committee will be formally recognized by the County's governing board (County Council or the Mayor) to maximize CRS points. This Committee will provide key local knowledge for all aspects of plan development.

PROJECT APPROACH

We recommend building on the work of Maui's previous mitigation plan with a community-driven approach. This will include meetings with key stakeholders and the public in each of the county's eight identified communities, including Molokai and Lanai. Our team will review and consider a full range of hazard mitigation measures with each community, including structural and non-structural techniques, to decrease vulnerability on a comprehensive range of physical scales. We will introduce and use custom methods and tools that allow us to capture information and input from the Steering Committee and stakeholders in a way that maximizes their time. Our proven project approach will enhance the County's capacity for implementing and maintaining the hazard mitigation plan on its own after the consultants are gone. We guarantee plan approval by FEMA, but more importantly, we are confident that our approach will result in a Hazard Mitigation Plan Update that serves as a meaningful blueprint for a more resilient and sustainable future for the County of Maui.

The eight communities included in the planning process are:

1. Molokai

2. Lanai
3. West Maui
4. Central Maui
5. North Maui
6. South Maui
7. Upcountry Maui
8. East Maui

The following five tasks outline our approach.

TASKS

The following tasks summarize our proposed approach to the project.

Task 1. Planning Process (November 2019-July 2020)

The Planning Process includes developing, implementing, and documenting the plan to develop the Hazard Mitigation Plan Update. It also includes a specific Public Outreach and Engagement Strategy.

1.1 Project Kick-off Meeting (November 13, 2019)

The Jamie Caplan Consulting (JCC) team proposes a kick-off meeting with key County leaders within ten days of project award. Developing the project Work Plan and the Community Outreach and Engagement Strategy will be a priority for the JCC team following a notice to proceed. Using this project approach as a guideline, JCC will develop a Work Plan to complete the County of Maui Hazard Mitigation Plan Update. The Work Plan will include all tasks needed for an approved Plan, as well as associated deliverables, timelines, proposed meeting dates, and roles and responsibilities for each. At this meeting, the JCC Team will assist the County to identify potential Steering Committee members.

1.2 Steering Committee Meetings

The Steering Committee will assist the consulting team with hazard identification, data collection, stakeholder engagement, and development of the mitigation strategy. The Steering Committee will consist of the County stakeholders who represent County departments, as well as key community stakeholders with fifty percent from outside the local government. To maximize CRS credit, the Steering Committee will include representatives from the Planning Department as well as experts in the following activities: preventative measures, property protection, natural resource protection, emergency services, structural flood control principles, and public information. In addition, each meeting will be open to the public and publicly posted. We recommend considering a representative from each of the eight communities in the County, including Molokai and Lanai. They will provide local knowledge such as identifying data resources, developing mitigation actions, and supporting stakeholder engagement. Our team will help develop this Committee.

The Steering Committee will meet four times. In addition, this committee will have the opportunity to review the plan prior to sending it to the Hawaii Emergency Management Agency (Hawaii EMA) and to

the Federal Emergency Management Agency (FEMA). The JCC team will coordinate closely with the Steering Committee to determine an effective meeting schedule and location that works best for all involved.

- Meeting #1 (December 10, 2019): The first Steering Committee meeting will be held about a month into the planning process. The meeting will include an opportunity for the consulting team to describe the mitigation planning process, and for the Steering Committee to learn about their roles and responsibilities in developing the plan. This meeting will also include sessions to:
  - Identify natural hazards and critical facilities
  - Discuss implementation of the Community Outreach and Engagement Strategy
  - Review potential mitigation actions based on wish-list projects

- Meeting #2 (February 3, 2020): The second Steering Committee meeting will be an opportunity for the JCC Team to share the preliminary risk and vulnerability assessment results. In addition, the consulting team will work with the Steering Committee to:
  - Review and potentially revise previous goal statements
  - Identify potential hazard mitigation actions, this will include a systematic review of a wide range of activities
  - Discuss the next steps of community engagement

- Meeting #3 (April 2020): The third meeting serves to further identify mitigation actions and their prioritization. In addition, at this meeting we will:
  - Review preliminary results from the Public Preparedness Survey (if one is used)
  - Discuss final Risk Assessment and Capability Assessment Results
  - Discuss community engagement and the final meetings

- Meeting #4 (June 2020): The final Steering Committee meeting will be a time to:
  - Review the priority order of mitigation actions
  - Review the draft plan and prepare for its public review
  - Discuss processes for implementing the plan and seeking grant funding

1.3 Conduct Community Outreach and Engagement November 2019-June 2020

Community outreach is an essential component of mitigation planning. The more engaged the public is in the planning process, the more likely they are to support future mitigation strategies. In addition, participation in mitigation planning often serves as a foundation for additional emergency preparedness and response planning.

The Community Outreach and Engagement Strategy will include methods to:

- Generate public interest in mitigation planning, resiliency, and climate adaptation
- Solicit public input

- Engage local stakeholders in eight key communities in the County
- Create opportunities for local stakeholders and the public to be actively involved in the mitigation planning process

We recommend that the Community Outreach and Engagement Strategy include stakeholder meetings, a Public Preparedness Survey, a project webpage, two public meetings, and an opportunity for the public to review and comment on the draft Hazard Mitigation Plan Update. Our team will provide many outreach materials including press releases, PowerPoint presentations, meeting handouts and a Project Fact Sheet.

For stakeholder meetings, we propose meeting with key County officials, such as the County Planner and Public Works Administration Director. Participants should also represent private industry, each key community, the University of Hawaii, and public utilities. We like to travel to these meetings as an opportunity to tour the County and meet people in their "home" environment. We like to spend time in the community, to get to know the people, see the areas of risk firsthand, and visualize mitigation actions. The purpose of these meetings is to gather detailed insight into the County's pre-disaster mitigation capabilities, hazards, and mitigation project interests.

The Public Preparedness Survey, if used, will provide an opportunity for individuals living and working in the County to share their opinions and participate in the mitigation planning process. The information will help the Steering Committee better understand what hazards are of most concern and what mitigation actions are of particular interest. We propose generating a digital survey (by way of SurveyMonkey) as well as distributing hard copies at public meetings.

The project webpage, located on the Maui County Emergency Management website, serves as a place for the consulting team to share information with the Steering Committee and the public. It will be used to publicize meetings, access the Public Preparedness Survey, and review the draft plan.

We intend to hold two public meetings throughout the planning process in three areas of the County—a total of six meetings. The public meetings offer an opportunity for the consulting team and the Steering Committee to learn from the public and key stakeholders, and for us to share information with the public regarding the planning process. We provide an update of the planning process in each meeting, review opportunities for the public to participate, and listen. We take public engagement seriously and have enjoyed tremendous success with it.

- Public Meeting #1 (week of February 3, 2020): The first public meeting will be an opportunity for the Steering Committee and the consulting team to gather local knowledge of hazard events and identify natural hazards and critical facilities to include in the plan. In addition, the Steering Committee will gain insight from the County regarding areas of risk that may not be apparent on a risk analysis, and on potential mitigation actions for the community. We will also discuss continued public involvement and introduce the Public Preparedness Survey. We bring maps to public meetings and encourage participants to point out places of high hazard and offer suggestions to mitigate risk.

- Public Meeting #2 (June 2020): This will be an opportunity for the consulting team and the Steering Committee to share the draft plan with the public and capture any of their comments. We will review the list of mitigation actions and the final risk and vulnerability assessment. We will also let meeting participants know how to review the draft plan in its entirety.

1.4 Draft Plan and Document Planning Process

Throughout the planning process, the consulting team will document the planning process as required by FEMA. This includes documentation of the overall process used to prepare the plan, including a description of the steps taken and who was involved in the process.

Task 2. Hazard Analysis and Risk Assessment (November 2019-April 2020)

The current risk assessment will be updated to reflect current conditions. Also, in alignment with FEMA regulations and CRS 510 compliance, we will assess the hazards and the problems. Our results include maps and graphics to effectively communicate the issues. We summarize vulnerability for the community with a hazard ranking and potential impacts on safety, public health, equity, and the economy. Our risk assessment is conducted via a four-step process.

2.1: Review the Hazards

The first step in the risk assessment process is understanding how hazards may impact the county's communities. We'll review the existing hazards with you, aligning it with the state plan, county priorities, and previous hazard events. As needed, we'll amend the existing hazard list to meet the goals of the project. We understand that flooding, wildfire, and lava flows are of particular concern, and while hurricanes are rare, impacts and threats are becoming more frequent (e.g., Hurricane Lane, Hurricane Erick and TS Flossie). As part of our approach, we'll integrate climate change into each hazard we profile. All natural hazards that may impact the planning area will be included and assessed; man-made and technological hazards will be considered and assessed at a higher level.

The final list of hazards will be reviewed and approved by the Steering Committee at their initial meeting on December 10, 2019.

2.2: Update the Hazard Profiles

Stantec will update profiles, using existing information as a foundation and integrating the latest hazard data. We'll coordinate with local entities, such as community officials and stakeholders, the PDC, and universities to gather and include existing hazard data, natural hazard studies, related hazard plans such as climate studies, and spatial building data. We'll update the existing information for each profile, including:

- Hazard description
- Previous events
- Hazard location
- Frequency/Probability
- Severity
- Warning Time
- Public health considerations
- Climate change considerations

As part of the profile update, we will:

- Update maps and graphics where necessary (i.e., new information supersedes the existing maps or graphics)
- Update the NFIP metrics to meet FEMA-identified "not met" requirements in coordination with ISO/CRS Specialists, local floodplain management coordinator and state floodplain management coordinator
- Rank hazards via a Hazard Priority Risk Index (PRI) based on several factors including impact, spatial reach, frequency of occurrence, and warning time.

2.3: Assess Vulnerability and Impacts

Building on the hazard profiles, we'll include an assessment of vulnerability. As datasets permit, we'll use GIS to analyze the population, number of structures, type of land ownership, type of structures (including critical facilities), and infrastructure exposed to hazard impacts for each community throughout the county. We'll also include qualitative considerations to the economy and population trends as they relate to impacts for each hazard.

Once areas of vulnerability are determined, these will be further analyzed by PDC to determine which communities face greatest vulnerability based on socio-economic factors. PDC will use Census demographic information to understand household composition (including age and ownership status), income, and access to information (e.g., internet access). Information will ideally be relayed based on the eight communities identified for study. If possible, Census block or tract data will be used. This information will be provided in tabular and mapped/graphical format as data permits and presented at public meetings.

2.4: Develop an Overall Summary of Vulnerability

With an understanding of vulnerability, we will summarize the key issues identified throughout the county via an executive summary. Each area will be considered separately. This information will include the results of the socio-economic analysis described above.

Task 3. Mitigation Strategy (November 2019-June 2020)

The Mitigation Strategy is the most crucial piece of the Hazard Mitigation Plan Update and will reflect the unique needs of each identified community. It represents the County's system for lessening the impact to the hazards identified in the risk assessment. The JCC Team will work closely with the Steering Committee to develop a robust assessment of the current local capabilities and resources for mitigating risk. This assessment spurs the development of mitigation actions by indicating strengths and weaknesses. It also illustrates growth in the County since the previous plan was developed.

3.1 Update Capability Assessment

The Steering Committee meetings, stakeholder meetings, and capability assessment questionnaires provide necessary information toward the capability assessment. This task also includes gathering and reviewing existing studies, plans, reports, such as the Coastal Zone Management Plan, Community Plans regional land use, and resiliency studies. The JCC team will also incorporate relevant capability information into the plan to address the County's current participation in the National Flood Insurance

Program (NFIP) and the Community Rating System (CRS), including but not limited to existing floodplain management activities, mapping updates, higher regulatory standards, and current policy statistics.

3.2 Update Mitigation Plan Goals

The JCC Team will work closely with the Steering Committee to review the goals listed in the previous plan and determine if they are feasible and/or require updating. At first glance, we recommend adding a goal specific to climate resilience. The development of these "guiding principles" for the plan will also take into account a review of the Hawaii State Hazard Mitigation Plan and best practices from around the United States that have resulted in effective and meaningful local hazard mitigation plans.

3.3 Analyze and Update Previous Mitigation Actions

A required element of this planning process is a review of the mitigation actions from the County's previous plan. For this, the JCC team will work with the County to identify the current status of each previously identified mitigation action. We will then determine if actions undone, should be carried forward to this Plan, or if they are no longer a priority.

3.4 Develop and Prioritize Mitigation Action Plan

Following the identification of goal statements, the Steering Committee and the consulting team will identify and analyze potential mitigation actions. The mitigation actions or projects identified will represent a mix of structural and non-structural mitigation measures, including an emphasis on integrating hazard mitigation and climate change adaptation policies into other local planning mechanisms.

All included mitigation actions will be ranked and include the required elements of the responsible department, a timeline, estimated cost, and funding sources. In addition, a cost-benefit review is necessary to determine the cost effectiveness of each strategy. The JCC team will use best information available to determine the costs and benefits available. Benefits may include dollars saved from future hazard events, environmental benefits, social benefits, and others. Costs include the dollar amount needed to complete the project. As part of the mitigation strategy, the JCC team will rely on the County of Maui to work with county departments and the areas of east Maui, upcountry Maui, west Maui, Molokai, and Lanai to determine reliable benefits and cost estimates.

We will develop a web-based **Mitigation Action Tracker**. This tool functions as Google Sheet or similar spreadsheet with rows for each action and columns for each action criteria. This includes all relevant data for each mitigation action, such as responsible department, implementation timing, and potential funding source. The Mitigation Action Tracker is expanded to track plan implementation. We include separate tabs with pre-sorted reports so the County can quickly identify priority projects, community-specific projects, and hazards addressed.

Task 4. Plan Review, Evaluation, and Implementation (July 2020)

Jamie Caplan Consulting will prepare a draft Plan based on the work completed in the previous tasks. The final section of the Plan details how the County will maintain, update and implement the Plan. We will also draft a section of the Plan required by FEMA regarding how this Plan relates to the original plan.

4.1 Develop Plan Maintenance Procedures

Plan maintenance procedures include a timeline with specific tasks the County will employ to implement and maintain the plan. This step will include ways to integrate the Plan with other County plans, such as the General Plan, Maui Island Plan, coastal studies, and zoning bylaws or capital improvement plans. Finally, this section includes methods and a schedule for the County to effectively monitor, evaluate, and update the Plan. We will use best practices from FEMA, and the field to develop these procedures with the Steering Committee.

4.2 Develop Procedures for Continued Public Involvement

Continued public involvement is a required element of the Plan maintenance process. The consulting team will develop a Community Outreach Strategy (similar to the one developed in Task 1) for maintaining public involvement throughout the five-year life of the Plan. Engaging targeted stakeholders in the mitigation strategy after the Plan receives FEMA approval will assist with garnering local support for mitigation project funding and implementation. The Community Outreach Strategy developed will undoubtedly include continued use of the County's project website and public meetings. Lessons learned through the Community Outreach and Engagement process and development of the Hazard Mitigation Plan Update will be linked to the method and scheduled for continued public involvement.

4.3 Document Plan Update Changes

A significant piece of the Plan we develop for the County will indicate to FEMA how this new Plan relates to the previous Plan from 2015. FEMA requires that we indicate how the plan has been revised to reflect changes in development or changes in priorities. They also require an update on the previously identified mitigation actions. In our experience, FEMA appreciates this update in a concise section at the front of the Plan. We will gather data for this section throughout the planning process and then develop the section when the plan is nearly complete.

Task 5. Plan Approval and Adoption (July 2020-October 2020)

We guarantee that both Hawaii EMA and FEMA will approve the Plan, and we will work with you and with them until that happens. In our experience, we anticipate one round of minor changes with each agency, although we have had many plans approved upon initial review. We cannot predict the speed with which Hawaii EMA or FEMA will review the plan. We will make any required changes to the plan within two-weeks of receiving feedback from either agency.

5.1 Public Review of Draft Plan (July 2020-August 2020)

When the draft plan is complete, the JCC team will deliver a digital editable copy of the plan to the Steering Committee for their review. After incorporating any requested changes, the Plan will be ready for public review. For the public review, we recommend making a digital copy and comment form available on the County's webpage and having at least one hard copy available in a centrally located County office. We will provide the County with a press release and flyer to use toward advertising the plan's availability.

5.2 Review by Hawaii EMA (September 2020)

Following public review, with the County's blessing, we will send the Plan to the Hawaii Emergency Management Agency (Hawaii EMA) for review. The Plan is submitted to Hawaii EMA with the Local Mitigation Plan Review Tool (Appendix A of FEMA's "Local Mitigation Plan Review Guide") completed to ensure all requirements are fulfilled prior to submission to FEMA. Should the state request revisions to the plan, all required revisions would be addressed by JCC. Revisions are handled in a timely manner to expedite the review process.

5.3 Review and Approval by FEMA (October 2020)

Following state approval of the Plan, Hawaii EMA will forward the Plan to FEMA Region 9 for a compliance review. Should FEMA request revisions, the JCC team would address all required revisions. Revisions will be handled in a timely manner to expedite the review process. JCC will work with the County of Maui, Hawaii EMA, and FEMA throughout the review process to ensure that all requirements are met for a federally approved plan. We remain available to you, Hawaii EMA, and FEMA throughout the revision process. In our experience, we receive only minor revisions or none at all.

5.4 Assist County with Adoption (October 2020)

Once your Plan receives "Approved Pending Adoption" certification from FEMA, the County of Maui has one year to formally adopt the Plan. We will assist you and provide guidance throughout this process. This assistance includes a formal adoption resolution with language required by FEMA. It may also include a PowerPoint presentation and/or talking points to assist the County in getting the Plan adopted.

DELIVERABLES

Our proposed schedule will result in a FEMA-approved Hazard Mitigation Plan Update. The final project deliverables include:

1. Monthly progress reports.
2. Draft Plan for Review by the Steering Committee and the public.
3. Final Hazard Mitigation Plan Update delivered to Hawaii EMA, FEMA and the County.
4. Digital copies of all tabular data, maps, mapping data, GIS data, or other geospatial information used in the development of the mitigation plan.
5. Digital Mitigation Action Tracker.
6. Digital copies of the Draft and Final versions of the Hazard Mitigation Plan Update.

7. Electronic copies of all meeting schedules, agendas, notes, sign-in sheets and presentations.

PROJECT SCHEDULE

It is our habit to keep our projects on time and on-budget. Work on the project will commence immediately upon execution of an agreement. It will be completed by **June 30, 2020**. This deadline allows ample time for the Steering Committee and the public to review the plan by July 31, 2020, and for Hawaii Emergency Management Agency to review the plan by August 14, 2020. Hawaii EMA will send the plan to FEMA when they are comfortable it will pass FEMA review. Jamie Caplan Consulting will work with the County throughout the review and approval process.

County of Maui Hazard Mitigation Plan Schedule *December 2, 2019*

PROJECT TASKS	2019			2020									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
Task 1. Planning Process													
1.1 Project Initiation (Kickoff Meeting)		11/13/19											
1.2 HMP Committee Meetings (4)			Mtg 1 12/10/19		Mtg 2 2/3/20		Mtg 3		Mtg 4				
1.3 Conduct Public/Stakeholder Engagement					Public Meeting #1 Identify Issues				Public Meeting #2 Present Draft Plan				
1.4 Draft Plan and Document Planning Process													
Task 2. Hazard Analysis and Risk Assessment													
2.1 Update Hazard Profiles													
2.2 Update Critical Facility Inventory													
2.3 Update Hazard Vulnerability													
Task 3. Mitigation Strategy													
3.1 Update Capability Assessment													
3.2 Update Mitigation Plan Goals													
3.3 Analyze and Update Previous Mitigation Actions													

1

County of Maui Hazard Mitigation Plan Schedule *December 2, 2019*

PROJECT TASKS	2019			2020									
	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct
3.4 Develop and Prioritize Mitigation Action Plan													
Task 4. Plan Review, Evaluation, and Implementation													
4.1 Develop Plan Maintenance Procedures													
4.2 Develop Procedures for Continued Public Involvement													
4.3 Document Plan Update Changes													
Task 5. Plan Approval and Adoption													
5.1 Committee and Public Review of Draft													
5.2 Review by Hawaii EMA													
5.3 Review and Approval by FEMA													
5.4 Assist County with Adoption													

COMMUNITY OUTREACH AND ENGAGEMENT PLAN

County of Maui Hazard Mitigation Plan Update 2020

Community Outreach and Engagement Plan

PURPOSE **2**
GOAL AND OBJECTIVES 2
OVERVIEW 2
ENGAGEMENT STRATEGIES **3**
THE HAZARD MITIGATION MESSAGE 3
PROJECT FACT SHEET 3
PROJECT WEBPAGE 3
NEWS MEDIA AND SOCIAL MEDIA 4
PUBLIC OPINION SURVEY 4
DRAFT PLAN REVIEW 4
ENGAGING TARGET GROUPS / AUDIENCES **4**
STEERING COMMITTEE MEETINGS 4
STAKEHOLDER INTERVIEWS AND COUNTY TOURS 5
PUBLIC MEETINGS 5
ENGAGEMENT STRATEGY EVALUATION **6**

Community Outreach and Engagement Plan

Purpose

The purpose of the Outreach and Engagement Plan is to describe how residents, stakeholders and leaders of the communities within Maui County will participate in the hazard mitigation planning process toward the development of the County of Maui Hazard Mitigation Plan Update in order to advance mitigation planning activities and maintain eligibility for post-disaster mitigation funding. The Planning Team, a group comprised of several County leaders and the consulting team is responsible for implementing this Outreach and Engagement Plan.

Goal and Objectives

The primary goal of the Community Outreach and Engagement Plan is to generate interest and involvement in the hazard mitigation planning process. This plan includes strategies to generate public interest, solicit public input, engage county partners and create opportunities for Maui County residents and key stakeholders to be actively involved in the mitigation planning process.

Core objectives of this Plan are to:

1. Promote dialogue among local stakeholders, community leaders and residents across sectors, disciplines and geography to identify issues, challenges, strengths and values relevant to hazard mitigation planning.
2. Build lasting partnerships to strengthen continuity of effort and plan implementation.
3. Utilize a wide range of tools and engagement opportunities to solicit and acquire public input regarding plan content and implementation.

Overview

The Hazard Mitigation Plan benefits the County directly and should accurately reflect the hazard risks and vulnerabilities faced by the communities of Maui, Moloka'i and Lana'i. It should also propose strategies and initiatives that will markedly reduce those risks and enhance the safety, sustainability and well-being of residents. The plan can do this only with the inputs, recommendations and advocacy of Maui County residents and stakeholders. The outreach and engagement strategies outlined in this document aim to achieve broad participation across communities, departments and sectors to reach those who stand to benefit from the project.

Outreach will focus on three target groups / audiences:

1. Hazard Mitigation Steering Committee
2. Community leaders and stakeholders
3. General public

While distinctions between the above audiences are imprecise (i.e., all being residents of Maui County), strategies of engagement (further described below) will vary in order to accomplish project outcomes. Involvement of industry leaders, department heads and organizations with complementary missions is desirable to strengthen and validate the mitigation planning effort.

As much as possible, the consulting team will engage in-person, conducting face-to-face meetings to generate interest in the project, share updates and information, and help build lasting partnerships.

Public input will greatly enhance the relevance and value of the Hazard Mitigation Plan. All reasonable effort will be made to provide opportunities for local stakeholders and the public to be actively involved

in the mitigation planning process. Meetings, public opinion surveys, media releases, an online presence and feedback mechanisms will afford opportunities to learn about and contribute to the process. Specific planning guidance will be sought during Steering Committee meetings, stakeholder interviews and public meetings.

Engagement Strategies

Outreach engagement to these groups will include a distinct message, a Project Fact Sheet, a Project Webpage, outreach to news media and social media, and review of the Draft Plan.

The Hazard Mitigation Message

Key to promoting community outreach and engagement will be the development of a compelling message that describes the value and importance of hazard mitigation, it's role in promoting resilience, how it helps us adapt to a changing climate, and why it matters to Maui County residents. This message will be used to generate interest and involvement in hazard mitigation planning, as well as related emergency preparedness and response activities.

The Hazard Mitigation message will be consistently incorporated into all outreach materials, including fact sheets, presentations, press releases, social media posts, promotional emails, etc. Multiple channels and repeated messages will be used to "get the word out," communicating project milestones and events such as public meetings.

Steering Committee members, stakeholders, and community representatives will be relied upon to share and promote information and materials related to the Hazard Mitigation Plan Update among their staff and constituents.

In addition, media outlets (e.g., newspapers, radio), social media, and the Maui County website will be utilized to maintain ongoing visibility throughout the period of project performance. These, and other channels of communication, as applicable, will be used to announce dates, times and locations of public meetings.

A schedule of announcements and press releases along with a list of contacts and submittal requirements will be developed by the team to facilitate messaging.

Project Fact Sheet

A double-sided, one-page Project Fact Sheet will be developed for the purposes of describing the project and soliciting public involvement. The Fact Sheet will promote the public opinion survey, public workshops and an opportunity to review the draft plan. The Fact Sheet will be available in print and digital form. Hard copies will be distributed at meetings and provided to Steering Committee members for distribution among their constituents.

Project Webpage

A digital "home base" will be created for information and announcements regarding the County Hazard Mitigation Plan. The web page will include background information, a project timeline, meeting announcements, and a link to the draft plan. The Planning Team will make the final determination regarding project web page content.

News Media and Social Media

The County will distribute press releases announcing project meetings and opportunities for participation to news outlets typically used by County Emergency Management. In addition, the Planning Team may utilize social media such as Facebook to make similar announcements.

Public Opinion Survey

A public opinion survey will provide an opportunity for individuals living and working in the County to share their opinions and participate in the mitigation planning process. The information will help the Steering Committee better understand what hazards are of greatest concern and what mitigation actions are of particular interest. The survey will be a digital survey (by way of SurveyMonkey); hard copies may also be distributed at public meetings. The use of an interactive presentation tool such as Mentimeter may also be used during meetings to obtain audience feedback.

Draft Plan Review

A Draft Final version of the Hazard Mitigation Plan Update will be made available for review prior to Maui County Emergency Management Agency sending the plan to the State for their review. The draft will be available in hard copy in the Maui County Emergency Management Agency and online in digital form. A comment form will be available to reviewers and all comments will be considered by the Steering Committee for inclusion in the final plan.

Engaging Target Groups / Audiences

Steering Committee Meetings

A Steering Committee comprised of county stakeholders and key community leaders will assist the consulting team with hazard identification, data collection, stakeholder engagement, and development of the mitigation strategy.

The Steering Committee will meet four times. In addition, this committee will have the opportunity to review the plan prior to sending it to the Hawaii Emergency Management Agency (HI-EMA) and to the Federal Emergency Management Agency (FEMA). The consulting team will coordinate closely with the Steering Committee to determine an effective meeting schedule and location that works best for all involved.

- Meeting #1 (December 10, 2019): The first Steering Committee meeting will be held about a month into the planning process. The meeting will include an opportunity for the consulting team to describe the mitigation planning process, and for the Steering Committee to learn about their roles and responsibilities in developing the plan. This meeting will also include sessions to:
  - Identify natural hazards and critical facilities
  - Discuss implementation of the Community Outreach and Engagement Plan
  - Review potential mitigation actions based on wish-list projects
- Meeting #2 (February 4, 2020): The second Steering Committee meeting will be an opportunity for the consulting team to share the preliminary risk and vulnerability assessment results. In addition, the consulting team will work with the Steering Committee to:
  - Review and potentially revise previous goal statements
  - Identify potential hazard mitigation actions

  - Discuss the next steps of community engagement
- Meeting #3 (April 2020): The third meeting serves to further identify mitigation actions and their prioritization. In addition, at this meeting we will:
  - Review preliminary results from the public opinion survey
  - Discuss final Risk Assessment and Capability Assessment Results
  - Discuss community engagement and final meetings
- Meeting #4 (June 2020): The final Steering Committee meeting will be a time to:
  - Review the priority order of mitigation actions
  - Review the draft plan and prepare for its public review
  - Discuss processes for implementing the plan and seeking grant funding

Call-in or video conferencing options will be available during Steering Committee Meetings to provide opportunities for representatives of Maui County's more remote communities to participate.

Stakeholder Interviews and County Tours

For stakeholder meetings, we propose meeting with key county officials, business leaders, public utilities and private industry. Travel to these meetings provides opportunities to tour the County and meet people in their "home" environment. The purpose of these meetings is to gather detailed insight into the Maui County's pre-disaster mitigation capabilities, hazards, and mitigation project interests. Efforts will be made to provide context and content to stakeholders in advance of interviews/meetings to be most efficient and respectful of their time. In addition, the Planning Team will tour the County to identify areas of high risk and potential mitigation actions.

Public Meetings

Two public meetings, each conducted within three distinct locations of the County, will offer opportunities for the consulting team and the Steering Committee to learn from the public and key stakeholders, and to share information with the public regarding the planning process.

- Public Meeting #1 (week of February 3, 2020): The first public meeting will be an opportunity for the Steering Committee and the consulting team to gather local knowledge of hazard events and identify natural hazards and critical facilities to include in the plan. In addition, the Steering Committee will gain insight from the County regarding areas of risk that may not be apparent in a risk analysis, and potential mitigation actions for the community. We will also discuss continued public involvement and introduce a public opinion survey. Maps and other presentation materials will be used to identify and facilitate participant discussion about places of high hazard and explore ways to mitigate risk.
- Public Meeting #2 (June 2020): The second public meeting will be an opportunity for the consulting team and Steering Committee to share the draft plan with the public and obtain feedback. The final risk and vulnerability assessment and a list of proposed mitigation actions will be reviewed. In addition, participants will learn how they can review the draft plan in its entirety and provide comment.

All engagements will be documented to measure participation and meet plan requirements. Sign-in sheets will be used at all meetings to track attendance and develop a contact list for follow-up and follow-on engagement.

Engagement Strategy Evaluation

The success of community outreach activities will have implications for follow-on engagement as envisioned in the Plan Implementation and Maintenance section of the Hazard Mitigation Plan. Over the course of the project, the consulting team will evaluate challenges and successes in working with target audiences, modify approaches and recommend strategies for continued engagement.

Steering Committee Meeting Agendas and Sign-in Sheets

December 10, 2019

County of Maui
Hazard Mitigation Plan Update
Steering Committee Meeting Agenda
December 10, 2019
9:00 am – 11:00 am

Introductions

Plan Development Process
- Work Plan
- Schedule

Outreach and Engagement Plan

Stakeholder and Public Engagement
- Public Meetings
- Survey

Next Steps
- Stakeholder Interviews/Meetings
- Data Collection
- Public Meeting Planning

Next Meetings
- February 4, 2020
- April 2020
- June 2020

Meeting Sign-In Sheet

Project: Maui County Haz. Mit. Plan Meeting 1
Facilitator: Jamie Caplan & Anthony Joyce (MEMA)
Place/Room: Maui County Emergency Management EOC

Date: 12/10/2019
Time: 9:00 AM

PRINT NAME	ORGANIZATION	TITLE	EMAIL	SIGN
1. Herman Andaya	MEMA	Administrator	herman.andaya@mauicounty.gov	
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7. Chris Reynolds	Maui Electric	Director - Operational Tech.	chris.reynolds@mauielectric.com	
8. Joyce Kawakami	Feed My Sheep	CEO, Founder	Joyce@feedmysheepmaui.com	
9. Michele Blair	American Red Cross	Maui County Director	michele.blair@redcross.org	
10. Janet Kuwahara	Maui Vistors Bureau	Senior Manager of Ops.	janet@mauivb.com	
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14. Zhantell Lindo	CM Keani Rawlins-Fernandez EA	Executive Assistant	zhantell.lindo@mauicounty.us	
15. Gail Miyahira	Hawaii Healthcare Emergency Management	Maui County Coordinator	gailm808@gmail.com	
16. Lindsay Ball	Department of Education	Area Superintendent	lindsay.ball@k12.hi.us	
17. Jamie Caplan	Jamie Caplan Consulting LLC.	Consultant	jamie@jamiecaplan.com	
18. Sharon Mielbrecht	Pacific Disaster Center	Hazard Mitigation Specialist	smielbrecht@pdc.org	
19. Alex DeRoode	Maui County	Energy Commissioner	Alexander.DeRoode@co.maui.hi.us	
20. Chana Ane	Office of Economic Development	Environmental Coordinator	chana.ane@co.maui.hi.us	
21. Charmaine Carroll	MEMA	Staff Specialist		
22. Colleen Hauptman	MEMA	Staff Specialist		
23.				
24.				
25.				
26.				

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February 4, 2020

County of Maui
Hazard Mitigation Plan Update
Steering Committee Meeting Agenda
February 4, 2020
1:00 pm – 3:00 pm

Introductions

Plan Development Update
- Public and Stakeholder Engagement

Risk Assessment
- Process
- Data Gathering
- Hazard List
- High Hazard Areas

Mitigation Strategy
- Goal Statements
- Previous Mitigation Actions

Next Steps for the Steering Committee
- Survey Distribution
- Public Meeting Participation

Next Meetings
- April 21, 2020
- June 2020

Meeting Sign-In Sheet

Project: Maui County Haz. Mit. Plan Meeting 2
Facilitator: Jamie Caplan & Anthony Joyce (MEMA)
Place/Room: Mayor's Conference Room

Date: 2/4/2020
Time: 1:00 PM

PRINT NAME	ORGANIZATION	TITLE	EMAIL	SIGN
1. Herman Andaya	MEMA	Administrator	herman.andaya@mauicounty.gov	
2. Tara Owens	University of Hawaii Manoa	Coastal Hazards Specialist	taram@hawaii.edu	
3. Annette Matsuda	Department of Transportation - Highways	Maintenance Engineer	annette.dh.matsuda@hawaii.gov	
4. Bridget Velasco	Department of Health	Public Health Planner	Bridget.Velasco@doh.hawaii.gov	
5. Rowena Dagdag-Andaya	Department of Public Works	Director	Rowena.Dagdag-Andaya@co.maui.hi.us	
6. Todd Teraoka	Maui Fire Department	Fire Captain	Todd.Teraoka@co.maui.hi.us	
7. Chris Reynolds	Maui Electric	Director - Operational Tech.	chris.reynolds@mauielectric.com	
8. Joyce Kawakami	Feed My Sheep	CEO, Founder	Joyce@feedmysheepmaui.com	
9. Michele Blair	American Red Cross	Maui County Director	michele.blair@redcross.org	
10. Janet Kuwahara	Maui Vistors Bureau	Senior Manager of Ops.	janet@mauivb.com	
11. Diego Sanchez-Gomez	Planning	Floodplain Manager	Diego.Sanchez-Gomez@co.maui.hi.us	
12. Kathleen Aoki	Planning	Division Chief	Kathleen.Aoki@co.maui.hi.us	Kathleen Aoki
13. Jim Buika	Planning	Shoreline Planner/Chair, State Hazard Mitigation Forum	James.Buika@co.maui.hi.us	
14. Zhantell Lindo	CM Keani Rawlins-Fernandez EA	Executive Assistant	zhantell.lindo@mauicounty.us	
15. Gail Miyahira	Hawaii Healthcare Emergency Management	Maui County Coordinator	gailm808@gmail.com	
16. Lindsay Ball	Department of Education	Area Superintendent	lindsay.ball@k12.hi.us	
17. Jamie Caplan	Jamie Caplan Consulting LLC.	Consultant	jamie@jamiecaplan.com	
18. Sharon Mielbrecht	Pacific Disaster Center	Hazard Mitigation Specialist	smielbrecht@pdc.org	
19. Alex DeRoode	Maui County	Energy Commissioner	Alexander.DeRoode@co.maui.hi.us	

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PRINT NAME	ORGANIZATION	TITLE	EMAIL	SIGN
20. Chana Ane	Office of Economic Development	Environmental Coordinator	chana.ane@co.maui.hi.us	
21. Loren Lapow	Maui Hero Project	Founder - Maui Hero Project	mauihero@pyccmaui.org	
22. Lance De Silva	Division of Forestry & Wildlife	Forestry Program Manager	lance.k.desilva@hawaii.gov	
23. Toni Eaton	Hawaiian Homelands	Maui District Supervisor	antonette.g.eaton@hawaii.gov	
24. Kau'l Awai-Dickson	MECO/Maui Chamber of Commerce Liaison	Business Community Liaison		
25. ~~Jamie Caplan~~				
26. Caroline Cunningham				
Keanu Lau Kee				
Andrea Finkelstein	MEMA			
Paul Coe	MEMA			
Charmaine Carroll	MEMA			

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Moloka'i February 5, 2020

MOLOKAI CORE GROUP PREPAREDNESS MEETING SIGN-IN SHEET			
Project:	Maui County Hazard Mitigation Plan Update	**Meeting Date:**	2/5/2020
Facilitator:	Anthony Joyce, PhD., MEMA	**Place/Room:**	Mitchell Pauole Center

Name	Affiliation/Company	Phone	E-Mail
Jerry Mayres Punahele	DLNR DOBOR	8085531742 8083442174	Jerry.Mayres-Punahele@Hawaii.gov
Matthew P. Pires	DOT Airports Fire	808-567-9663 808-344-1030	Matthew.p.pires@hawaii.gov
Harley Tancayo	DOT Harbors	808-295-0935	Harley.tancayo@hawaii.gov
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Roger Apuna	Co of M DPW	808-553-3223	roger.apuna@co.maui.hi.us
Ui Kalani	Parks & Rec	808-336-0303	natasha.kalani@co.maui.hi.us
NATE OSHIRO	MAUI FIRE DEPT	808-336-0326	NATHAN.OSHIRO@MAUICOUNTY.GOV
Antone Ledesma	DLNR DOFAW	808-870-7598	antone.l.ledesma@hawaii.gov
Julie Bicoy	DMVB Visitors	808 336 0258	mvajulie@gmail.com
Gene Ross K Davis	DHHL	808 560-6105	gene.davis@hawaii.gov.
LESTER KEANU SR	Red Cross	808-646-1622	keanu56@gmail.com
Dalton Bicoy	MGH	553-3185	dalbicoy@queens.org
GREGG OKAMOTO	MAUI POLICE	553-4120	Gregg.Okamoto@mpd.net

Hana February 6, 2020

and Public Meeting 4pm - 6pm

HANA CORE GROUP PREPAREDNESS MEETING SIGN-IN SHEET			
Project:	Maui County Hazard Mitigation Plan Update	**Meeting Date:**	2/6/2020
Facilitator:	Anthony Joyce, PhD., MEMA	**Place/Room:**	Helene Hall

Name	Affiliation/Company	Phone	E-Mail
Alohalani Smith (Uncle Tony Hulaton)	Am. Red Cross/Aha Moku O Kaupo	808 870-2820	Kaukaulani@gmail.com
Harolen Kaiwi	Am Red Cross	808 868 1190	hkaiwi@aol.com
Dawn Lono	County Council	808 270-7246	dawn.lono@mauicounty.us
Heidi Lua	Hana Business Council	808 248-8808	hbc@hanabusinesscouncil.com
Lia Williams	CERT	280-7773	shining-raven@live.com
Mavis Oliveira-Medeiros	Council Ofc	2487513 2488606	Mavis.Medeiros@mauicounty.us
Gale Notestone	Maui Fire Dept.	808 281.9323	FIND0591@MAUI.GMAIL
Lolly S. Bergan	PHN public health nurse	248-4855	dolores.soler-bergan@doh.hawaii.gov
Aaron Asay	Ikana Health Clinic	(w)808-248-8244 (c)801-361-9425	aasay@hanahealth.org
Tom Bacon	CERT	248-8750	tom@rainbowridgewest.com all 1 word
Chris Gaerder	CERT	248-8750	chris@rainbowridgewest.com
JAMES HERBAUGH	NATIONAL PARK SERVICE	357-2160	James_Herbaugh@NPS.GOV
KAMALU CARROLL	Hana Community Asso.	264-0139	clairekamalucarroll@gmail
Kaipo Kahai	MFD		

June 10, 2020

County of Maui
Hazard Mitigation Plan Update
Steering Committee Meeting Agenda
June 10, 2020
1:00 pm – 2:30 pm

Plan Development Update

- Work Done to Date
- Schedule for Completion
- Preliminary Survey Results

Risk Assessment Presentation

- Process and Overview
- Outstanding Questions
- Key Findings
- Prioritizing Hazards

Mitigation Strategy

- Update
  - Goal Statements
  - Previous Mitigation Actions
- 2020 Mitigation Actions
  - Adding Essential Details
- Prioritizing Mitigation Actions

Questions and Answers

Next Steps for the Steering Committee

- Outreach for Public Meeting
- Public Meeting Participation
- Risk Assessment Review
- Mitigation Actions Add Essential Details

Next Zoom Meetings

- Public Meeting June 30, 2020, 12:00 pm – 1:00 pm
- Steering Committee Meeting, July 2, 2020 11:00 am – 12:30 pm

Meeting Sign-In Sheet

Project:	Maui County Haz. Mit. Plan Meeting 3	Date:	6/10/20
Facilitator:	Jamie Caplan & Anthony Joyce (MEMA)	Time:	12:00 PM
Place/Room:	Zoom		

PRINT NAME	ORGANIZATION	TITLE	EMAIL	SIGN
1. Herman Andaya	MEMA	Administrator	herman.andaya@mauicounty.gov	
2. Tara Owens	University of Hawaii Manoa	Coastal Hazards Specialist	taram@hawaii.edu	
3. Annette Matsuda	Department of Transportation - Highways	Maintenance Engineer	annette.dh.matsuda@hawaii.gov	
4. Bridget Velasco	Department of Health	Public Health Planner	Bridget.Velasco@doh.hawaii.gov	
5. Rowena Dagdag-Andaya	Department of Public Works	Director	Rowena.Dagdag-Andaya@co.maui.hi.us	
6. Todd Teraoka	Maui Fire Department	Fire Captain	Todd.Teraoka@co.maui.hi.us	
7. Chris Reynolds	Maui Electric	Director - Operational Tech.	chris.reynolds@mauielectric.com	
8. Joyce Kawakami	Feed My Sheep	CEO, Founder	Joyce@feedmysheepmaui.com	
9. Michele Blair	American Red Cross	Maui County Director	michele.blair@redcross.org	
10. Janet Kuwahara	Maui Vistors Bureau	Senior Manager of Ops.	janet@mauivb.com	
11. Diego Sanchez-Gomez	Planning	Floodplain Manager	Diego.Sanchez-Gomez@co.maui.hi.us	
12. Kathleen Aoki	Planning	Division Chief	Kathleen.Aoki@co.maui.hi.us	
13. Jim Buika	Planning	Shoreline Planner/Chair, State Hazard Mitigation Forum	James.Buika@co.maui.hi.us	

14. Zhantell Lindo	CM Keani Rawlins-Fernandez EA	Executive Assistant	zhantell.lindo@mauicounty.us	
15. Gail Miyahira	Hawaii Healthcare Emergency Management	Maui County Coordinator	gailm808@gmail.com	
16. Lindsay Ball	Department of Education	Area Superintendent	lindsay.ball@k12.hi.us	
17. Jamie Caplan	Jamie Caplan Consulting LLC.	Consultant	jamie@jamiecaplan.com	
18. Sharon Mielbrecht	Pacific Disaster Center	Hazard Mitigation Specialist	smielbrecht@pdc.org	
19. Alex DeRoode	Maui County	Energy Commissioner	Alexander.DeRoode@co.maui.hi.us	
20. Chana Ane	Office of Economic Development	Environmental Coordinator	chana.ane@co.maui.hi.us	
21. Loren Lapow	Maui Hero Project	Founder - Maui Hero Project	mauihero@pyccmaui.org	
22. Lance De Silva	Division of Forestry & Wildlife	Forestry Program Manager	lance.k.desilva@hawaii.gov	
23. Toni Eaton	Hawaiian Homelands	Maui District Supervisor	antonette.g.eaton@hawaii.gov	
24. Gale Notestone	Maui Fire Department	Fire Captain	Gale.Notestone@co.maui.hi.us	
25. Keanu Lau Hee	Mayor's Office		Keanu.LauHee@co.maui.hi.us	
26. Mavis Medeiros	Council Services	EA CM Shane Sinenci	Mavis.Medeiros@mauicounty.us	
27. Dawn Lono	Council Services	EA CM Shane Sinenci	Dawn.Lono@mauicounty.us	
28. Lauren Armstrong	Maui Metro Planning Group	Planner	lauren@mauimpo.org	
29. Anthony Joyce	MEMA	Hazard Mitigation Officer	anthony.joyce@mauicounty.gov	

July 2, 2020

Meeting Sign-In Sheet

Project: Maui County Haz. Mit. Plan Meeting 4
Facilitator: Jamie Caplan & Anthony Joyce (MEMA)
Place/Room: Zoom
Date: 7/2/20
Time: 12:00 PM

PRINT NAME	ORGANIZATION	TITLE	EMAIL	SIGN
1. Herman Andaya	MEMA	Administrator	herman.andaya@mauicounty.gov	
2. Tara Owens	University of Hawaii Manoa	Coastal Hazards Specialist	taram@hawaii.edu	
3. Annette Matsuda	Department of Transportation - Highways	Maintenance Engineer	annette.dh.matsuda@hawaii.gov	
4. Bridget Velasco	Department of Health	Public Health Planner	Bridget.Velasco@doh.hawaii.gov	
5. Rowena Dagdag-Andaya	Department of Public Works	Director	Rowena.Dagdag-Andaya@co.maui.hi.us	
6. Todd Teraoka	Maui Fire Department	Fire Captain	Todd.Teraoka@co.maui.hi.us	
7. Chris Reynolds	Maui Electric	Director - Operational Tech.	chris.reynolds@mauielectric.com	
8. Joyce Kawakami	Feed My Sheep	CEO, Founder	Joyce@feedmysheepmaui.com	
9. Michele Blair	American Red Cross	Maui County Director	michele.blair@redcross.org	
10. Janet Kuwahara	Maui Vistors Bureau	Senior Manager of Ops.	janet@mauivb.com	
11. Diego Sanchez-Gomez	Planning	Floodplain Manager	Diego.Sanchez-Gomez@co.maui.hi.us	
12. Kathleen Aoki	Planning	Division Chief	Kathleen.Aoki@co.maui.hi.us	
13. Jim Buika	Planning	Shoreline Planner/Chair, State Hazard Mitigation Forum	James.Buika@co.maui.hi.us	
14. Zhantell Lindo	CM Keani Rawlins-Fernandez EA	Executive Assistant	zhantell.lindo@mauicounty.us	
15. Gail Miyahira	Hawaii Healthcare Emergency Management	Maui County Coordinator	gailm808@gmail.com	
16. Lindsay Ball	Department of Education	Area Superintendent	lindsay.ball@k12.hi.us	
17. Jamie Caplan	Jamie Caplan Consulting LLC.	Consultant	jamie@jamiecaplan.com	

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PRINT NAME	ORGANIZATION	TITLE	EMAIL	SIGN
18. Sharon Mielbrecht	Pacific Disaster Center	Hazard Mitigation Specialist	smielbrecht@pdc.org	
19. Alex DeRoode	Maui County	Energy Commissioner	Alexander.DeRoode@co.maui.hi.us	
20. Chana Ane	Office of Economic Development	Environmental Coordinator	chana.ane@co.maui.hi.us	
21. Loren Lapow	Maui Hero Project	Founder - Maui Hero Project	mauihero@pyccmaui.org	
22. Lance De Silva	Division of Forestry & Wildlife	Forestry Program Manager	lance.k.desilva@hawaii.gov	
23. Toni Eaton	Hawaiian Homelands	Maui District Supervisor	antonette.g.eaton@hawaii.gov	
24. Gale Notestone	Maui Fire Department	Fire Captain	Gale.Notestone@co.maui.hi.us	
25. Keanu Lau Hee	Mayor's Office		Keanu.LauHee@co.maui.hi.us	
26. Mavis Medeiros	Council Services	EA CM Shane Sinenci	Mavis.Medeiros@mauicounty.us	

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Public Meeting Sign-in Sheets

January 7, 2020 Climate Action and Resilience Committee

The Maui Emergency Management Agency testifies in front of the Climate Action and Resilience Committee
January 7, 2020

On Monday, the Maui Emergency Management Agency (MEMA) testified in front of the Climate Action and Resilience Committee about how MEMA is working with Maui County and other non-governmental organizations to mitigate the effects of climate change and promote future resiliency. Herman Andaya, MEMA's Administrator and Anthony Joyce, PhD, MEMA's Hazard Mitigation Officer discussed what climate change is, how Maui County may be impacted and the steps taken to mitigate these affects. The data presented during their testimony highlighted issues such as rising sea levels that are exacerbating coastal erosion, decreasing precipitation in the Hawaiian Islands, and increasing ocean acidity causing degradation of Maui's coastal ecosystems and coral reefs. In addition, MEMA discussed the on-going work of the Maui County Multi-Hazard Mitigation Plan, a document used to study and analyze risk of multiple natural hazards that Maui County faces. Dr. Joyce explained this document will be a living document, and will be used to develop and keep track of hazard mitigation projects on Maui. The Multi-Hazard Mitigation Plan is expected to be accepted and adopted by October of 2020 and will keep Maui County eligible for pre- and post-disaster mitigation federal funding.

Video Presentation: http://mauicounty.granicus.com/MediaPlayer.php?view_id=1&clip_id=1027

PUBLIC MEETING NOTICE

COUNCIL OF THE COUNTY OF MAUI *www.MauiCounty.us/CAR*

Committee Chair
Kelly Takaya King

Committee Vice-Chair
Shane M. Sinenci

Voting Members:
Riki Hokama
Tasha Kama
Alice L. Lee
Tamara Paltin
Keani N.W. Rawlins-Fernandez

Non-Voting Members:
Michael J. Molina
Yuki Lei K. Sugimura

CLIMATE ACTION AND RESILIENCE COMMITTEE

Monday, January 6, 2020
9:00 a.m.

MEETING SITE:
Council Chamber
Kalana O Maui Building, 8th Floor
200 South High Street
Wailuku, Hawaii

A G E N D A

MITIGATING CLIMATE-ACTIVATED DISASTERS (CAR-1(1))

Description: In accordance with Rule 7(B) of the Rules of the Council, the Committee intends to receive a presentation relating to Maui Emergency Management Agency's efforts toward mitigating climate-activated disasters and related matters.

Status: The Committee may receive a presentation from representatives of Maui Emergency Management Agency providing an overview of their current efforts and plans toward mitigating climate-activated disasters and may discuss the matter. No legislative action will be taken.

CLIMATE ACTION POLICIES BY GOVERNMENT AGENCIES (CAR-1(2))

Description: In accordance with Rule 7(B) of the Rules of the Council, the Committee intends to receive a presentation relating to climate action policies pending and being taken by various government agencies, including those by the Hawaii State Legislature and the Maui County Council.

Status: The Committee may receive a presentation from Rita Ryan, Chair of the Climate Reality Project - Hawaii Chapter. The Committee may also receive an update on pending County and State legislation on climate action and may discuss the matter. No legislative action will be taken.

MORE →

February 3, 2020 Climate Action and Resilience Committee

Video presentation: http://mauicounty.granicus.com/MediaPlayer.php?view_id=1&clip_id=1040

PUBLIC MEETING NOTICE

COUNCIL OF THE COUNTY OF MAUI *www.MauiCounty.us/CAR*

Committee Chair
Kelly Takaya King

Committee Vice-Chair
Shane M. Sinenci

Voting Members:
Riki Hokama
Tasha Kama
Alice L. Lee
Tamara Paltin
Keani N.W. Rawlins-Fernandez

Non-Voting Members:
Michael J. Molina
Yuki Lei K. Sugimura

CLIMATE ACTION AND RESILIENCE COMMITTEE

Monday, February 3, 2020

9:00 a.m.

MEETING SITE:
Council Chamber
Kalana O Maui Building, 8th Floor
200 South High Street
Wailuku, Hawaii

A G E N D A

MITIGATING CLIMATE-ACTIVATED DISASTERS (CAR-1(1))

Description: In accordance with Rule 7(B) of the Rules of the Council, the Committee intends to receive an update on the County's Hazard Mitigation Plan that will serve as a meaningful blueprint for a more resilient and sustainable future for the County of Maui and address threats such as wildfires, significant beach erosion, highway rockslides, and related matters.

Status: The Committee may receive presentations from representatives of Maui Emergency Management Agency, the Steering Committee of County Leaders, and members of the consulting team led by Jamie Caplan Consulting LLC who are informing the update process of the County's Hazard Mitigation Plan and may also discuss the matter. No legislative action will be taken.

RESILIENCY HUBS (CAR-2)

Description: The Committee is in receipt of County Communication 20-9, from Council Chair Kelly Takaya King, relating to resiliency hubs.

Status: The Committee may receive a presentation from the County Administration providing an overview of the matter relating to resiliency hubs, especially as it pertains to Maui County. The Committee may also consider the filing of County Communication 20-9 and other related action.

County Communication 20-9.pdf

MORE →

Central Maui, February 4, 2020

County of Maui Mitigation Plan Update

PUBLIC MEETING

DISASTER MITIGATION

February 4, 2020

Kahului Community Center, Central Maui
5:00 p.m. – 6:00 p.m.

The development of the Maui County Hazard Mitigation Plan Update is underway. This plan will serve as a strategy for reducing current and future risks in the County and enable the County to leverage Federal funding sources to prevent damages from natural hazards such as wildfires, power outages, and floods.

During this public meeting, you will learn about the process of developing the plan and contribute your ideas for making the island safer and more resilient to natural hazards.

Take the Maui County Disaster Preparedness Survey Today:
https://www.surveymonkey.com/r/mitigatemaui.

Your Participation is Needed!

Share your ideas for reducing risk on Central Maui.

Get involved to make Central Maui safer!

Power Outages, Coastal Erosion, Hurricanes!

FOR MORE INFORMATION CONTACT
Anthony Joyce, PhD, Hazard Mitigation Specialist
Maui Emergency Management Agency
(808) 270-7286 anthony.joyce@mauicounty.gov

Refreshments Served!

CENTRAL MAUI PUBLIC MEETING SIGN-IN SHEET			
Project:	Maui County Hazard Mitigation Plan Update	**Meeting Date:**	2/4/2020
Facilitator:	Anthony Joyce, PhD., MEMA	**Place/Room:**	Kahului Community Center

Name	Affiliation/Company	Phone	E-Mail
Kathleen Aoki	Planning Dept	270-7734	Kathleen.aoki@mauicounty.gov
Loren Lapow	MAUI HERO PROJECT	276-0969	mauiheroproject@gmail.com
Joyce KAWAKAM	FEED My SHEEP - VOAD	870-4428	
Bridget Velasco	DOH - OPHP	357-7239	bridget.velasco@doh.hawaii.gov
Colin Lindeman	Niyom IT Maui County Resident	360 201 3860	Colin.Lindeman@hawaii.edu
Sharon Mielbrecht	Pacific Disaster Center	808 891-7927	smielbrecht@pdc.org
Anthony Joyce			
Caroline Cunningham			

Moloka'i Public Meeting, February 5, 2020

County of Maui Mitigation Plan Update

PUBLIC MEETING

DISASTER MITIGATION

February 5, 2020

Mitchell Pauole Center, Moloka'i
4:30 p.m. – 5:30 p.m.

The development of the Maui County Hazard Mitigation Plan Update is underway. This plan will serve as a strategy for reducing current and future risks in the County and enable the County to leverage Federal funding sources to prevent damages from natural hazards such as wildfires, power outages, and floods.

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Power Outages, Coastal Erosion, Hurricanes!

FOR MORE INFORMATION CONTACT
Anthony Joyce, PhD, Hazard Mitigation Specialist
Maui Emergency Management Agency
(808) 270-7286 anthony.joyce@mauicounty.gov

Refreshments Served!

MOLOKAI PUBLIC MEETING SIGN-IN SHEET			
Project:	Maui County Hazard Mitigation Plan Update	**Meeting Date:**	2/5/2020
Facilitator:	Anthony Joyce, PhD., MEMA	**Place/Room:**	Mitchell Pauole Center

Name	Affiliation/Company	Phone	E-Mail
JULIE BICOY	DMVB-Visitor	808 336-0288	mvajulie@gmail.com
Jim & Leila Stone		808 558-8484	hakaano@hotmail.com
Sharon Mielbrecht	Pacific Disaster Center	808 891-7927	smielbrecht@pdc.org
Monique Camp		347-3190	
Pat Tamashiro	Hawaii Red cross	213-5091	
Judy L. Caparida	Kupuna	5588-558	—
Hali Drearing	Kalamula Ass.	5535339	
Aisha Senas-Childs	M'loa resident	658-0805	chefaisha808@gmail.com
Wilmina K. English	Community member	6580815	wenglish@oniparc.org
LESTER DELOS REYES	NPS. KALAUPAPA	336-1308	lester_delos_reyes@nps.gov
Gene Ross & Davis	DHHL	560-6105	gene.davis@hawaii.gov
Kurt Go	Molokai Drugs, Inc.	553-5790 Ext 0	kurt@molokaidrugsinc.com
Deb Mapel	COM-Office on aging	553-5241	debra.mapel@co.maui.hi.gov

Hana Public Meeting, February 6, 2020

County of Maui Mitigation Plan Update

PUBLIC MEETING

DISASTER MITIGATION

February 6, 2020

Helene Hall, Hana

5:00 p.m. – 6:00 p.m.

The development of the Maui County Hazard Mitigation Plan Update is underway. This plan will serve as a strategy for reducing current and future risks in the County and enable the County to leverage Federal funding sources to prevent damages from natural hazards such as wildfires, power outages, and floods.

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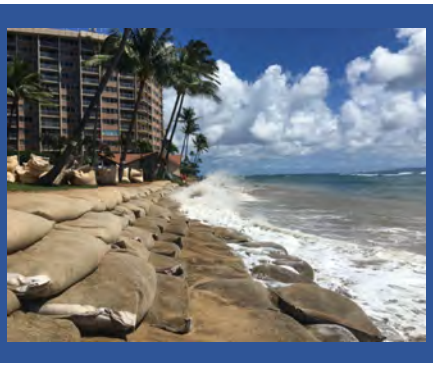
Your Participation is Needed!



Share your ideas for reducing risk on Hana.

Get involved to make Hana safer!

Power Outages, Coastal Erosion, Hurricanes!

FOR MORE INFORMATION CONTACT
Anthony Joyce, PhD, Hazard Mitigation Specialist
Maui Emergency Management Agency
(808) 270-7286 anthony.joyce@mauicounty.gov

Refreshments Served!

and Public Meeting 4pm - 6pm

HANA CORE GROUP PREPAREDNESS MEETING SIGN-IN SHEET			
Project:	Maui County Hazard Mitigation Plan Update	**Meeting Date:**	2/6/2020
Facilitator:	Anthony Joyce, PhD., MEMA	**Place/Room:**	Helene Hall

Name	Affiliation/Company	Phone	E-Mail
Alohalani Smith (Uncle Tony Hulaton)	Am. Red Cross/Aha Moku O Kaupo	808 870-2820	Kaukaulani@gmail.com
Harolen Kaiwi	Am Red Cross	808 868-1190	hkaiwi@aol.com
Dawn Lono	County Council	808 270-7246	dawn.lono@mauicounty.us
Heidi Lua	Hana Business Council	808 248-8808	hbc@hanabusinesscouncil.com
Lia Williams	CERT	280-7713	shining-raven@live.com
Mavis Oliveira-Medeiros	Council Ofc	2487513 2488606	Mavis.Medeiros@mauicounty.us
Gale Notestone	Maui Fire Dept.	808 281-9323	FIN00591@MAUI.GMAIL
Lolly S. Bergan	PHN public health nurse	248-4855	dolores.soler-bergan@doh.hawaii.gov
Aaron Asay	Ikua Health Clinic	(w)808-248-8244 (c)801-361-9425	aasay@hanahealth.org
Tom Bacon	CERT	248-8750	tom@rainbowridgewest.com all 1 word
Chris Gaerder	CERT	248-8750	chris@rainbowridgewest.com
JAMES HERBAUGH	NATIONAL PARK SERVICE	357-2160	James_Herbaugh@NPS.GOV
KAMALU CARROLL	Hana Community Asso.	264-0139	clairekamalucarroll@gmail
Kaipo Kahai	MFD		

June 15, 2020 Climate Action and Resilience Committee Meeting

Video presentation: http://mauicounty.granicus.com/MediaPlayer.php?view_id=1&clip_id=1149

PUBLIC MEETING NOTICE

COUNCIL OF THE COUNTY OF MAUI *www.MauiCounty.us/CAR*

Committee Chair
Kelly Takaya King

Committee Vice-Chair
Shane M. Sinenci

Voting Members:
Riki Hokama
Tasha Kama
Alice L. Lee
Tamara Paltin
Keani N.W. Rawlins-Fernandez

Non-Voting Members:
Michael J. Molina
Yuki Lei K. Sugimura

CLIMATE ACTION AND RESILIENCE COMMITTEE

Monday, June 15, 2020
9:00 a.m.

MEETING SITE:
Online Only
Phone testimony: 1-408-915-6290, meeting code 498 712 703
Video testimony: https://bluejeans.com/498712703
View live: Akaku, Channel 53 or mauicounty.us/agendas
*Subject to change without notice. Visit mauicounty.us for more information.

A G E N D A

RECOGNIZING THE 2019-2020 UPDATE TO THE COUNTY'S HAZARD MITIGATION PLAN (CAR-19)

Description: The Committee is in receipt of County Communication 20-175, from Administrator Herman Andaya of the Maui Emergency Management Agency, transmitting a proposed resolution entitled "RECOGNIZING THE 2019-2020 UPDATE TO THE COUNTY OF MAUI HAZARD MITIGATION PLAN."

Status: The Committee may receive an update from the Maui Emergency Management Agency and members of the consulting team led by Jamie Caplan Consulting LLC and may discuss the 2019-2020 update to the County's hazard mitigation plan. The Committee may also consider whether to recommend adoption of the proposed resolution, with or without revisions, and the filing of County Communication 20-175 and other related action.

County Communication 20-175.pdf

MORE →

Zoom June 30, 2020

Meeting Sign-In Sheet

Project: Maui County Haz. Mit. Plan Public Meeting 4
Facilitator: Jamie Caplan & Anthony Joyce (MEMA)
Place/Room: Zoom

Date: 6/30/20
Time: 1:00 PM

PRINT NAME	ORGANIZATION	TITLE	EMAIL
Adele			
Christina			
Cindy A.			
Dennis Terpin			
Dick Mayer			
James			
Joseph Pluta			
Kate Blystone			
Kitty Courtney			
Sharon Meilbrecht			
SW			
Andrea Finkelstein			
Kathleen Aoki			
JoAnn Scardino			

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County of Maui Mitigation Plan Update

PUBLIC MEETING

DISASTER MITIGATION

June 30, 2020

https://sparling.zoom.us/j/99856521887
12:00 p.m. – 1:00 p.m.

The Maui County Hazard Mitigation Plan Update is nearly complete. This plan serves as a strategy for reducing current and future risks in the County and enables the County to leverage Federal funding sources to prevent damages from natural hazards such as wildfires, power outages, and floods. Join the Zoom meeting and learn about the contents of the plan and contribute your ideas for making the islands safer and more resilient to natural hazards.

Last Chance - Take the Natural Hazards Survey:
https://www.surveymonkey.com/r/mitigatemaui

Share your ideas for reducing risk in Maui.

Get involved to make Maui safer!

Power Outages, Wildfires, Hurricanes!

Zoom Meeting!

FOR MORE INFORMATION CONTACT

Anthony Joyce, PhD, Hazard Mitigation Specialist

Maui Emergency Management Agency

(808) 270-7286 anthony.joyce@mauicounty.gov

June 26, 2020 MauiNow

Maui Draft Hazard Mitigation Plan Nears Completion

June 25, 2020, 11:06 AM HST · Updated June 25, 11:06 AM

0 Comments

Recommend 11 people recommend this. Be the first of your friends.

Text Size: A A A

The County of Maui will share its draft Hazard Mitigation Plan with the public in a Zoom meeting from noon to 1 p.m. **June 30, 2020**. To join the meeting visit: https://sparling.zoom.us/j/99856521887.

The Maui Emergency Management Agency has nearly completed an update to the County's **Hazard Mitigation Plan.** It addresses threats such as wildfires, significant beach erosion and highway rockslides. The plan looks at how the County can lessen the impact of natural hazards such as wildfires, tropical storms and erosion on Maui, Moloka'i and Lāna'i.

This includes projects such as strengthening school buildings to serve as shelters during hurricanes, adding generators to critical facilities for backup power and developing tsunami evacuation routes. Once approved by the Federal Emergency Management Agency, the plan makes the County eligible for pre- and post-disaster mitigation project grant funding through FEMA's Hazard Mitigation Assistance programs and other non-emergency disaster assistance.

In January 2020 the County opened a Public Mitigation Planning Survey. The survey closes on June 30, 2020. The public is invited to help the survey reach more than 500 participants. Public feedback helps the County identify solutions to the problems associated with natural hazards. To take the survey, go to **https://www.surveymonkey.com/r/mitigatemaui**

The Maui County Hazard Mitigation Plan also includes consideration of infectious disease and pandemics as part of the Public Health Hazard. In alignment with the State Hazard Mitigation Plan and federal hazard mitigation requirements, public health concerns are recognized. The Maui County Hazard Mitigation Plan provides an opportunity for county officials and the public to recommend potential mitigation measures.

With support of a consulting team led by Jamie Caplan Consulting LLC, Maui Emergency Management Agency has formed a Steering Committee of County leaders to inform the update process. Prior to the pandemic, the Steering Committee met twice and team members interviewed a dozen key stakeholders, and hosted public meetings in Hāna, Moloka'i and Central Maui.

For more information about the Hazard Mitigation Plan or to learn about ways to participate in the development of the Hazard Mitigation Plan, contact Anthony Joyce, PhD, Hazard Mitigation Officer, Maui Emergency Management Agency, at (808) 270-7286 or send email to Anthony.joyce@mauicounty.gov. More information is available at https://www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan.

Print

Fact Sheets

County of Maui Hazard Mitigation Plan Update

FACT SHEET

The Maui Emergency Management Agency (MEMA) is developing an update to the County's Hazard Mitigation Plan. The plan serves as an essential strategy for reducing current and future risks to natural hazards and improving the emergency preparedness of the county's three islands. Updates are required every five years. This update is scheduled for completion in Summer 2020.

The Hazard Mitigation Plan Update will focus on the identification, assessment, and mitigation of natural hazards such as wildfires, coastal erosion, and tropical storms. The plan will result in a list of mitigation actions or projects the County can take to save lives and reduce damages. It will also double as a creditable "floodplain management plan" under FEMA's Community Rating System (CRS), helping the County maintain its current CRS rating of Class 7.

Federal Emergency Management Agency (FEMA) Requirements Met
Once approved by FEMA, the plan makes the County eligible for pre- and post-disaster mitigation project grant funding through FEMA's Hazard Mitigation Assistance (HMA) programs and other non-emergency disaster assistance.

Hazard Mitigation Plans
Hazard Mitigation Plans form the foundation for a long-term strategy to reduce disaster losses and break the cycle of disaster damage, rebuilding, and repeated damage.

Steering Committee Representation

- American Red Cross
- Department of Education
- Department of Health
- Department of Public Works
- Department of Transportation – Highways
- Feed My Sheep
- Hawaii Healthcare Emergency Management
- Hawaiian Homelands, Division of Forestry and Wildlife
- Maui Electric
- Maui Emergency Management Agency
- Maui Fire Department
- Maui Hero Project
- Maui Planning Department
- Maui Visitor's Bureau
- Office of Economic Development
- Pacific Disaster Center
- University of Hawaii Manoa

Fire in Central Maui

Public Meetings–Everyone is Welcome
Additional Public Meetings in April and June

Central Maui Kahului Community Center	2/4/20 5:00 pm - 6:00 pm
Molokai Mitchell Pauole Center	2/5/20 4:30 pm - 5:30 pm
Hana Helene Hall	2/6/20 5:00 pm – 6:00 pm

Reduce or Eliminate Risk to People and Property from Natural Hazards.

For more information and to get involved, please contact Anthony Joyce, PhD, Hazard Mitigation Specialist, Grants Manager, Maui Emergency Management Agency, Phone: (808) 270-7286
Email: anthony.joyce@mauicounty.gov

County of Maui Hazard Mitigation Plan Update

Hurricane Lane Flooding on Puu Way

Maui County Residents – Get Involved!
Opportunities exist for Maui County residents to get involved in the hazard mitigation planning process including:

Steering Committee
A Steering Committee of County leaders has been convened to guide the planning process. The Committee will meet four times during the planning process; their knowledge and participation is critical to the success of the project.

Public Opinion Survey
A Public Opinion Survey is available online. Survey results will identify what hazards are of greatest concern and what mitigation actions are of interest. You can access the survey at https://www.surveymonkey.com/r/mitigatemaui.

Public Meetings
These meetings provide an opportunity to discuss the unique risks, capabilities and mitigation actions necessary for each region of the county.

Stakeholder Meetings
Generating interest, soliciting input and engaging partners in the plan development process provides an opportunity for project leaders to gain significant insight into the needs and capabilities of County leaders and businesses.

Purpose of Mitigation Plan Update

- Develop County Mitigation Plan Update for FEMA Approval
- Revise Risk and Vulnerability Assessment with Best Available Data
- Update Mitigation Strategy with Feasible Actions to Reduce Risk
- Maintain Community Rating System (CRS) Status to keep Flood Insurance Costs Down

Winter Storm Causes Ice and Snow on Haleakala

For more information and to get involved, please contact Anthony Joyce, PhD, Hazard Mitigation Specialist, Grants Manager, Maui Emergency Management Agency, Phone: (808) 270-7286
Email: anthony.joyce@mauicounty.gov

County of Maui Hazard Mitigation Plan Update

FACT SHEET

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Federal Emergency Management Agency (FEMA) Requirements Met
Once approved by FEMA, the plan makes the County eligible for pre- and post-disaster mitigation project grant funding through FEMA's Hazard Mitigation Assistance (HMA) programs and other non-emergency disaster assistance.

Hazard Mitigation Plans
Hazard Mitigation Plans form the foundation for a long-term strategy to reduce disaster losses and break the cycle of disaster damage, rebuilding, and repeated damage.

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- Department of Education
- Department of Health
- Department of Public Works
- Department of Transportation – Highways
- Feed My Sheep
- Hawaii Healthcare Emergency Management
- Hawaiian Homelands, Division of Forestry and Wildlife
- Maui Electric
- Maui Emergency Management Agency
- Maui Fire Department
- Maui Hero Project
- Maui Planning Department
- Maui Visitor's Bureau
- Office of Economic Development
- Pacific Disaster Center
- University of Hawaii Manoa

Fire in Central Maui

Get Involved Today!

Take the Mitigation Planning Survey
https://www.surveymonkey.com/r/mitigatemaui

Visit the Project Web Page
https://www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan

For more information and to get involved, please contact Anthony Joyce, PhD, Hazard Mitigation Specialist, Grants Manager, Maui Emergency Management Agency, Phone: (808) 270-7286
Email: anthony.joyce@mauicounty.gov

County of Maui Hazard Mitigation Plan Update

Hurricane Lane Flooding on Puu Way

Covid-19 and the Hazard Mitigation Plan

The Maui County Hazard Mitigation Plan includes consideration of infectious disease and pandemics as part of the Public Health Hazard. In alignment with the State Hazard Mitigation Plan and federal hazard mitigation requirements, public health concerns are addressed at a high level within the mitigation plan, meaning a broad number of public health impacts are recognized as having previous occurred and possible in the future. The Maui County Hazard Mitigation Plan also provides an opportunity for county officials and the public to recommend potential mitigation measures to generally lessen the impacts of these events. This plan is currently under development and will reflect COVID-19 as a new public health hazard to the county.

Maui County Emergency Management (MEMA) addresses infectious disease and pandemic concerns through a number of plans and policies such as the County Emergency Operations Plan. These outline the necessary procedures, personnel and steps to manage emergency situations such as the COVID-19 and other disaster impacts. As each emergency is unique, our procedures are adapted to meet the specific aspects of the event in coordination with local, county, state, and federal officials and partners.

Purpose of Mitigation Plan Update

- Develop County Mitigation Plan Update for FEMA Approval
- Revise Risk and Vulnerability Assessment with Best Available Data
- Update Mitigation Strategy with Feasible Actions to Reduce Risk
- Maintain Community Rating System (CRS) Status to keep Flood Insurance Costs Down

Winter Storm Causes Ice and Snow on Haleakala

Take the Mitigation Planning Survey

https://www.surveymonkey.com/r/mitigatemaui

Visit the Project Web Page

https://www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan

For more information and to get involved, please contact Anthony Joyce, PhD, Hazard Mitigation Specialist, Grants Manager, Maui Emergency Management Agency, Phone: (808) 270-7286
Email: anthony.joyce@mauicounty.gov

Press Releases and Media

January 28, 2020

County of Maui
Public Information Office
200 South High Street
Wailuku, Hawai'i 96793-2155
Phone: (808) 270-7855
Fax: (808) 270-7870

Brian Perry
Communications Director

Ryan Piros & Chris Sugidono
Asst. Communications Directors

PRESS RELEASE
For Immediate Release
January 28, 2020

Contact: Anthony Joyce
(808) 270-7286

Maui County updating Hazard Mitigation Plan, multiple opportunities available for public input

The Maui Emergency Management Agency has begun to develop an update to the County's Hazard Mitigation Plan to address threats such as wildfires, significant beach erosion and highway rockslides.

The County needs your help identifying solutions to the problems associated with natural hazards. The general public is encouraged to participate in the hazard mitigation plan by filling out the survey and attending the meetings posted below:

- Take the Public Preparedness Survey: https://www.surveymonkey.com/r/mitigatemaui
- Participate in a public meeting:
  - **February 3, 9 a.m., Maui County Council Climate Action and Resilience Committee, Council Chambers; public testimony welcome.**
  - February 4, 5 to 6 p.m., Kahului Community Center
  - February 5, 4:30 to 5:30 p.m., Mitchell Pauole Center, Moloka'i
  - February 6, 5 to 6 p.m., Helene Hall, Hana

More public meetings will be offered throughout the County in the coming months.

The Hazard Mitigation Plan will serve as a meaningful blueprint for a more resilient and sustainable future for the County of Maui. The plan looks at how the County can lessen the impact of natural hazards such as wildfires, tropical storms and erosion on all three islands. This includes projects such as strengthening school buildings to serve as shelters during hurricanes, adding generators to critical facilities for backup power, and developing tsunami evacuation routes. Once approved by the Federal Emergency Management Agency, the plan makes the County eligible for pre- and post-disaster mitigation project grant funding through FEMA's Hazard Mitigation Assistance programs and other non-emergency disaster assistance.

With support of a consulting team led by Jamie Caplan Consulting LLC, Maui Emergency Management Agency has formed a Steering Committee of County Leaders to inform the update process. Team members have also developed a community-driven project approach that includes interviewing key stakeholders, hosting public meetings, distributing a public preparedness survey and review of the draft plan. The Steering Committee held its first meeting on December 10, 2019, and plans to hold a second meeting on February 4, 2020. The Planning Team interviewed a dozen stakeholders in December, included but not limited to, the Maui County Planning Department, the Maui Visitor's Bureau, the Maui County Department of Public Works, and the chief executive officer of Feed My Sheep and chair of Voluntary Organizations Active in Disaster.

For more information about the Hazard Mitigation Plan or to learn about ways to participate in the development of the Hazard Mitigation Plan, contact Anthony Joyce, PhD, Hazard Mitigation Officer, Maui Emergency Management Agency, at (808) 270-7286 or send email to Anthony.joyce@mauicounty.gov. You can also visit https://www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan.

March 23, 2020

County of Maui
Public Information Office
200 South High Street
Wailuku, Hawai`i 96793-2155
Phone: (808) 270-7855
Fax: (808) 270-7870

Brian Perry
Communications Director

Ryan Piros & Chris Sugidono
Asst. Communications Directors

PRESS RELEASE
For Immediate Release
March 23, 2020

Contact: Anthony Joyce
(808) 270-7286

Maui County updating Hazard Mitigation Plan,
Take the Public Mitigation Planning Survey

The Maui Emergency Management Agency has been working on developing an update to the County's Hazard Mitigation Plan to address threats such as wildfires, significant beach erosion and highway rockslides. The plan looks at how the County can lessen the impact of natural hazards such as wildfires, tropical storms and erosion on all three islands. This includes projects such as strengthening school buildings to serve as shelters during hurricanes, adding generators to critical facilities for backup power, and developing tsunami evacuation routes. Once approved by the Federal Emergency Management Agency, the plan makes the County eligible for pre- and post-disaster mitigation project grant funding through FEMA's Hazard Mitigation Assistance programs and other non-emergency disaster assistance.

The County needs your help identifying solutions to the problems associated with natural hazards. The general public is encouraged to participate in the hazard mitigation plan by filling out the **Public Mitigation Planning Survey: https://www.surveymonkey.com/r/mitigatemaui**

The Maui County Hazard Mitigation Plan also includes consideration of infectious disease and pandemics as part of the Public Health Hazard. In alignment with the State Hazard Mitigation Plan and federal hazard mitigation requirements, public health concerns are recognized. The Maui County Hazard Mitigation Plan also provides an opportunity for county officials and the public to recommend potential mitigation measures to generally lessen the impacts of these events. This plan is currently under development and will reflect COVID-19 as a new public health hazard to the county.

With support of a consulting team led by Jamie Caplan Consulting LLC, Maui Emergency Management Agency has formed a Steering Committee of County Leaders to inform the update process. Prior to the pandemic, the Steering Committee met twice and Team members interviewed a dozen key stakeholders, and hosted public meetings in Hana, Molokai, and Central Maui.

For more information about the Hazard Mitigation Plan or to learn about ways to participate in the development of the Hazard Mitigation Plan, contact Anthony Joyce, PhD, Hazard Mitigation Officer, Maui Emergency Management Agency, at (808) 270-7286 or send email to Anthony.joyce@mauicounty.gov. You can also visit https://www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan.

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- Maui Now - https://mauinow.com -

Hazard Mitigation Plan Meetings on Maui This Week

Posted By *Wendy Osher* On February 4, 2020 @ 9:15 am In Maui News | Comments Disabled

Sandbag barrier in Kahana where condominium properties are threatened by erosion and high waves. File image 2017 Credit: Tara Owens via PacIOOS.

Community meetings continue this week as the Maui Emergency Management Agency attempts to develop and update the County's Hazard Mitigation Plan.

The public is invited to identify solutions to problems associated with natural hazard threats such as wildfires, significant beach erosion and highway rockslides.

The next meeting takes place from 5 to 6 p.m. tonight (Tuesday, Feb. 4, 2020) at the Kahului Community Center. Additional meetings will be held on Wednesday, Feb. 5, from 4:30 to 5:30 p.m. at the Mitchell Pauole Center on Moloka'i and on Thursday, Feb. 6, from 5 to 6 p.m., at Helene Hall in Hāna.

Once approved by the Federal Emergency Management Agency, the plan makes the County eligible for pre- and post-disaster mitigation project grant funding through FEMA's Hazard Mitigation Assistance programs and other non-emergency disaster assistance.

The general public is encouraged to participate in the hazard mitigation plan by attending one of the meetings or filling out a Public Preparedness Survey online [1].

More public meetings will be offered throughout the County in the coming months.

County of Maui Mitigation Plan Update

PUBLIC MEETING

DISASTER MITIGATION

February 5, 2020

Mitchell Pauole Center, Moloka'i

4:30 p.m. – 5:30 p.m.

The development of the Maui County Hazard Mitigation Plan Update is underway. This plan will serve as a strategy for reducing current and future risks in the County and enable the County to leverage Federal funding sources to prevent damages from natural hazards such as wildfires, power outages, and floods.

During this public meeting, you will learn about the process of developing the plan and contribute your ideas for making the island safer and more resilient to natural hazards.

Take the Maui County Disaster Preparedness Survey Today:
https://www.surveymonkey.com/r/mitigatemaui.

Your Participation is Needed!

Share your ideas for reducing risk on Moloka'i.

Get involved to make Moloka'i safer!

Power Outages, Coastal Erosion, Hurricanes!

FOR MORE INFORMATION CONTACT
Anthony Joyce, PhD, Hazard Mitigation Specialist
Maui Emergency Management Agency
(808) 270-7286 anthony.joyce@mauicounty.gov

Refreshments Served!

Meeting event flyer. PC: Maui Emergency Management Agency.

Article printed from Maui Now: **https://mauinow.com**

URL to article: **https://mauinow.com/2020/02/04/hazard-mitigation-plan-meetings-on-maui-this-week/**

URLs in this post:

[1] online: **https://www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan**

Click here to print.

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Maui county seeks public comment on hazard mitigation plan

LOCAL NEWS
Posted: Jan 27, 2020 / 05:25 PM HST / Updated: Jan 27, 2020 / 05:25 PM HST

HONOLULU (KHON2) — Maui county's emergency management agency is updating the hazard mitigation plan to address threats such as wildfires, significant beach erosion and highway rockslides.

The county needs your help identifying solutions.

You can do so by attending any of the three meetings scheduled for next month or by taking an online survey.

February 4, 5 to 6 p.m., Kahului Community Center

February 5, 4:30 to 5:30 p.m., Mitchell Pauole Center, Molokai

February 6, 5 to 6 p.m., Helene Hall, Hana

Take the Public Preparedness Survey: https://www.surveymonkey.com/r/mitigatemaui

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What can be done to better protect West Maui from fires?

March 12, 2020
Lahaina News

Save |

It's sad that House Bill 2518 promptly died at the Hawaii Legislature, because it would have initiated steps to help address two major issues in West Maui.

Introduced by Maui representatives, the doomed bill would have facilitated the reuse of treated wastewater and established a network of water reservoirs for firefighters to use during brush fires - perhaps the greatest ongoing threat to health and safety in West Maui.

The measure explains, "The legislature finds that an average of over 8,700,000 gallons of treated water is disposed of every day using injection wells on the island of Maui. This method of disposal causes groundwater contamination, algae blooms and coral reef damage in nearshore waters."

Based on its history of legal challenges, this idiotic practice will continue until the County of Maui is forced to make changes.

With summer approaching, wildfires are a very real and dangerous threat in West Maui.

Residents certainly have the right to ask state and county officials, "What are you doing to address the situation?"

Regardless of the bill, the county and state should work with landowners to shore up former plantation reservoirs and fill them for use this summer and fall.

Creating the berm to keep flames away from Honoapiilani Highway at the entrance to the Pali was a smart step. What else should be done?

The Maui Emergency Management Agency has begun to develop an update to the county's Hazard Mitigation Plan to address threats such as wildfires, significant beach erosion and highway rockslides.

The county needs your help identifying solutions to the problems associated with natural hazards. The general public is encouraged to participate in the hazard mitigation plan by filling out the Public Preparedness Survey at www.surveymonkey.com/r/mitigatemaui.

Public meetings will be offered throughout the county in the coming months.

For more information about the Hazard Mitigation Plan, or to learn about ways to participate in its development, contact Hazard Mitigation Officer Anthony Joyce at 270-7286 or visit www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan.

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Brian Perry
Communications Director

Ryan Piros & Chris Sugidono
Asst. Communications Directors

PRESS RELEASE
For Immediate Release
March 23, 2020

Contact: Anthony Joyce
(808) 270-7286

Maui County updating Hazard Mitigation Plan, Take the Public Mitigation Planning Survey

The Maui Emergency Management Agency has been working on developing an update to the County's Hazard Mitigation Plan to address threats such as wildfires, significant beach erosion and highway rockslides. The plan looks at how the County can lessen the impact of natural hazards such as wildfires, tropical storms and erosion on all three islands. This includes projects such as strengthening school buildings to serve as shelters during hurricanes, adding generators to critical facilities for backup power, and developing tsunami evacuation routes. Once approved by the Federal Emergency Management Agency, the plan makes the County eligible for pre- and post-disaster mitigation project grant funding through FEMA's Hazard Mitigation Assistance programs and other non-emergency disaster assistance.

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###

https://themolokaidispatch.com/maui-county-updating-hazard-mitigation-plan/
Wednesday, April 8th, 2020 **By News Release**

Maui County Updating Hazard Mitigation Plan

County of Maui News Release

Molokai residents are being asked to help find solutions to problems associated with natural hazards by participating in hazard mitigation. One way is to fill out the Public Mitigation Planning Survey at surveymonkey.com/r/mitigatemaui.

The survey is part of the Maui Emergency Management Agency's work to develop an update to the County's Hazard Mitigation Plan. It addresses threats such as wildfires, significant beach erosion and highway rockslides and now includes the COVID-19 pandemic as a public health threat.

The plan looks at how the County can lessen the impact of natural hazards such as wildfires, tropical storms and erosion on all three islands. This includes projects such as strengthening school buildings to serve as shelters during hurricanes, adding generators to critical facilities for backup power, and developing tsunami evacuation routes. Once approved by the Federal Emergency Management Agency, the plan makes the County eligible for pre- and post-disaster mitigation project grant funding through FEMA's Hazard Mitigation Assistance programs and other non-emergency disaster assistance.

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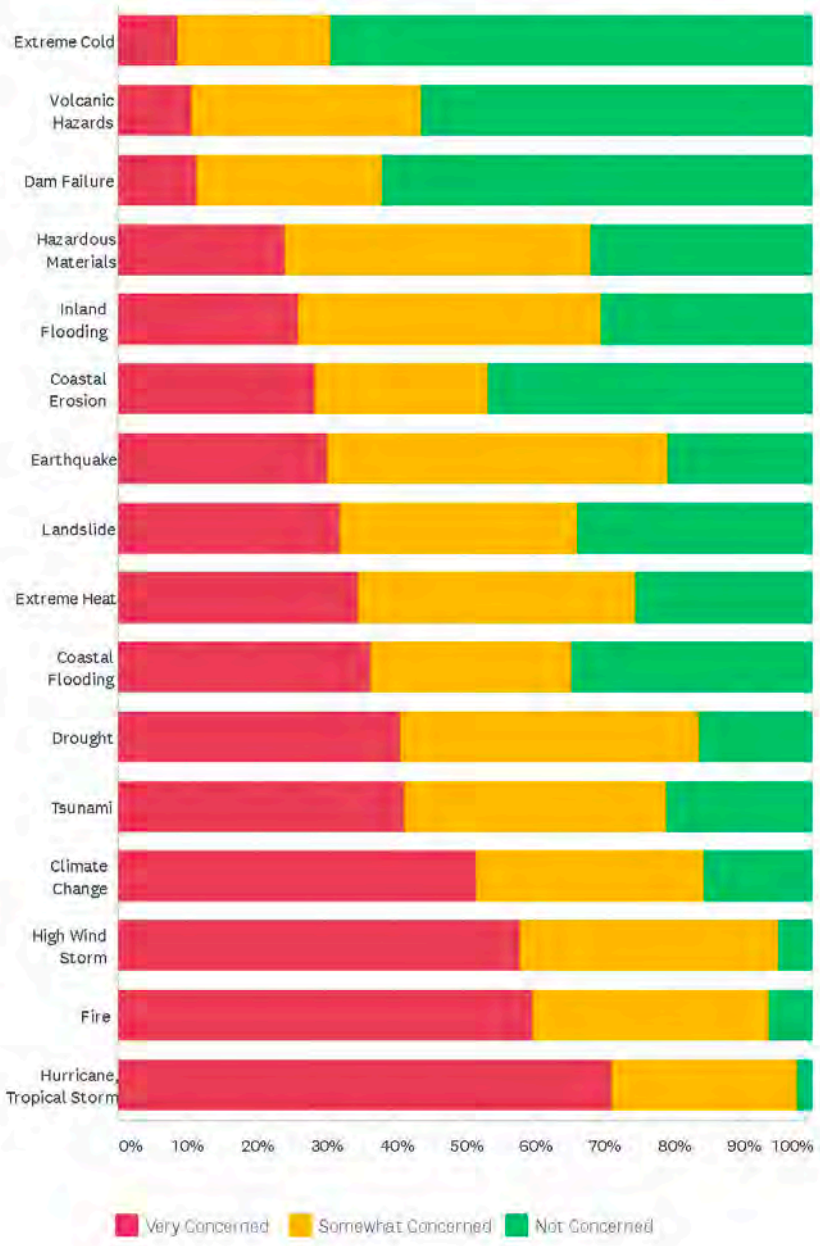
County of Maui Public Mitigation Planning Survey Results

County of Maui Public Mitigation Planning Survey

Q1 How concerned are you about the possibility of your home or business being impacted by the following hazards?

Answered: 494 Skipped: 0



1 / 70

County of Maui Public Mitigation Planning Survey

	VERY CONCERNED	SOMEWHAT CONCERNED	NOT CONCERNED	TOTAL	WEIGHTED AVERAGE
Extreme Cold	8.59% 42	22.09% 108	69.33% 339	489	3.30
Volcanic Hazards	10.55% 52	33.27% 164	56.19% 277	493	3.02
Dam Failure	11.41% 56	26.68% 131	61.91% 304	491	3.12
Hazardous Materials	24.18% 118	44.06% 215	31.76% 155	488	2.39
Inland Flooding	26.08% 127	43.53% 212	30.39% 148	487	2.35
Coastal Erosion	28.46% 140	25.00% 123	46.54% 229	492	2.65
Earthquake	30.41% 149	48.98% 240	20.61% 101	490	2.11
Landslide	32.11% 157	34.15% 167	33.74% 165	489	2.35
Extreme Heat	34.83% 171	39.92% 196	25.25% 124	491	2.16
Coastal Flooding	36.53% 179	28.98% 142	34.49% 169	490	2.32
Drought	40.73% 200	43.18% 212	16.09% 79	491	1.91
Tsunami	41.46% 204	37.60% 185	20.93% 103	492	2.00
Climate Change	51.83% 255	32.72% 161	15.45% 76	492	1.79
High Wind Storm	57.96% 284	37.35% 183	4.69% 23	490	1.51
Fire	59.92% 296	34.01% 168	6.07% 30	494	1.52
Hurricane, Tropical Storm	71.20% 351	26.77% 132	2.03% 10	493	1.33

County of Maui Public Mitigation Planning Survey

Q2 Are there any specific areas of your community exposed to the hazards above? If so, please list them by location (e,g., street address, intersection, or landmark).

Answered: 242 Skipped: 252

ANSWER CHOICES	RESPONSES	
1	100.00%	242
2	56.20%	136
3	33.88%	82
4	21.90%	53

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County of Maui Public Mitigation Planning Survey

#	1	DATE
1	Pali Highway to Lahaina	7/2/2020 4:02 PM
2	All of Hauoli Street in Maalaea	6/29/2020 11:20 PM
3	Waipulani park	6/29/2020 10:46 PM
4	Large areas of land susceptible to fire	6/28/2020 5:34 AM
5	Waiehu	6/27/2020 3:54 PM
6	Large areas of land susceptible to fire	6/27/2020 7:51 AM
7	Kulanihakoi gulch	6/26/2020 5:34 PM
8	wild fires on abandoned former cane fields thru-out Central Valley.	6/26/2020 1:56 PM
9	Honoapiilani Hwy between pali and new bypass	6/26/2020 12:15 PM
10	Harbor	6/26/2020 12:05 PM
11	4435 Lower Honoapiilani Rd., Lahaina	6/26/2020 2:10 AM
12	The entire coast of Maui	6/26/2020 1:19 AM
13	Kahana Bay	6/25/2020 11:13 PM
14	Lahaina	6/25/2020 8:58 PM
15	Kahekili Highway right after Mendez Ranch	6/25/2020 8:13 PM
16	The Pali, road to lahaina	6/25/2020 5:56 PM
17	Intersection of Kaahumanu and Puunene	6/25/2020 5:48 PM
18	Keanae to Kaupo Ahupua'a	6/18/2020 5:58 PM
19	Some homes in Lana'i City have unsecured roofing iron and other potentially lethal objects in yards. These could fly during high wind events.	6/17/2020 5:57 PM
20	Mānele Small Boat Harbor	6/17/2020 5:44 PM
21	All major roads on Lāna'i there is only 3.	6/17/2020 5:24 PM
22	High wind and hurricane Haiku Rd.- Kauhikoa Rd. 96708	6/16/2020 10:20 PM
23	Piilani Highway undermining between Kaupo & Kipahulu	6/16/2020 5:05 PM
24	From mile marker 38 to 30 Hana hwy. Kipahulu to kaupo. Landslide	6/16/2020 4:06 PM
25	Haneoo	6/16/2020 2:59 PM
26	flooding across the Hana Highway at m.m. 31	6/16/2020 1:13 PM
27	44 Kanani Rd Kihei, HI 96753	6/16/2020 1:04 PM
28	All residences and residents in Kaupo as we have no shelters here and our roads can easily be inaccessible in an emergency	6/15/2020 9:53 PM
29	all pavement on the Hana Highway Twin Falls to Hana	6/15/2020 8:44 PM
30	Hamoa area coastal erosion.	6/15/2020 3:51 PM
31	kipahulu through kaupo area	6/15/2020 1:07 PM
32	43 Hansen Road, MEO Transportation	6/13/2020 12:39 PM
33	Entire district of Hana.	6/12/2020 8:25 PM
34	Haneo'o Rd., Hamoa, Hana, Hawaii	6/12/2020 5:03 PM
35	Iao Valley State Park (and Kepaniwai County Park)	6/12/2020 4:16 PM
36	King Kamehameha III School, Front Street	4/23/2020 7:17 PM

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County of Maui Public Mitigation Planning Survey

37	Street lighting and coastal (hotel-condo) lighting affecting sea like and birds	4/23/2020 2:15 PM
38	Kahului	4/23/2020 6:32 AM
39	paia	4/22/2020 7:49 PM
40	Mahola Street - flooding	4/13/2020 5:32 PM
41	Dixie Maru Beach	4/11/2020 8:56 PM
42	home, old sand hills	4/8/2020 7:18 PM
43	1462 Fleming Road	4/7/2020 5:02 PM
44	West Maui. Coastal Erosion. Loss of tourism in future due to no beaches.	4/4/2020 5:21 PM
45	Maki man bridge to Kawaiola - makai flooding	4/4/2020 1:21 AM
46	360020030000	4/3/2020 3:44 PM
47	kihei	4/3/2020 1:54 PM
48	Kamehameha School, Pukalani	4/3/2020 5:44 AM
49	NA	4/2/2020 11:25 PM
50	Front street, Lahaina	4/2/2020 3:17 PM
51	Kamaole Parks area	4/2/2020 7:42 AM
52	Lower Honoaplilani Rd between Napili Hau Rd and Hui Rd F	4/2/2020 4:24 AM
53	Haiku	4/2/2020 2:13 AM
54	Lahainatown	4/1/2020 11:43 PM
55	High wind , Tall Trees, Kauhikoa Rd.	4/1/2020 9:28 PM
56	Ohukai Beach	4/1/2020 8:42 PM
57	Hoonani St., Kihei	4/1/2020 8:31 PM
58	Fire	4/1/2020 8:19 PM
59	Central Maui	4/1/2020 8:08 PM
60	Piiholo Rd. Trees	4/1/2020 7:58 PM
61	Whole Island	4/1/2020 7:49 PM
62	Close proximity on W Papa Avenue for Fire from dry brush; old cane field.	4/1/2020 7:48 PM
63	Laulea Place, Paia - it is in Tsunami zone.	4/1/2020 7:48 PM
64	N/A	4/1/2020 7:26 PM
65	Pesticide usage/air spread specifically on old sugarcane land by currant owners.	4/1/2020 7:24 PM
66	Kaonoulu street & kanolio road	4/1/2020 7:23 PM
67	Maalaea condos in regard to recent fires and evacuations	4/1/2020 7:11 PM
68	44 Kanani Rd Kihei, HI 96753	4/1/2020 7:03 PM
69	Honoapiilani Highway	4/1/2020 6:58 PM
70	West Maui Mountains Drying up from inside out	4/1/2020 6:49 PM
71	Pukalani	4/1/2020 6:44 PM
72	Oceanview estates/ Leisure Estates	4/1/2020 6:39 PM
73	Haleakala volcano	4/1/2020 6:13 PM
74	Ukali Street, Paukualo	4/1/2020 6:10 PM

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County of Maui Public Mitigation Planning Survey

75	High wind , Tall Trees, Kauhikoa Rd.	4/1/2020 6:05 PM
76	South Kihei Rd, btwn Ohukai and Uwapo	4/1/2020 5:57 PM
77	Kula Lodge area, high winds	4/1/2020 5:52 PM
78	Kihei in General	4/1/2020 5:51 PM
79	112B Lower Waiehu Beach Road	4/1/2020 5:48 PM
80	Front Street at Kenui Street	4/1/2020 5:48 PM
81	Keheilani	4/1/2020 5:47 PM
82	Fire 700 Punakea Loop Lahaina	3/18/2020 11:44 AM
83	Hana 96713	3/14/2020 2:07 PM
84	Historical and comercial Front Street Lahaina	3/13/2020 7:42 PM
85	Launiupoko has very high fire risks	3/13/2020 6:52 PM
86	Haneoo Road	3/5/2020 11:16 AM
87	Hana Highway	3/1/2020 3:13 PM
88	Please keep shoring up the back road to Kipahulu, and keep the road open while doing so, thank you!	2/28/2020 3:53 PM
89	Piilani Hwy mm 38-39 Kalepa-Kipahulu undermining	2/28/2020 3:52 PM
90	back road Hana Highway MM 42 to 30	2/28/2020 2:59 PM
91	Drought - every where on Maui	2/26/2020 6:33 PM
92	Ditch at intersection of 0 Hiwalani Loop and 2780 Iolani St.	2/18/2020 4:38 PM
93	Lower Nahiku Road	2/12/2020 7:02 PM
94	Resource Too many to list. See Hawai'i Sea Level Rise Vulnerability and Adaptation Report, 12/17	2/11/2020 9:27 PM
95	south kihei road	2/11/2020 1:04 PM
96	Fire risk from illegal aerial fireworks in residential areas island-wide	2/10/2020 3:08 PM
97	Lahaina, Front St. Coastal flooding.	2/10/2020 2:44 PM
98	Iao Valley Road prone to flooding and concerned for mudslide/rockslide	2/10/2020 2:41 PM
99	Shoreline	2/10/2020 2:28 PM
100	We marked it on your map	2/10/2020 12:24 AM
101	Kamehameha V Highway	2/9/2020 4:48 PM
102	Airport	2/9/2020 2:54 PM
103	Koki Road	2/8/2020 4:16 PM
104	Coastal erosion is severe in many areas	2/7/2020 9:18 PM
105	Kihei	2/7/2020 6:13 PM
106	Dry areas Landfill to Kihei	2/7/2020 6:07 PM
107	Kahului Power Plant	2/7/2020 6:04 PM
108	Akoakoa Pl, Lahaina, HI 96761	2/7/2020 5:50 PM
109	274 Nahiku Road, 96708	2/7/2020 4:27 PM
110	County Roads	2/6/2020 10:36 PM
111	Hana Highway Hana district	2/6/2020 10:33 PM

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County of Maui Public Mitigation Planning Survey

112	Fire at my home located at Kamalani in Kihei	2/6/2020 4:53 PM
113	County WWTP, K'kai Town	2/6/2020 1:46 PM
114	Gas line pipes	2/6/2020 1:33 PM
115	Ua Kea Road	2/6/2020 12:32 PM
116	Maunaloa highway	2/5/2020 10:27 PM
117	Whole Island	2/5/2020 10:21 PM
118	All businesses and residences along S Kihei Rd	2/5/2020 7:40 PM
119	Sea level rise - Haneo'o Rd., Waikoloa, Hana Bay	2/5/2020 6:14 PM
120	Unmonitored ag land in Lahaina	2/5/2020 5:23 PM
121	earthquakes will affect everyone in Hana area	2/5/2020 3:33 PM
122	Kuukama Street flooded several feet after a big rain	2/5/2020 1:33 PM
123	Bridge /stream areas	2/5/2020 12:59 PM
124	Kaunakakai Town , fuel storage facility & pier, Molokai	2/5/2020 12:12 PM
125	District in critical zone	2/5/2020 2:41 AM
126	Hana Bay	2/5/2020 2:06 AM
127	Hana Highway from Hana coast to Kahului North route	2/5/2020 1:55 AM
128	Lahana Harbor	2/5/2020 1:21 AM
129	Honoapiilani Highway for coastal erosion	2/5/2020 1:16 AM
130	Hana Bay - Hana	2/5/2020 1:11 AM
131	Haneoo Road impacted by coastal flooding	2/5/2020 1:11 AM
132	South Kihei Rd, anywhere it contacts or comes close to the 3.2 foot sea level rise vegetation line	2/4/2020 8:50 PM
133	Hwy from Lahaina to Ma'alaea. There Will Be Sink Holes that Open up in the Road, and then the County will notice	2/4/2020 3:04 PM
134	Lower Honoapiilani Road between Kahana & Napili	2/4/2020 1:49 PM
135	811 Hoomau st	2/4/2020 1:35 PM
136	Dip in Makani Rd immediately off of old Haleakala Hwy	2/4/2020 1:24 PM
137	Wahikuli housing development and fire especially during fireworks	2/4/2020 10:42 AM
138	Veterans Highway and Piilani Highway intersection	2/4/2020 2:58 AM
139	Paunau Subdivison in Lahaina	2/3/2020 10:18 PM
140	Iao Valley	2/3/2020 8:53 PM
141	COUNTY OFFICE - FLOODING	2/3/2020 8:39 PM
142	Drought, we always seem to ask upcountry Maui to restrict waster usage.	2/3/2020 7:08 PM
143	Fire - Waikapu Gardens	2/3/2020 6:26 PM
144	Coastal Erosion - Honoapiilani Highway	2/3/2020 6:26 PM
145	Hawaiian Homes Lahaina sits is in a dam evacuation zone with a dam that isn't well maintained. There are so many dams on Maui and they are all avg 50+ years old and not well maintained.	2/3/2020 6:16 PM
146	401 Alakapa Place, Paia, HI 96779	2/3/2020 5:45 PM
147	Front St/Papalaua	2/3/2020 5:18 PM

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County of Maui Public Mitigation Planning Survey

148	Pakakalu - Tsunami	2/3/2020 3:55 PM
149	The Pali, please create a new mauka highway	2/3/2020 3:47 PM
150	Lower Honoapiilani Road (erosion)	2/3/2020 3:21 PM
151	Kulanihakoi gulch	2/3/2020 3:04 PM
152	All Lower Beach side roads, Lahaina, Kahana, Wailuku, Hana etc	2/3/2020 2:46 PM
153	Beach parks	2/3/2020 2:09 PM
154	honoapiilani hwy	2/3/2020 12:42 PM
155	honoapiilani hwy west side	2/3/2020 12:07 PM
156	All critical power generation are in low land areas subject to tsunami impacts. The harbors are also the main inlet of supplies.	2/3/2020 11:59 AM
157	Piiholo area-multiple power outages and trees blocking access during high winds	1/31/2020 6:45 PM
158	Omaopio	1/31/2020 6:31 PM
159	Lower Honoapiilani Road from Kahana to Kapalua	1/31/2020 6:13 PM
160	shoreline	1/31/2020 5:32 PM
161	Route 30	1/31/2020 5:05 PM
162	Kihei Town	1/31/2020 4:21 PM
163	ALL The old AG(mauiland&pine/ HCNS) Land is catching Fire alot	1/31/2020 4:18 PM
164	South Kihei	1/31/2020 3:34 PM
165	Lahaina	1/31/2020 3:33 PM
166	Ke'e Road/Puaina Place Makawao	1/31/2020 3:24 PM
167	Kihei	1/31/2020 2:44 PM
168	Upper Pili Loko St in Paia. Residents filling in dirt, etc to drainage easements on their properties.	1/31/2020 2:29 PM
169	Iao Valley	1/31/2020 1:19 PM
170	Baldwin Beach Park	1/31/2020 1:14 PM
171	11 Waimahaihai Street, Kihei HI, 96753	1/31/2020 12:59 PM
172	Kihei, sugar beach, whale foundation area	1/31/2020 12:29 PM
173	Kulamanu Circle- hurricane, landslide	1/31/2020 11:05 AM
174	Areas surrounding the Maui Lani sub-divisions	1/30/2020 8:35 PM
175	North Kihei is exposed to hazardous materials from Monsanto	1/30/2020 8:28 PM
176	banana trees & debris at the end of Nenelea Street that dead ends into the Punawai, has twice caused damaging flooding on my property because the natural flow was diverted and just went right downhill onto my property	1/30/2020 8:04 PM
177	Monsanto in North Kihei	1/30/2020 7:50 PM
178	Hamoa Village - High Water	1/30/2020 7:40 PM
179	Kahului	1/30/2020 7:01 PM
180	Kaunakakai town	1/30/2020 6:46 PM
181	Pauu Pl / Paunau St Lahaina	1/30/2020 6:31 PM
182	HWY 440	1/30/2020 6:19 PM
183	Honoapiilani Hwy	1/30/2020 6:04 PM

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County of Maui Public Mitigation Planning Survey

184	south shore molokai	1/30/2020 5:38 PM
185	Earthquake, Hurricane, Fire in Wailuku	1/30/2020 5:38 PM
186	Electrical poles seem ready to collapse especially with high winds or hurricane	1/30/2020 5:30 PM
187	Waialua Molokai, Kamehameha V Hwy 19 mile marker	1/30/2020 4:48 PM
188	Upcountry-exiting in an emergency	1/30/2020 4:45 PM
189	Piiholo Rd	1/30/2020 4:18 PM
190	Hana Hwy; Heavy rainfall has caused rock landslides that can seriously injure and kill passengers/pedestrians	1/30/2020 4:12 PM
191	Fire Island wide	1/30/2020 4:05 PM
192	West Maui	1/30/2020 3:56 PM
193	upcountry drought	1/30/2020 3:51 PM
194	141 KALANIANAOLE AVENUE,KAUNAKAKAI HI 96748	1/30/2020 3:49 PM
195	Upcountry	1/30/2020 3:44 PM
196	Kahului Harbor	1/30/2020 3:43 PM
197	Honoapiilanai Hwy near mile marker 13 thru 15, coastal errosion.	1/30/2020 3:41 PM
198	West Maui & Central Maui- drought	1/30/2020 3:40 PM
199	Liholiho St. (Fire from brush nearby, earthquake shake hill)	1/30/2020 3:39 PM
200	South Kihei road - flooding	1/30/2020 3:35 PM
201	Waiehu Beach Road	1/30/2020 3:35 PM
202	30 Waipaa Lane, Wailuku	1/30/2020 3:34 PM
203	Coastal Erosion	1/30/2020 3:31 PM
204	27 Kaimao St.	1/30/2020 3:26 PM
205	HWY 30 / HONOAPIILANI HWY	1/30/2020 3:25 PM
206	Upper Olinda	1/30/2020 3:24 PM
207	Kahului & Waieahu Beach Road, Paukukalo neighborhood	1/30/2020 3:24 PM
208	intersection of puunene and wakea, during heavy rain water pools and floods intersection and Christ the King Church parking lot	1/30/2020 3:18 PM
209	Kaikoo	1/30/2020 3:16 PM
210	Area between/above Rice Park and Omaopio Rd.	1/30/2020 3:14 PM
211	Kaupakalua Road	1/30/2020 3:13 PM
212	Highway that is very close to the ocean near Olowalu	1/30/2020 3:07 PM
213	Reservoir off Peahi RD	1/30/2020 3:05 PM
214	extreme heat, papa ave, kahului	1/30/2020 3:03 PM
215	High wind areas: Piiholo and Olinda Roads and surrounding roads	1/30/2020 2:57 PM
216	No specific areas in my community	1/30/2020 2:54 PM
217	Iao Stream along Eha Street in Wailuku	1/30/2020 2:54 PM
218	Kalama	1/30/2020 2:53 PM
219	Puuhoolai St, Khei Flood control channel in my backyard, can accumulate debris	1/30/2020 2:53 PM
220	Maui Lani Legends is right next to heavy brush (across Maui Lani Parkway)	1/30/2020 2:53 PM

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County of Maui Public Mitigation Planning Survey

221	WAILUKU	1/30/2020 2:51 PM
222	VERY CONCERNED REGARDING FIRE AS THERE IS A VACANT LOT RIGHT BEHIND MY HOUSE THAT ALWAYS CATCHES ON FIRE AND CAN DAMAGE MANY HOUSE 95 HOOMOKU LOOP KAHULUI HI 96732	1/30/2020 2:50 PM
223	Kahului	1/30/2020 2:49 PM
224	Puunene & Wakea	1/30/2020 2:48 PM
225	South Maui	1/30/2020 2:47 PM
226	Lono Avenue - Kahului	1/30/2020 2:47 PM
227	North Kihei Road	1/29/2020 12:23 PM
228	Northshore	1/28/2020 9:41 PM
229	The islands of Maui	1/28/2020 8:33 PM
230	Kahului Wastewater Treatment Plant	1/28/2020 7:24 PM
231	coastal erosion/flooding - Lower Honoapiilani Highway, West Maui	1/28/2020 7:21 PM
232	Lahainaluna Street (fire, hurricane, wind)	1/28/2020 6:58 PM
233	Shoreline areas	1/28/2020 6:04 PM
234	Maui Electric Power Plant - Kahului	1/28/2020 3:34 PM
235	Any zoned "ag" but laying fallow	1/28/2020 1:58 PM
236	If our Lahaina schools are deemed a shelter for hurricane, they are not safe. People would have to go outside in the elements to go to the bathroom.	1/28/2020 9:54 AM
237	Maui meadows	1/28/2020 4:42 AM
238	Upcountry Maui County Baseyard: continued use of hazardous materials in the middle of a residential area	1/28/2020 1:37 AM
239	Rock slides affect traffic into and out of Hana on East Maui.	1/28/2020 12:38 AM
240	West Maui	1/28/2020 12:02 AM
241	Kahului Harbor so near and low to the water - tsunami, hurricane and sea level rise concerns	1/27/2020 6:21 PM
242	Ranch land next to Maui Meadows has brush fires	1/27/2020 3:17 PM

County of Maui Public Mitigation Planning Survey

#	2	DATE
1	Kahului Power Plant	7/2/2020 4:02 PM
2	The flood retention basin at Maalaea off Hauoli Street	6/29/2020 11:20 PM
3	VFW unincorporated beach land	6/29/2020 10:46 PM
4	Potential overflow of Keawe water channel	6/28/2020 5:34 AM
5	Kahului	6/27/2020 3:54 PM
6	Potential overflow of Keawe water channel	6/27/2020 7:51 AM
7	Kahului Harbor	6/26/2020 12:15 PM
8	Honoapiilani Highway between pali and bypass	6/26/2020 12:05 PM
9	Kihei	6/25/2020 8:58 PM
10	Puunene Avenue	6/25/2020 5:48 PM
11	Hana Coastal Areas	6/18/2020 5:58 PM
12	There isn't sufficient shelter space for Lāna'i.	6/17/2020 5:57 PM
13	East side of Lāna'i	6/17/2020 5:44 PM
14	Fire and Earthquake Haiku Rd - Kauhikoa Rd 96708	6/16/2020 10:20 PM
15	Mile marker 9 to 22 Hana Hwy. road hazard, fire, landslides	6/16/2020 4:06 PM
16	Waikaloa	6/16/2020 2:59 PM
17	Cove Park, Kihei, iliili rd	6/16/2020 1:04 PM
18	Coastal areas, Hui Aloha Church	6/15/2020 9:53 PM
19	Climate change extreme heat	6/15/2020 3:51 PM
20	Kapueokahi - Hana Bay, Hana	6/12/2020 5:03 PM
21	Kanaha Beach Park (slowly eroding)	6/12/2020 4:16 PM
22	Waihee	4/23/2020 6:32 AM
23	Makawao Avenue	4/13/2020 5:32 PM
24	Coastal Erosion at Maui Mile Marker 14 on West Side Honoappilani Hwy is already undercutting the road. One good south passing hurricane could cut West Maui off from Central Maui for weeks.	4/4/2020 5:21 PM
25	Haneoo- high waves	4/4/2020 1:21 AM
26	central planes of Maui	4/3/2020 3:44 PM
27	kula	4/3/2020 1:54 PM
28	NA	4/2/2020 11:25 PM
29	Kahului	4/2/2020 2:13 AM
30	Kulani Hakoi St, Kihei	4/1/2020 8:31 PM
31	Drought	4/1/2020 8:19 PM
32	Mountain Areas	4/1/2020 8:08 PM
33	Haleakalā National Park	4/1/2020 7:49 PM
34	Downtown Paia, Baldwin Ave / Hana Hwy.	4/1/2020 7:48 PM
35	central maui in regard to high winds and storms	4/1/2020 7:11 PM
36	Lower Honoapiilani Rd.	4/1/2020 6:58 PM

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County of Maui Public Mitigation Planning Survey

37	West Maui Stream's Biological Integrity	4/1/2020 6:49 PM
38	Wailuku	4/1/2020 6:44 PM
39	Waiehu beach park	4/1/2020 6:39 PM
40	Maui coastlines, shrinking	4/1/2020 5:52 PM
41	Hana Hwy from Haiku to Kaupo	3/14/2020 2:07 PM
42	Kaanapali Resorts	3/13/2020 7:42 PM
43	Launiupoko often lacks water in dry season	3/13/2020 6:52 PM
44	Kaihalulu beach	3/5/2020 11:16 AM
45	Manawainui & Nuanualoa stream fords cutting road	2/28/2020 3:52 PM
46	Fire-same as above - but Pukalani was affected on July 4th a few years ago	2/26/2020 6:33 PM
47	Lower Nahiku Road bridge	2/12/2020 7:02 PM
48	Wildfires. County wide during dry season.	2/10/2020 2:44 PM
49	Maliko Gulge and Kapakalua Rd (from Makawao down to Hana Highway prone to flooding and rockslides	2/10/2020 2:41 PM
50	River stream (Kauaula stream	2/10/2020 2:28 PM
51	Bottom of Haneo'o Road, waves constantly go over the road, with rocks & debris	2/10/2020 12:24 AM
52	Waikoloa Road	2/8/2020 4:16 PM
53	All areas are susceptible to hurricanes and tropical storms	2/7/2020 9:18 PM
54	Lahaina	2/7/2020 6:13 PM
55	Airport area to Paia	2/7/2020 6:07 PM
56	All coastal areas with our infrastructure	2/7/2020 6:04 PM
57	Waiale Street, Wailuku	2/7/2020 5:50 PM
58	Water Tanks, 100 block Nahiku Road, 96708	2/7/2020 4:27 PM
59	Inadequate Culverts	2/6/2020 10:36 PM
60	Hana bridges	2/6/2020 10:33 PM
61	Power outages	2/6/2020 4:53 PM
62	EVERYTHING in K'kai Town - EVERYTHING within a 1/2 mile radius of Mile Marker 0/0	2/6/2020 1:46 PM
63	Facilities on county property but are not used for shelters. High school is the only shelter for the entire island of Molokai.	2/6/2020 1:33 PM
64	Haneo'o Road	2/6/2020 12:32 PM
65	Medic 3 station (below Uwapo rd)	2/5/2020 7:40 PM
66	Inland flooding - MANY rivers in East Maui	2/5/2020 6:14 PM
67	MM 14 on Honoapiilani Hwy	2/5/2020 5:23 PM
68	high wind damage closes the highway and damages homes & buildings	2/5/2020 3:33 PM
69	buffer zone by Maui Lani golf course had a fire in the summer	2/5/2020 1:33 PM
70	Coastal roads	2/5/2020 12:59 PM
71	All homes on the South and East coast of Molokai	2/5/2020 12:12 PM
72	Hamoa valley	2/5/2020 2:06 AM
73	Hana Highway to Kula south route	2/5/2020 1:55 AM

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County of Maui Public Mitigation Planning Survey

74	Pukalani Hi	2/5/2020 1:21 AM
75	Hamoa Beach - Hana	2/5/2020 1:11 AM
76	Shoreline Erosion Everywhere!	2/4/2020 3:04 PM
77	The new bypass (my daughter got stuck on the otherside at her school when the new bypass flooded. She attends school in wailuku and lives Lahaina side	2/4/2020 1:49 PM
78	Kihei Road near above intersections	2/4/2020 2:58 AM
79	Kelawea Subdivisions in Lahaina	2/3/2020 10:18 PM
80	Kanaha Beach Park	2/3/2020 8:53 PM
81	Fire hazards - open cane land seem suseptible to fires	2/3/2020 7:08 PM
82	Coastal Erosion - Lower Honoapiilani Road	2/3/2020 6:26 PM
83	Honoapiilani Hwy is at severe risk of being washed out by erosion or storm or surf	2/3/2020 6:16 PM
84	Front St./Fleming/Hwy 31	2/3/2020 5:18 PM
85	Ka'anapali Beach	2/3/2020 3:47 PM
86	Coastal sections of Honoapiilani Highway	2/3/2020 3:21 PM
87	honoapiilani highway	2/3/2020 2:09 PM
88	Any high wind incident will impact the power distribution to the island. These areas include the Piiholo area as well as much of the up country area. This is, of course, driven by climate change.	2/3/2020 11:59 AM
89	Drought exacerbates already dry conditions in the summer months creating extreme fire conditions. Stronger prevention methods needed to mitigate hazards to the community.	1/31/2020 6:45 PM
90	Olowalu fires and Launiopoku Fires	1/31/2020 6:13 PM
91	Entire Hana Highway and Piilani Highway (Backside)	1/31/2020 5:05 PM
92	Kaunoa Center	1/31/2020 4:21 PM
93	seaside Kahului	1/31/2020 3:33 PM
94	Kahului	1/31/2020 2:44 PM
95	1929 Kauhikoa RD, Haiku, HI 96708	1/31/2020 12:59 PM
96	Napili, S turn, kapalua	1/31/2020 12:29 PM
97	Kahului	1/30/2020 8:35 PM
98	East Maui - Direct Hurricane Landfall	1/30/2020 7:40 PM
99	Kula	1/30/2020 7:01 PM
100	Kaunakakai wharf	1/30/2020 6:46 PM
101	Whole shoreline--	1/30/2020 6:31 PM
102	kaunakakai town/critical infrastructure and school	1/30/2020 5:38 PM
103	Communication between government and residents seems questionable	1/30/2020 5:30 PM
104	8033 Kamehameha V Hwy, 14.5 mile marker, fronting Our Lady of Seven Sorrows Catholic Church	1/30/2020 4:48 PM
105	Olinda Rd	1/30/2020 4:18 PM
106	Bridges on Road to Hana need to be checked quarterly and after heavy rainfalls	1/30/2020 4:12 PM
107	Coastal Erosion Lahaina, Kihei and Paia	1/30/2020 4:05 PM
108	Molokai	1/30/2020 3:56 PM

County of Maui Public Mitigation Planning Survey

109	KAUNAKAKAI TOWN AREA	1/30/2020 3:49 PM
110	From Hanako'o Beach to Launiapoko; coastal errosion	1/30/2020 3:41 PM
111	Keopuolani Park-Harboe side	1/30/2020 3:35 PM
112	High Wind Storm	1/30/2020 3:31 PM
113	Kuau Yacht Club	1/30/2020 3:26 PM
114	Makawao Town	1/30/2020 3:24 PM
115	Kahului Harbor	1/30/2020 3:24 PM
116	Honoapiilani Hwy during high tide and surf events, waves wash across the road	1/30/2020 3:18 PM
117	Waiehu Beach Road	1/30/2020 3:16 PM
118	Olinda Road	1/30/2020 3:13 PM
119	climate change, papa ave, kahului	1/30/2020 3:03 PM
120	Kihei	1/30/2020 2:53 PM
121	KAHULUI	1/30/2020 2:51 PM
122	Ma'alaea	1/30/2020 2:49 PM
123	West Maui	1/30/2020 2:47 PM
124	Puunene Avenue - Kahului	1/30/2020 2:47 PM
125	South Kihei Road	1/29/2020 12:23 PM
126	coastal areas	1/28/2020 9:41 PM
127	Honoapiilani Highway, Ukumehame thru Olowalu areas	1/28/2020 7:24 PM
128	coastal erosion - Honoapiilani Highway, West Maui	1/28/2020 7:21 PM
129	Honoapiilani Hwy (tsunami, hurricane)	1/28/2020 6:58 PM
130	Roadway funnels in evacuation	1/28/2020 6:04 PM
131	Maui County Wastewater Treatment Plant -Kahului	1/28/2020 3:34 PM
132	Lahaina needs a large enough shelter with indoor restrooms and area for food prep in a hurricane.	1/28/2020 9:54 AM
133	Extreme Drought: can the water system handle the increasingly long drought periods?	1/28/2020 1:37 AM
134	I love driving into Lahaina with beach right there...I do hope solution does NOT include a unsighrly, view blocking barrier wall to protect against extreme high tides.	1/28/2020 12:38 AM
135	Honopiilani Hwy at MM 14	1/28/2020 12:02 AM
136	Olowalu Waves over road on kings tide like for the last 10 years plus. Move it inland, make the area family camping.	1/27/2020 6:21 PM

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County of Maui Public Mitigation Planning Survey

#	3	DATE
1	Kahului Wastewater Facility	7/2/2020 4:02 PM
2	Single rout of access to west side susceptible to inundation or erosion	6/28/2020 5:34 AM
3	Kanaha	6/27/2020 3:54 PM
4	Single rout of access to west side susceptible to inundation or erosion	6/27/2020 7:51 AM
5	Front Street	6/26/2020 12:15 PM
6	Front Street	6/26/2020 12:05 PM
7	Maalaea Harbor	6/25/2020 8:58 PM
8	Ulaino	6/16/2020 2:59 PM
9	Dry weather with dminished rain.	6/15/2020 3:51 PM
10	Keanae & Wailua Pennisulas, East Maui	6/12/2020 5:03 PM
11	Wailuku	4/23/2020 6:32 AM
12	Bleaching of corals in West Maui already leading to loss of tourism to West Maui, and loss of fish close to shore.	4/4/2020 5:21 PM
13	Hana hwy- high wind - trees falling- insufficient preventative maintenance	4/4/2020 1:21 AM
14	NA	4/2/2020 11:25 PM
15	Not being able to get across Pali	4/1/2020 8:19 PM
16	Maui County	4/1/2020 8:08 PM
17	Kahana	4/1/2020 6:58 PM
18	IAO Aquifer Recharge	4/1/2020 6:49 PM
19	Waiehu golf course	4/1/2020 6:39 PM
20	climate change and global warming in Kula effecting produce	4/1/2020 5:52 PM
21	Coastal Highway	3/13/2020 7:42 PM
22	Hana Bay	3/5/2020 11:16 AM
23	Kahikinui area brushfires	2/28/2020 3:52 PM
24	Extreme heat-last year was the HOTTEST ever in Pukalani the summer and fall and now its getting really HOT again	2/26/2020 6:33 PM
25	Cliffs & Hana Road, potential for rocks, landslides & road is undermined in several locations, ie falls off into the cliff side or ocean	2/10/2020 12:24 AM
26	Ulaino Road	2/8/2020 4:16 PM
27	Molokai	2/7/2020 6:13 PM
28	Coastal flood Tsunami Hobron lane	2/7/2020 6:07 PM
29	Highly vegetated areas	2/7/2020 6:04 PM
30	Water main breaks - which occurred in the past where we had no water	2/6/2020 4:53 PM
31	All coastal roads from Coconut Grove out to Maurice Point	2/6/2020 1:46 PM
32	Waikaloa	2/6/2020 12:32 PM
33	Engine 6 station (near Kalama Park)	2/5/2020 7:40 PM
34	Landslides - Hana Hwy 360 when rain and/or wind	2/5/2020 6:14 PM
35	Landslides & rock falls are an everyday experience on the Hana Hwy.	2/5/2020 3:33 PM

County of Maui Public Mitigation Planning Survey

36	our house has cracks from previous earthquakes.	2/5/2020 1:33 PM
37	Slope areas where mudslides can occur	2/5/2020 12:59 PM
38	Kaunakakai Wastewater Plant 375,Maunaloa Highway	2/5/2020 12:12 PM
39	Keanae peninsula	2/5/2020 2:06 AM
40	Extreme heat in 2019 was very uncomfortable in Hana	2/5/2020 1:55 AM
41	Hana	2/5/2020 1:21 AM
42	Koki Beach - Hana	2/5/2020 1:11 AM
43	Lack of consideration of shoreline erosion and flooding when planning zoning	2/4/2020 3:04 PM
44	Honoapiilani Highway between Honokowai and Napili. Fire and accident/flood with new construction of 1000 new homes. Such a hazard for this small community	2/4/2020 1:49 PM
45	One Main Plaza	2/3/2020 8:53 PM
46	Landslide / Rock Fall - Honoapiilani Highway	2/3/2020 6:26 PM
47	Lower Honoapiilani road in Kahana is notorious for major flooding	2/3/2020 6:16 PM
48	The native forest on the west side (fire threat from bush fires)	2/3/2020 3:47 PM
49	Fallow Fields around Launiupoko area	2/3/2020 3:21 PM
50	Fire has been a problem for a while but now with the increase of residential sprawl and the feral land now controlled by Mahi Pono the fire hazard has been high. Land owners need to take responsibility to control the growth of grasslands. Primarily along main roadways like between Hana Highway and the airport. Also, areas in north Kihei that area adjacent to open grassland land.	2/3/2020 11:59 AM
51	Within Central Maui Flood Zone	1/31/2020 5:05 PM
52	North and South Kihei Road/Maalaea	1/31/2020 3:33 PM
53	Paia	1/31/2020 2:44 PM
54	Waiehe,	1/31/2020 12:29 PM
55	Keanai, Nahiku cut off from landslide/earthquake	1/30/2020 7:40 PM
56	Kihei	1/30/2020 7:01 PM
57	kaunakakai's fuel supply	1/30/2020 6:46 PM
58	Whole island fire	1/30/2020 6:31 PM
59	Kalaupapa, Molokai	1/30/2020 5:38 PM
60	Need more Resident involvement/training for disasters	1/30/2020 5:30 PM
61	Kamehameha V Hwy, makai erosion from 18.5 mile to 22 mile	1/30/2020 4:48 PM
62	Ehu Rd	1/30/2020 4:18 PM
63	Makawao avenue continues to have potholes and needs paving	1/30/2020 4:12 PM
64	Landslide, Debris Lahaina, Hana, Kaupo	1/30/2020 4:05 PM
65	East Maui	1/30/2020 3:56 PM
66	Tsunami	1/30/2020 3:31 PM
67	Paia Youth and Cultural Center	1/30/2020 3:26 PM
68	Power Plant in low lying area	1/30/2020 3:24 PM
69	South Kihei Road	1/30/2020 3:16 PM
70	Piiholo Road	1/30/2020 3:13 PM

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County of Maui Public Mitigation Planning Survey

71	hurrican, papa ave, kahului	1/30/2020 3:03 PM
72	The Pali	1/30/2020 2:53 PM
73	Kihei	1/30/2020 2:49 PM
74	Kaunakakai	1/30/2020 2:47 PM
75	ravines and streambeds	1/28/2020 9:41 PM
76	coastal erosion - South Kihei Beaches, various spots where there is residential development	1/28/2020 7:21 PM
77	Beaches on the west side (erosion.hurricane)	1/28/2020 6:58 PM
78	Kahului Businesses along Kaahumanu Ave. and Puunene Ave	1/28/2020 3:34 PM
79	High Wind and Wind Based Storms: what is the county doing in the long term to protect our above ground power grid from storms so that we do not face prolonged outages (and lack of access to life saving equipment) after major storms	1/28/2020 1:37 AM
80	More effective water storage is needed to get County through drought prone years; expected to increase with climate change extremes.	1/28/2020 12:38 AM
81	North Kaanapali beachs at Kahekeli Park	1/28/2020 12:02 AM
82	Kahana Condo owners have been fighting shoreline erosion for 20 years, should offer some basic assistance with permits, but not money	1/27/2020 6:21 PM

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County of Maui Public Mitigation Planning Survey

#	4	DATE
1	Kahului Harbor	7/2/2020 4:02 PM
2	Kihei	6/27/2020 3:54 PM
3	Paia	6/26/2020 12:15 PM
4	Paia	6/26/2020 12:05 PM
5	North shore	6/25/2020 8:58 PM
6	Kawaipapa	6/16/2020 2:59 PM
7	Land slides Hana Hwy	6/15/2020 3:51 PM
8	Waikoloa area of Hana, East Maui	6/12/2020 5:03 PM
9	Kihei and lahaina	4/23/2020 6:32 AM
10	More and stronger Pacific hurricanes every year with warmer seas. High probability of Hawaii getting hit more often and harder.	4/4/2020 5:21 PM
11	Prolonged power outages	4/4/2020 1:21 AM
12	NA	4/2/2020 11:25 PM
13	High wind	4/1/2020 8:19 PM
14	Lahaina	4/1/2020 6:58 PM
15	West Maui Reef and shoreline species health	4/1/2020 6:49 PM
16	The entire Hana Highway	3/5/2020 11:16 AM
17	No public facilities to shelter & provide services/water	2/28/2020 3:52 PM
18	We need more wetlands and TREES!!!	2/26/2020 6:33 PM
19	Low lying areas in Waikaloa, Keanae, Haneo'o & Lilikea, parts of Kaupo, coastal erosion	2/10/2020 12:24 AM
20	Keanae lower road	2/8/2020 4:16 PM
21	Olowalu to Lahaina dry areas	2/7/2020 6:07 PM
22	Diesel fuel storage & supply. All electricity is diesel generated. All water well pumps are electrical. No diesel - no potable water.	2/6/2020 1:46 PM
23	Lower Ke'anae	2/6/2020 12:32 PM
24	Maalaea power plant (N Kihei rd)	2/5/2020 7:40 PM
25	hurricanes and big storms close the highway and damage everything in its wake	2/5/2020 3:33 PM
26	Trees near power lines	2/5/2020 12:59 PM
27	All the bridges along Hana Highway	2/5/2020 2:06 AM
28	Kipahulu	2/5/2020 1:21 AM
29	The Hana Road bridges - Paia to Ulupalakua	2/5/2020 1:11 AM
30	The upper portion of The neighborhood on Lahainaluna road by Princess Nahienaena school is a fire trap. There is only 1 exit and thousands of people who live in there that need additional exits in case of fire.	2/3/2020 6:16 PM
31	All public beach parks	2/3/2020 3:47 PM
32	Kahana (Flooding)	2/3/2020 3:21 PM
33	Kihei below Piilani Highway	1/31/2020 5:05 PM
34	Maalaea	1/31/2020 2:44 PM
35	Hana,Huelo	1/31/2020 12:29 PM

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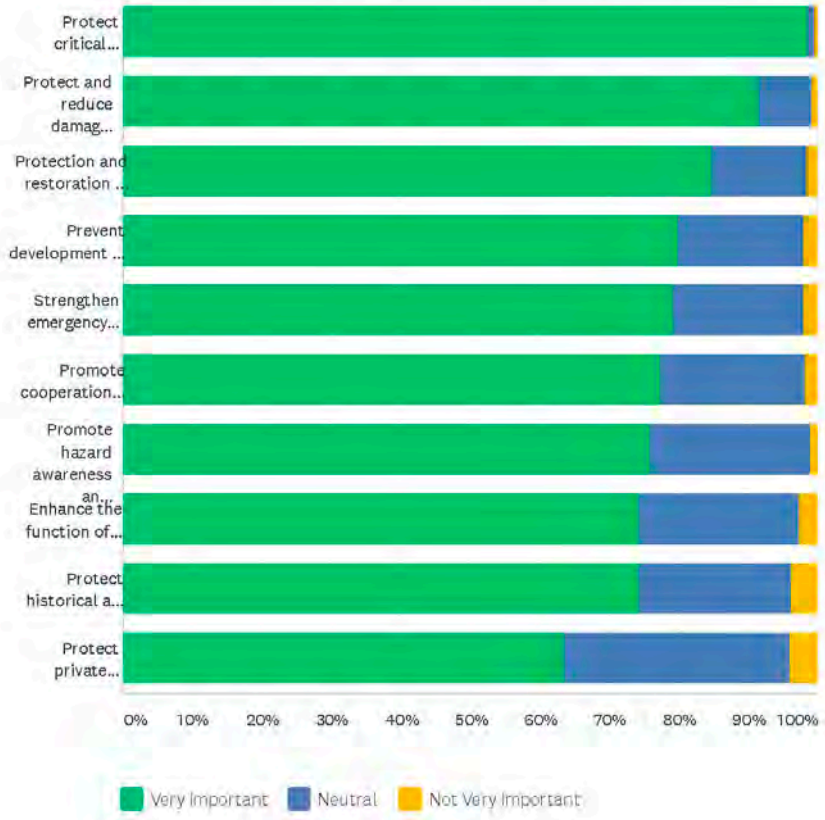
County of Maui Public Mitigation Planning Survey

36	Kipahulu cut off from the above as well	1/30/2020 7:40 PM
37	Lahaina	1/30/2020 7:01 PM
38	about 23 miles of Molokai's main highway	1/30/2020 6:46 PM
39	Civil Defense Leadership must be strong/smart/dependable and decisive	1/30/2020 5:30 PM
40	Kaunakakai Wharf, the entire access road, boat ramp, and barge facility	1/30/2020 4:48 PM
41	Residential streets (Lanai, Kauai) by Kahului School need paving	1/30/2020 4:12 PM
42	West Maui	1/30/2020 3:56 PM
43	Fire	1/30/2020 3:31 PM
44	Paia	1/30/2020 3:26 PM
45	North Kihei Road	1/30/2020 3:16 PM
46	drought, papa ave, kahului	1/30/2020 3:03 PM
47	Kipahulu	1/30/2020 2:47 PM
48	neighborhoods and properties without AC or efficient heating	1/28/2020 9:41 PM
49	coastal flooding - North/South Kihei road	1/28/2020 7:21 PM
50	Lahaina town (flooding)	1/28/2020 6:58 PM
51	Honoapiilani Highway, Ukumehame to Lahaina	1/28/2020 3:34 PM
52	Shelters: Our shelters are not adequately equipped to handle sheltering large numbers of people for more than a few days, also, the shelters themselves are unsafe in high winds (i.e. many DOE properties have deferred maintenance that could prove deadly in storms)	1/28/2020 1:37 AM
53	Lahaina Harbor	1/28/2020 12:02 AM

County of Maui Public Mitigation Planning Survey

Q3 How important do you consider each of the following actions ?

Answered: 493 Skipped: 1



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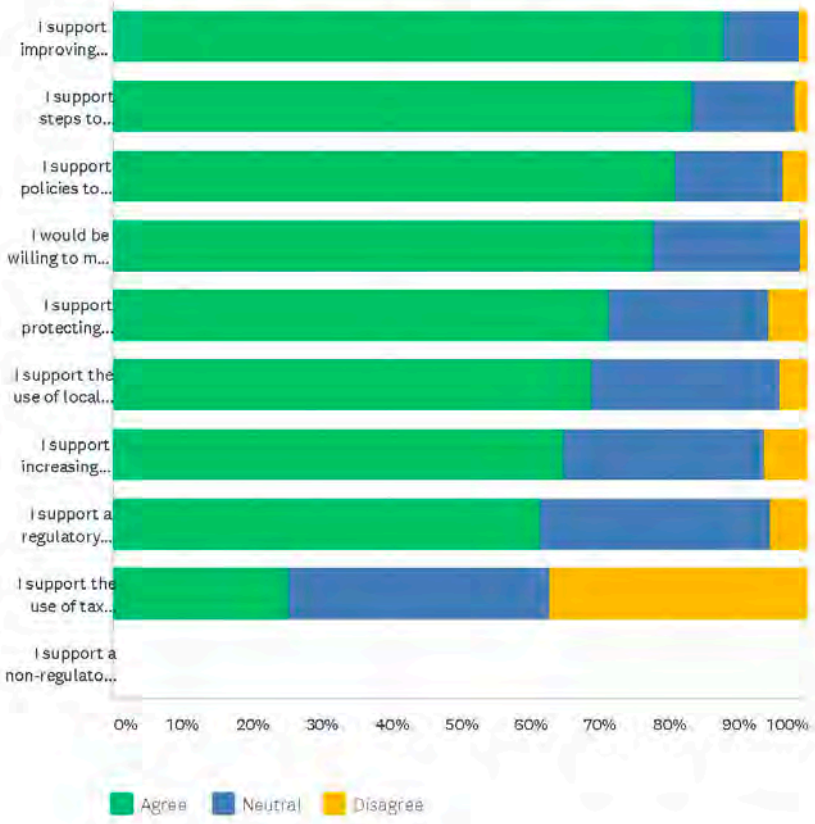
County of Maui Public Mitigation Planning Survey

	VERY IMPORTANT	NEUTRAL	NOT VERY IMPORTANT	TOTAL
Protect critical facilities (i.e. transportation networks, hospitals, fire stations)	98.58% 485	1.22% 6	0.20% 1	492
Protect and reduce damage to utilities	91.68% 452	7.71% 38	0.61% 3	493
Protection and restoration of natural systems (i.e., stream corridors, forests, conservation areas)	84.99% 419	13.59% 67	1.42% 7	493
Prevent development in high hazard areas	80.16% 392	18.00% 88	1.84% 9	489
Strengthen emergency services (e.g., police, fire, ems)	79.27% 390	18.90% 93	1.83% 9	492
Promote cooperation between public agencies, citizens, non-profit groups and businesses.	77.44% 381	20.93% 103	1.63% 8	492
Promote hazard awareness and preparedness	76.17% 374	23.01% 113	0.81% 4	491
Enhance the function of natural features (i.e. wetlands, sand dunes, floodplains)	74.59% 367	22.97% 113	2.44% 12	492
Protect historical and cultural landmarks	74.54% 366	21.79% 107	3.67% 18	491
Protect private property	63.56% 307	32.71% 158	3.73% 18	483

County of Maui Public Mitigation Planning Survey

Q4 Please indicate your level of agreement with each of the following strategies.

Answered: 492 Skipped: 2



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County of Maui Public Mitigation Planning Survey

	AGREE	NEUTRAL	DISAGREE	TOTAL	WEIGHTED AVERAGE
I support improving disaster preparedness of local schools	88.19% 433	10.79% 53	1.02% 5	491	1.13
I support steps to safeguard the local economy following a disaster event	83.50% 410	14.87% 73	1.63% 8	491	1.18
I support policies to prohibit development in areas subject to natural hazards	81.22% 398	15.31% 75	3.47% 17	490	1.22
I would be willing to make my home more disaster-resistant	78.00% 383	21.18% 104	0.81% 4	491	1.23
I support protecting historical structures	71.54% 352	22.97% 113	5.49% 27	492	1.34
I support the use of local tax dollars to reduce risks and losses from natural disasters	69.12% 338	26.99% 132	3.89% 19	489	1.35
I support increasing building and infrastructure code standards	64.97% 319	28.92% 142	6.11% 30	491	1.41
I support a regulatory approach to reducing risk	61.68% 301	33.20% 162	5.12% 25	488	1.43
I support the use of tax dollars (federal and/or local) to compensate land owners for not developing in areas subject to natural hazards	25.36% 124	37.63% 184	37.01% 181	489	2.12
I support a non-regulatory approach to reducing risk	0.00% 0	0.00% 0	0.00% 0	0	0.00

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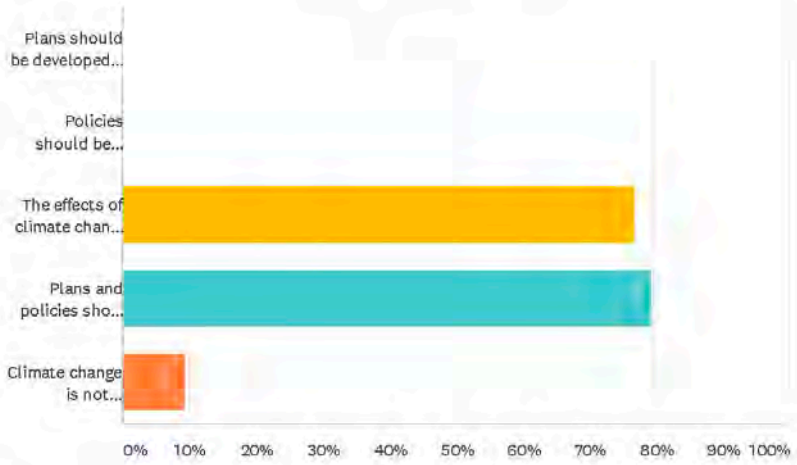
County of Maui Public Mitigation Planning Survey

Q5 Please indicate your level of agreement with each of the following statements.

Answered: 472 Skipped: 22



ANSWER CHOICES	RESPONSES	
Plans should be developed to address climate change impacts.	0.00%	0
Policies should be enacted to address climate change impacts.	0.00%	0
The effects of climate change are directly impacting Maui County.	76.91%	363
Plans and policies should be in place to address climate change impacts.	79.45%	375
Climate change is not affecting Maui County.	9.32%	44
Total Respondents: 472		

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County of Maui Public Mitigation Planning Survey

Q6 What climate changes have you observed?

Answered: 381 Skipped: 113

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County of Maui Public Mitigation Planning Survey

#	RESPONSES	DATE
1	Rising sea level. Decrease in trade wind days. Increase in heavy rain events but a decrease in overall water retention in aquifers, invasive species moving upslope due to warmer weather, increased climate variability, coral reef stress	7/2/2020 4:02 PM
2	Ocean waves going onto the highway	6/30/2020 3:27 PM
3	Shoreline erosion. Flooding.	6/29/2020 11:20 PM
4	It's hotter and hotter every year! I've lived here most of my life and getting a ninety degree day used to make the news. Now it's normal. Wildfires are worse too. Linked to heat and drought issues. Zero effort by Dept. of Water Supply to build more reservoirs. Catch the water when we have it!	6/29/2020 10:55 PM
5	Warmer summer temperatures, shore erosion	6/28/2020 5:34 AM
6	Shorelines disappearing north & south shore,	6/27/2020 3:54 PM
7	Warmer summer temperatures, shore erosion	6/27/2020 7:51 AM
8	SLR	6/26/2020 5:34 PM
9	Hotter summers	6/26/2020 1:56 PM
10	coastal erosion, drought	6/26/2020 12:15 PM
11	Shoreline erosion, less tradewinds and more drought	6/26/2020 12:05 PM
12	Hurricanes, rising ocean levels, extreme winter rain storms, flooding	6/26/2020 3:59 AM
13	None.	6/26/2020 3:17 AM
14	Warmer ocean, coral bleaching, more hurricanes	6/26/2020 1:19 AM
15	Less rain, more dry, lower cloud level, more mosquitoes, less biome diversification (plants, insects, mammals, amphibians), coral bleaching, and warmer temperatures.	6/25/2020 11:43 PM
16	Erosion of beaches, hotter weather, more invasive species, soil erosion, coral reef decline	6/25/2020 8:58 PM
17	Beach erosion	6/25/2020 8:13 PM
18	Major increase in very hot days Major increase in major fires due to heat and dryness	6/25/2020 7:50 PM
19	Less rainfall in Haiku; more days without trade winds (or weak trade winds); beach erosion	6/25/2020 5:52 PM
20	shoreline erosion	6/25/2020 5:48 PM
21	Rising tides, especially Kahana area. Hotter summers, which include coral reefs' diminished health.	6/25/2020 5:18 PM
22	More acid rain	6/20/2020 5:12 PM
23	Warm ocean water. Changes in seasons/Weather.	6/18/2020 5:58 PM
24	Serious and longer-lasting drought. Many high-wind events. Increasing number of hurricanes.	6/17/2020 5:57 PM
25	Drought, accretion of land onto to shoreline	6/17/2020 5:44 PM
26	Sea level rise, water shed shrinking and it's get hotter. Because now we need AC in the summer now.	6/17/2020 5:24 PM
27	Stronger and more frequently storms. Longer droughts. The seasons are different for fruit trees then before	6/16/2020 10:20 PM
28	Increasing severity & flashiness of rain events. Increase in inundation from tidal events. Increase in severity of brushfires.	6/16/2020 5:05 PM
29	Native plants destroyed. Land and water resources polluted by chemicals. Coral reefs and sea animals by toxic chemicals of sunblock, lotions ect.	6/16/2020 4:06 PM
30	More intense flooding, more intense high and low tide.	6/16/2020 2:59 PM
31	colder ocean temperatures. 68 degrees F. ocean in Kaupo in May is surprising.	6/16/2020 1:13 PM

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County of Maui Public Mitigation Planning Survey

32	HOT! Record breaking temps in 2019 and now again in 2020. Ocean heating: coral bleaching.	6/16/2020 1:04 PM
33	Increased rainfall	6/16/2020 3:01 AM
34	It's a natural cycle that is being messed with by the planes that flyover dropping their chem trails	6/15/2020 8:51 PM
35	Extreme heat events, beach erosion, detrimental effects of shoreline hardening, brown-water events on coral reefs, the inability of wastewater facility to contain wastewater and dumping untreated water into the ocean during extreme storm events, buildings at risk to SLR in Napili and Kahana, wildfires during drought, utility outages during storm events, substandard drinking water quality during storm events (Upcountry).	6/15/2020 4:46 PM
36	Less rain than normal. Hotter springs, summers and falls.	6/15/2020 3:51 PM
37	Costal erosion, increase weather extremes, especially heat during the summer.	6/13/2020 12:39 PM
38	Sea level / High surf, eroding Honoapiilani HWY in West Maui. Hotter summers than in years past.	6/12/2020 11:19 PM
39	Drought. Abnormal seasons. Higher than normal temperatures.	6/12/2020 8:25 PM
40	Sea level rise	6/12/2020 6:19 PM
41	Sea level rise, temperature rise, drought	6/12/2020 5:03 PM
42	Reduction in coastlines. Hotter summers (although I only have been here for 3 years, so I have a small sample size and just hear from the locals that it used to be cooler and also get more rain). More intense hurricanes (again, small sample size, but we had two Category 5's in one year, which was historic).	6/12/2020 4:16 PM
43	Heat is hotter, air less clean	4/26/2020 1:57 AM
44	Temperature changes, more rain n wind. My trees used to only lose their leaves during hurricane force winds. Now it's regular	4/23/2020 7:44 PM
45	Much wetter and colder winters.	4/23/2020 7:17 PM
46	Beach erosion	4/23/2020 2:15 PM
47	Its either way too hot or way too cold. Pouring rain or dry enough to start fires with two sticks rubbing together.	4/23/2020 6:32 AM
48	much warmer ocean during summer months. increase in wildfires. change in weather patterns. increased number of close call hurricanes	4/22/2020 7:49 PM
49	Flooding	4/13/2020 5:32 PM
50	overall increase in temperature and greater flow of dirt into the ocean	4/11/2020 8:56 PM
51	Weather patterns, warmer summers, more droughts.	4/10/2020 2:45 PM
52	Fires, rising temperatures and loss of beaches due to shoreline erosion at an alarming rate.	4/7/2020 6:35 PM
53	Waves crashing over Honoapiilani Hwy to West Maui. Drought & fires Maalaea/West Maui	4/7/2020 5:02 PM
54	Higher temperatures, frequent droughts, sea levels rising, king tides	4/4/2020 7:46 PM
55	Last summer was the hottest summer since we moved to Maui 8 years ago.	4/4/2020 7:42 PM
56	I arrived on Maui in 2008. In 12 years, I have seen nearly all West Maui corals bleached out, and nearly all West Maui beaches distance from high water mark to ocean cut in half approximately. Please start doing some photographic forensics on West Maui beaches comparing different prior years to now and measure the beach erosion. Just 10 years in one person's life and memory is distorted and like trying to watch a child in your house grow by 1/2" each day. You are too close, and it happens to slowly for humans to see in real time. Ocean levels are definitely higher since I arrived in 2008, but I do not know how to measure that.	4/4/2020 5:21 PM
57	Sea level rise and erosion	4/4/2020 7:53 AM
58	Heat weather	4/4/2020 2:18 AM

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59	Extreme hot weather, hotter than previous 33 years	4/4/2020 1:21 AM
60	exacerbates the difficulties already faced by vulnerable and indigenous communities, including political and economic marginalization, loss of land and resources, increase in frequency and intensity of storms, coral bleaching, increased fires (high temperatures/heat related), exacerbated king tides and coastal erosion, sea level rise,	4/3/2020 3:44 PM
61	Drought, fires, flooding, coral damage, water pollution, storms/hurricanes	4/3/2020 1:54 PM
62	Warmer temperatures of ocean and land. Extreme, unprecedented weather events like 50-inch rainstorm on Kauai. Condos and hotels having to build sea walls etc to stop beach erosion due to sea level rise. Complete failure of Kiwikiu bird restoration (all chicks died of avian malaria) due to mosquitos because of warmer temps in higher elevations.	4/3/2020 5:44 AM
63	Temperature, erosion, hurricane frequency and strength.	4/3/2020 2:15 AM
64	Rising ocean levels on southern coast	4/2/2020 11:25 PM
65	Drought	4/2/2020 10:50 PM
66	Sea level rise, drought, flooding, rising ocean temperature, longer and hotter summers,	4/2/2020 7:16 PM
67	Hotter summers and random fires over dry land.	4/2/2020 3:17 PM
68	Higher high tides, erosion of beaches	4/2/2020 2:56 PM
69	Erosion of beaches. Increased temperatures.	4/2/2020 7:42 AM
70	Hotter Summers/Temperature rise	4/2/2020 7:26 AM
71	Sea level rising, increasingly warmer average temperatures, coral reef suffering	4/2/2020 4:24 AM
72	Warmer weather, fires	4/2/2020 2:52 AM
73	Drought, extremes in weather, erosion	4/2/2020 2:13 AM
74	Been in my house 10 years and the heat during summers has become increasingly unbearable in the past few years.	4/2/2020 2:02 AM
75	Hotter.	4/2/2020 1:56 AM
76	Hot, dry summer. Fire. Coral death. Warmer ocean temps. Higher tides and costal erosion.	4/2/2020 12:10 AM
77	Sea level rise, hotter days, drought, flooding	4/1/2020 11:47 PM
78	Record breaking heat, higher sea levels, erosion, rain/flood/drought changes, ocean temperature etc	4/1/2020 11:43 PM
79	Erosion, coastal flooding, climate change: drought, fire, temperature change, more storms	4/1/2020 9:32 PM
80	Natural Habitat loss.	4/1/2020 9:28 PM
81	Erosion of Lahaina sea walls and beaches	4/1/2020 9:16 PM
82	Lots of beach erosion around all of Maui, hotter summers/colder rainy days. more air pollution than 10 years ago.	4/1/2020 8:42 PM
83	Ocean warming with longer shoulder seasons.	4/1/2020 8:32 PM
84	Drought, fires and also thunderstorms	4/1/2020 8:31 PM
85	Rise in temperature	4/1/2020 8:22 PM
86	Rising temperatures, records set in 12/19. Increased severity of storms. Ocean populations decreasing. Reefs dying	4/1/2020 8:21 PM
87	Change at the beaches on the north shore	4/1/2020 7:58 PM
88	Shore erosion	4/1/2020 7:58 PM
89	More frequent high tide effecting roadways. Drought and increasing fire activity. Invasive species increasing in density and elevation.	4/1/2020 7:49 PM
90	Extreme heat during the summer, more floods from rain and colder during winter	4/1/2020 7:48 PM

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91	Beach erosion and private property erosion. Trend of more fires. Hotter summers the last 3 years.	4/1/2020 7:48 PM
92	Increased and more intense fires; High coastal erosion	4/1/2020 7:46 PM
93	Shoreline erosion	4/1/2020 7:26 PM
94	The usual changes in climate are apparent. Some years are warmer and dryer. Some years are colder and wetter. The federal state and or local government should have been purchasing available makai land long ago and continued until no makai land available for private home/usage. Allow Sand dunes to protect inland. Let those who purchase makai properties to let the buyer beware and be responsible for their own property.	4/1/2020 7:24 PM
95	Weather patterns Impact to tourism. Sea level rise	4/1/2020 7:23 PM
96	Hotter summer temperatures, leading to drier (vacant) lands & droughts, and cooler winter temps. Heavier winds and rains when storms do move through. Soil erosion	4/1/2020 7:11 PM
97	Warmer water = Coral bleaching, RECORD heat in 2019.	4/1/2020 7:03 PM
98	Rising ocean levels and wave impacts; more severe weather, hurricanes, and rain events; hotter summers	4/1/2020 6:58 PM
99	Baldwin Beach erosion, Road to Lahaina, and higher temperatures in the summer	4/1/2020 6:48 PM
100	Beach Erosion & Brush Fires	4/1/2020 6:44 PM
101	higher temperatures and rain patterns shifting	4/1/2020 6:42 PM
102	Coastal and Beach erosion, hotter climates and less trade winds to keep us cool. More fires due to excessive heat.	4/1/2020 6:39 PM
103	weather changes	4/1/2020 6:13 PM
104	Less rainfall/short rainy season, warmer temperatures/hotter winter	4/1/2020 6:10 PM
105	BEACH EROSION.	4/1/2020 6:06 PM
106	Natural Habitat loss.	4/1/2020 6:05 PM
107	Increased rainfall and consequences from this	4/1/2020 6:03 PM
108	more coastal erosion, more severe hurricane season	4/1/2020 6:00 PM
109	erosion of beach and walls.	4/1/2020 6:00 PM
110	Coral reef bleaching, Lahaina fires, beach erosion	4/1/2020 5:58 PM
111	More unstable weather patterns in Kihei, more hot and record breaking heat days in Kihei, increase of fire hazards because of lack of rain	4/1/2020 5:57 PM
112	extreme temperature changes during the seasons	4/1/2020 5:54 PM
113	Rain water upcountry has a film. Citrus have developed mold. Avocados have developed mold	4/1/2020 5:52 PM
114	Extreme humidity, which makes it feel extremely hot. Vulnerable populations are subject to dehydration and outdoor work hazards are higher. Living without AC is no longer a safe option. Summers and high heat/humidity months are longer and have been brutal the last two years.	4/1/2020 5:51 PM
115	Excessive heat in summer months compared to 25+ years ago. Flooding of coastal roads.	4/1/2020 5:50 PM
116	Extreme heat in Lahaina for 6 months, when it was only about 3 months previously.	4/1/2020 5:48 PM
117	Kihei mud flats drying up, rivers drying up, sand erosion on all beaches, erosion along Honoapiilani highway	4/1/2020 5:47 PM
118	Increased temperatures in west Maui. More frequent fires.	3/18/2020 11:44 AM
119	More rain, more humidity, less sunlight for growing food	3/14/2020 2:07 PM
120	Shoreline rise on the West Side, coastal road erosion, king tides, longer periods of heat with higher temperatures in Lahaina	3/13/2020 7:42 PM
121	Getting warmer and drier in summer months. Ocean levels going up.	3/13/2020 6:52 PM

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122	Sea level rise; increased coastal erosion; departure from "normal" or typical climate patterns (e.g., longer rainy periods, extended drought periods, warmer summers); deterioration of coral reefs around Maui Island.	3/5/2020 4:50 PM
123	Sea lēvel rise Haneo'o road More high rainfall events causing rockslides on our roads. Extreme heat in summer	3/5/2020 11:16 AM
124	Much hotter and longer summers. More days of draught and water conservation. Less rain. Missing cool trade winds.	3/3/2020 3:24 PM
125	More heat, more rain, Roads falling apart	3/1/2020 3:13 PM
126	Increased intensity of storms and droughts	2/28/2020 11:41 PM
127	Colder winters, hotter summers.	2/28/2020 3:53 PM
128	Rainfall patterns: more flashy, wet areas wetter, dry places drier, more often & severe weather events.	2/28/2020 3:52 PM
129	rising ocean waters encroaching on coast, increase in average heat, erosion and undermining of Hana Highway back road	2/28/2020 2:59 PM
130	REceding coastlines - extreme heat - fires, etc.	2/26/2020 6:33 PM
131	Coastal flooding, drought, and record breaking temperatures.	2/20/2020 2:46 PM
132	Increasing frequency of king tides, sea level rise, Longer season of hotter temps producing droughts and increasing fire prone areas.	2/18/2020 9:45 PM
133	Large waves constantly wash over Honoapiilani Highway during high tide events. There are also more wildfires on the island due to frequent droughts.	2/18/2020 4:38 PM
134	We are getting a lot less rain and it is getting hotter during the year in the higher elevation areas.	2/13/2020 2:56 PM
135	Serious beach erosion in Ma'alaea and Hamoa. Notably higher water temps in South and East Maui. Wilder fluctuations between drought and deluge in East Maui.	2/12/2020 7:02 PM
136	Less frequent cloud cover in West Maui Mountains.	2/11/2020 9:27 PM
137	Very hot last year, many record temperatures!	2/11/2020 4:09 PM
138	erosion of our roadways fronting the beaches.	2/11/2020 1:04 PM
139	Stronger storms Shoreline erosion along hwy to Lahaina	2/10/2020 5:38 PM
140	Coastal erosion, extreme heat,reduce winds	2/10/2020 3:32 PM
141	Coastal flooding and inland flooding.	2/10/2020 3:08 PM
142	Warmer temperatures, longer periods. In drought conditions more than not. Ocean seems to be warmer for longer periods (coral bleaching).	2/10/2020 2:44 PM
143	severe beach erosion at Baldwin Beach and Paia Bay. The trees I used to swing from as a kid are now completely gone and the beach has crept up past where they were.	2/10/2020 2:41 PM
144	Hot and colder temps. King tides	2/10/2020 2:28 PM
145	Extreme heat	2/10/2020 1:04 PM
146	increased temperature ranges, increased frequency of storms	2/10/2020 12:30 PM
147	Coastal erosion	2/10/2020 12:29 PM
148	Brown out, coastal erosion	2/10/2020 12:24 AM
149	Hotter than normal weather, more frequent severe weather changes, higher than normal sea levels	2/9/2020 4:48 PM
150	Annual increased extreme heat, potential drought conditions.	2/9/2020 11:39 AM
151	Some of the beaches have eroded away.	2/8/2020 6:12 PM

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152	change in temperatures during summer and winter months	2/8/2020 5:26 PM
153	low line coastal areas and the Hana highway 360/ pi'ilani road.	2/8/2020 4:16 PM
154	Drought, rain bombs, heat, coastal erosion	2/7/2020 9:18 PM
155	I have not. We should be prepared.	2/7/2020 8:55 PM
156	Record breaking heat during the summer, impacting school activities. Coastal erosion/sea level rise along Honoapiilani, Lower Honoapiilani and beach road.	2/7/2020 8:28 PM
157	hotter days	2/7/2020 8:14 PM
158	sea level rises, hotter temps during the summer and shorter winters.	2/7/2020 7:19 PM
159	Coral reef bleaching, rise in ocean tempertures	2/7/2020 6:20 PM
160	erosion	2/7/2020 6:13 PM
161	Sea level rise.	2/7/2020 6:08 PM
162	coastal changes north shore, west	2/7/2020 6:07 PM
163	Longer periods of drought, more severe storms.	2/7/2020 6:04 PM
164	Shore erosion between Ukumehame and Olowalu	2/7/2020 5:50 PM
165	I thought that this summer was extremely hot and lasted a lot longer than usual summers on Maui.	2/7/2020 5:48 PM
166	Coastal erosion - Ma'alaea condos Temperature - sea water notably higher, air higher	2/7/2020 4:27 PM
167	Storms are bigger, longer and more frequent.	2/6/2020 10:36 PM
168	Increase heat, agriculture dry, fires	2/6/2020 10:33 PM
169	Sea level rise, record breaking high temperatures, drought	2/6/2020 4:53 PM
170	Increased heat and increased season length, king tides more frequent and more intense	2/6/2020 3:54 PM
171	Lower low-tides. Higher high-tides. Warmer average temperatures during the summer months.	2/6/2020 1:46 PM
172	rising sea levels erosion	2/6/2020 1:33 PM
173	Less rain in Hāna, it seems to be dryer. More people getting sick more often. Sun feels hotter.	2/6/2020 12:32 PM
174	Tides keep getting higher	2/6/2020 6:02 AM
175	Rising sea levels	2/6/2020 12:31 AM
176	Road erosion	2/5/2020 10:21 PM
177	Hottest summer/fall on record-largest number of days with record temperature set (2019). Increased acidification damaging coral reefs.	2/5/2020 7:40 PM
178	Coastal roads being overtaken by ocean waters Higher temperatures, especially in summer-heat record	2/5/2020 6:14 PM
179	Severe weather changes and patterns inconsistent with previous years, flooding and inundation of our coastal roads, unpredictable weather patterns, more frequent and severe fire season.	2/5/2020 5:23 PM
180	King tides are just the begining.	2/5/2020 5:16 PM
181	Increase of rainfall; increase of humidity	2/5/2020 3:33 PM
182	Sea level is rising: there is erosion on the beaches, especially in Kihei where sea walls are built and you can't walk on the sand anymore. I noticed driving to Lahaina that the ocean is washing over the road when it used to be a lot farther away from the road about 40 years ago.	2/5/2020 1:33 PM
183	Coastal erosion, increased flooding, heat, fires on west side and Central Valley of Maui	2/5/2020 12:59 PM
184	All areas	2/5/2020 2:41 AM
185	rising sea levels	2/5/2020 2:06 AM

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186	high temperatures mainly	2/5/2020 1:55 AM
187	Extreme temperature range . UV sun exposure to skin. Car and machine finishes rapidly fade.	2/5/2020 1:21 AM
188	Drought	2/5/2020 1:16 AM
189	Heat and drought and. bizarre weather patterns that aren't easy to predict. Also the loss of animal species due to habitat change.	2/5/2020 1:13 AM
190	Temperature, weather, plants/fruiting patterns, insects/disease impact on agriculture	2/5/2020 1:11 AM
191	Unpredictable seasons with rain, fruit and fish. Coastal flooding from more frequent high tide/surge events. Inland flooding from more frequent extreme rain events. Unusual periods of drought.	2/5/2020 1:11 AM
192	coastal erosion, higher temps, altered trade winds, flooding	2/4/2020 8:50 PM
193	Shoreline impacts, drought, increased water use in hotter, dryer conditions, weather disruptions increased.	2/4/2020 4:05 PM
194	Higher tides and waves, more extreme temperatures both hot and cold	2/4/2020 3:58 PM
195	Shoreline Erosion is obvious. Hurricanes are more frequent and stronger.	2/4/2020 3:04 PM
196	The fact that Maui has been overly dry in the past year, which resulted in many more fires than usual.	2/4/2020 2:31 PM
197	Not so much climate change but continuous disrespect to the island by building every inch of coastline and pollution to our waters from all this construction.. homes, golf course, hotels.. the weather is different global. Maybe our reef is being effected by global warming, more fires but thats also due to selling out and not using the open lands for its natural purpose and stealing water. Hotels shouldn't be getting bigger portions of the water and natural flow.	2/4/2020 1:49 PM
198	The climate is hotter then it's ever been. In results of this climate change there are less rain. With less rain our plants don't grow to flower properly thus for the butterfly and bees don't pollinate. This is the reasoning for lack of fruited trees like Mango, Lychees, papayas, etc. I excited to see the development of Mahi Pono. We can no longer depend on tourism or construct to fuel our economy.	2/4/2020 1:35 PM
199	Breaking high temperature records. Tradewinds not as frequent. Less rain.	2/4/2020 1:24 PM
200	Coral and reefs, dry vegetation, erosion	2/4/2020 1:11 PM
201	Wind direction changes from typical. Sea level rise. Hotter summers, burned plants and trees so much so that they are not able to bloom and produce fruit.	2/4/2020 10:42 AM
202	I believe weather is cyclical and historic. I am not a believer in climate change as permanent.	2/4/2020 2:58 AM
203	Less rain, higher temperatures, more pests to combat, more fire.	2/4/2020 2:56 AM
204	Record heat, drought induced fires, and increase in damaging storms	2/3/2020 10:18 PM
205	Hotter and drier summers.	2/3/2020 8:53 PM
206	Maui County experienced very hot weather in 2019 which is very unusual compared to years prior.	2/3/2020 8:10 PM
207	Warmer than in the past.	2/3/2020 7:44 PM
208	temperatures, weather patterns	2/3/2020 7:31 PM
209	King tides, coastal damage, dramatic changes in weather	2/3/2020 7:08 PM
210	Change in temperatures, tides, beaches - sand erosion.	2/3/2020 6:26 PM
211	Sea level rise/erosion of the coast along Honoapiilani Hwy from Lahaina to the Pali. The water never used to come up on the road and now it happens on a regular basis. Increased storm activity and intensity of storms.	2/3/2020 6:16 PM
212	Record levels of high temperatures are being exceeded each year. Extreme dry conditions due to lesser rainfall.	2/3/2020 5:45 PM
213	coastal erosion	2/3/2020 5:18 PM

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214	weather temperature gets hotter every year	2/3/2020 4:33 PM
215	The change in seasons and how extreme the weather is now. When it's hot, it's really hot and when it's wet, it's floods.	2/3/2020 4:15 PM
216	Extreme heat and unusual cold. Flooding on the highway. Erosion of our shoreline. Drought.	2/3/2020 3:47 PM
217	Shoreline erosion, sea level rise, more intense "rain bomb" situations (short, heavy rains)	2/3/2020 3:21 PM
218	Less rain Higher temps Coral stress	2/3/2020 3:04 PM
219	Shoreline erosions, natural water runoffs not entering the ocean	2/3/2020 2:46 PM
220	None. Seas rise and fall over the years. Overtourism has caused loss of reef. Concrete holds heat and makes it warmer!	2/3/2020 2:26 PM
221	Honoapiilani Highway needs to be moved inland. Ocean hitting highway is causing tremendous traffic, sea walls not answer	2/3/2020 2:09 PM
222	Summers and winters are vastly different in the last 2 -5 then there were say 10 years ago.	2/3/2020 1:35 PM
223	Hotter, drier weather for longer periods of time.	2/3/2020 1:35 PM
224	coastal erosion, drought	2/3/2020 12:42 PM
225	some areas of Maui are very dry less rain	2/3/2020 12:41 PM
226	Ocean level rise and its impacts on coastal areas. As well as the warming of the ocean increasing the frequency and strength of storms.	2/3/2020 11:59 AM
227	Drought (lack of rain) and increasing temperatures	2/3/2020 11:43 AM
228	higher tides, higher tempretures	2/2/2020 3:48 PM
229	hotter and colder climate, then we've had in the past.	2/2/2020 12:41 PM
230	weather and coastal erosion	1/31/2020 8:24 PM
231	weather changes between seasons year to year,	1/31/2020 7:25 PM
232	temperature extremes, changing weather patterns, coastal erosion	1/31/2020 6:54 PM
233	Record heat, extreme weather patterns, higher than normal tides	1/31/2020 6:45 PM
234	extreme heat; drought	1/31/2020 6:31 PM
235	Heat in Classrooms at schools too high High tides coastal erosion	1/31/2020 6:13 PM
236	hotter days, coastal erosion	1/31/2020 5:32 PM
237	Sea level rise/coastal erosion on the west side	1/31/2020 5:05 PM
238	Higher temperatures, coastal erosion,	1/31/2020 4:21 PM
239	Drier, and hotter summers. Drier winters.	1/31/2020 3:34 PM
240	beach erosion, oceanside road erosion, increasing heat	1/31/2020 3:33 PM
241	Its getting more and more HOT each year	1/31/2020 3:31 PM
242	drought, in-land flooding, fire and high winds	1/31/2020 3:24 PM
243	Drought	1/31/2020 2:44 PM
244	drought which has brought on more fires.	1/31/2020 2:29 PM
245	Coastline erosion, wildfires	1/31/2020 2:03 PM
246	I have not been on the island long enough to assess the situation	1/31/2020 1:19 PM
247	Beach Erosion	1/31/2020 1:14 PM
248	SLR, coastal erosion, drout...	1/31/2020 12:59 PM
249	Warmer climate, Drought,	1/31/2020 12:29 PM

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250	Higher and lower temps. Higher sea levels.	1/31/2020 11:05 AM
251	Hotter temps., seasons shifting, lack of tradewinds	1/30/2020 8:53 PM
252	Rising seas, very dry areas of the island, warmer temperatures, less rain.	1/30/2020 8:35 PM
253	Temperature changes, summer is hotter, winter is colder, there is more thunder and lightening, the "rainy" season has moved months or like this year is not rainy at all.	1/30/2020 8:28 PM
254	Weather changes	1/30/2020 8:17 PM
255	it's hotter	1/30/2020 8:11 PM
256	Drought mostly	1/30/2020 8:04 PM
257	land erosion, contaminated ocean areas, reef erosion, receding shorelines	1/30/2020 8:03 PM
258	Heat, fires, and higher seas	1/30/2020 7:50 PM
259	Dryness from the recent extreme heat waves in Maui County - record breaking heat for many months. Fires which may/may not have been brought on my MECO or weather, e.g., lightning.	1/30/2020 7:48 PM
260	rising sea levels, drought	1/30/2020 7:46 PM
261	I disagree with any regulations based on the climate "in the name of saving the planet, we will impose more regulations, which in other words: more taxes	1/30/2020 7:40 PM
262	Kula is not as cold as in the past	1/30/2020 7:21 PM
263	Less rain fall , lack of water on the islands	1/30/2020 7:18 PM
264	Coastal erosion, increased average temperatures, increase in tropical storm activities and occurrences.	1/30/2020 7:01 PM
265	Rising sea level along coastlines. Much hotter temperatures year-round. Drought. More frequent high winds.	1/30/2020 7:00 PM
266	higher high tides and temps	1/30/2020 6:46 PM
267	HEAT	1/30/2020 6:38 PM
268	Coastal erosion	1/30/2020 6:34 PM
269	Fires/rising tides/shoreline erosion/more severe storms	1/30/2020 6:31 PM
270	glacial ice melting, warmer ocean	1/30/2020 6:19 PM
271	Coastal erosion Less rivers flowing	1/30/2020 6:17 PM
272	Lack of rainfall and increasing temperatures	1/30/2020 5:56 PM
273	increase in coastal erosion, flooding of yards and property near the coast, Erosion of roads and highways near costal areas, sewage problems for systems near the coastline, increase of sedimentation in ocean especially on the south shore of Molokai, increase runoff and erosion on west Molokai	1/30/2020 5:38 PM
274	Extreme dryness in various parts of the island.	1/30/2020 5:38 PM
275	Very hot summers last 3 years - coral deteriorating (ocean temp increase?) - beach erosion (melting ice? sea level rise?) Need more education!	1/30/2020 5:30 PM
276	Prolonged record temperatures; storms striking areas seemingly at random; reduced trade winds	1/30/2020 5:29 PM
277	Rising sea levels and less rain.	1/30/2020 5:13 PM
278	Erosion!!! West Maui, South Maui, the roads to both places are in dire need to be relocated soon!	1/30/2020 5:05 PM
279	Change in weather paterns	1/30/2020 4:51 PM
280	None	1/30/2020 4:48 PM
281	Increased incidents of heavy rainfall & flooding, shoreline erosion and tidal surge into	1/30/2020 4:48 PM

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	properties, intensity of hurricane-tropical storms and pathways they are taking, doesn't seem to be a dry or wet season as before - weather patterns unpredictable	
282	Rising oceans. More extreme weather.	1/30/2020 4:45 PM
283	Every year it's been getting hotter and hotter in the summer.	1/30/2020 4:24 PM
284	hotter weather	1/30/2020 4:12 PM
285	Hotter summers and colder winters	1/30/2020 4:12 PM
286	Coastal erosion, King Tides (never knew of this until recently), hotter days, more drought effects	1/30/2020 3:59 PM
287	Sea level rise and increased frequency and intensity of weather events	1/30/2020 3:56 PM
288	High temperatures especially during the summer. Each year seems to get hotter. Upcountry is not as cold as it used to be. Less fish and ogo in the ocean.	1/30/2020 3:51 PM
289	HIGH TIDES,HEAT,DRY CONDITIONS	1/30/2020 3:49 PM
290	Beach errosion	1/30/2020 3:47 PM
291	There are natural and human induced changes, nature is in constant flux, we should focus on the human impacts.	1/30/2020 3:44 PM
292	Rising sea levels	1/30/2020 3:43 PM
293	drought	1/30/2020 3:41 PM
294	Temperature and rainfall.	1/30/2020 3:41 PM
295	Climate changes that I have observed is that it's been extremely cold from night to morning and then it's extremely hot in the afternoon. It's less rain.	1/30/2020 3:40 PM
296	Extreme drought, fire hazard. High winds.	1/30/2020 3:39 PM
297	Fires are bigger, happen more frequently. Shoreline erosion.	1/30/2020 3:35 PM
298	Rising temperatures, erosion of coastal areas and having to move roads or create barriers, less water flowing in the rivers and streams	1/30/2020 3:35 PM
299	Sea level rise, sand dune displacement, extreme heat or cold (ie. the temperature changes we felt from July to November were so hot, then in December/January it's so cold...there was no middle ground)	1/30/2020 3:34 PM
300	hotter temperatures, less rain, observing coastal erosion (especially if you look at historical aerial photos compared to todays aerial photos).	1/30/2020 3:34 PM
301	Changes in weather patterns; mosquitoes in different areas due to changing climate; hotter temperatures; less rain at times; more fires	1/30/2020 3:31 PM
302	The extreme heat this past summer into fall in county of maui.	1/30/2020 3:31 PM
303	Coastal erosion and higher elevation ocean levels	1/30/2020 3:31 PM
304	Drought, Heat, Warmer ocean temperatures, seasonal extremes	1/30/2020 3:26 PM
305	Mostly weather	1/30/2020 3:24 PM
306	The most extensive and extreme frequency of fires. The record number of days with very high temperatures. The adjustment of boundaries of all the micro-climants. People are more grumpy because the heat and more heat related health issues. Increased energy use as more local home install residential HVAC units.	1/30/2020 3:24 PM
307	Kings tide, high temperatures.	1/30/2020 3:18 PM
308	Dying coral, increase in growth of slimy limu in the ocean, overall ocean temperatures are warmer, increase in beach erosion -- during certain seasons the beach would retreat and then it would come back, it was a cyclical pattern, but now beaches keep eroding and they don't come back.	1/30/2020 3:18 PM
309	Increase in King Tide incidents; hotter temperatures for longer periods of time; stronger storms; irregular rain events	1/30/2020 3:16 PM

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County of Maui Public Mitigation Planning Survey

310	Tides, heat	1/30/2020 3:15 PM
311	Warmer temperatures at our home	1/30/2020 3:14 PM
312	Tide rises and rain patterns	1/30/2020 3:08 PM
313	Record heat temperatures, draught as well as heavy rainfall, brush fires, high tides crossing main roadways and flooding areas	1/30/2020 3:08 PM
314	Increasing coastal erosion from rising sea levels; hotter temperatures; less tradwinds; more drought; rainfall events produce more rainfall in a shorter time.	1/30/2020 3:07 PM
315	Coastal erosion	1/30/2020 3:05 PM
316	heat, higher temperatures	1/30/2020 3:05 PM
317	Coastal Erosion, Drought, sea level rise, Extreme Heat	1/30/2020 3:03 PM
318	dry conditions and fire hazards	1/30/2020 3:03 PM
319	Hap-hazard seasons. Where we use to relatively have some kind of consistency within the year in terms of weather, we seem to lack the same within the last 5-10 years or so.	1/30/2020 3:00 PM
320	Heat, coastal flooding	1/30/2020 3:00 PM
321	It does not rain as much as it used to when I was growing up.	1/30/2020 2:57 PM
322	Extreme heat, coastal flooding,	1/30/2020 2:57 PM
323	More frequent extreme weather, fires	1/30/2020 2:57 PM
324	higher tides/more frequent king tides eroding shorelines and impacting roadways/housing; hotter, longer, and drier summers; shorter and less wet rainy season	1/30/2020 2:55 PM
325	higher, more frequent king tides washing over the poli highway	1/30/2020 2:54 PM
326	It has been a lot hotter than in previous years. Having snowfall for the first time in Upper Kula vs just on Haleakala.	1/30/2020 2:54 PM
327	Summer was hotter, and went for a longer duration, than many people (anecdotally) could remember. More fires. Also, coral bleaching.	1/30/2020 2:53 PM
328	coastal erosion, elevated temperatures, reduced inland water sources	1/30/2020 2:53 PM
329	"Climate change" is a natural occurring cyclical event. Out of human control. Is politically driven and irresponsible. Inciting panic. Similar to Y2K concerns that never materialized.	1/30/2020 2:53 PM
330	Hotter, drier summers, which results in more fires; coastal erosion, especially in West Maui	1/30/2020 2:53 PM
331	Recent temperature changes in Hawaii are directly attributable to NOAA airport thermometer locations (next to blacktop, transformers, air conditioner exhaust). Sea level rise has been a consistent 2mm/year since 1950. The proposed "solutions" merely fulfill globalist/elite ruling preferences for increased control over the people. Climate is always in flux, but there is no data which proves that human action is responsible for it, and since we do not have a second identical earth to serve as a scientific control it is impossible to prove AGW is occurring.	1/30/2020 2:52 PM
332	LONGER HOTTER SUMMERS	1/30/2020 2:51 PM
333	Extreme heat, diminished ecosystems, warmer ocean temperatures (extremely worrying), coral bleaching, and less rain.	1/30/2020 2:51 PM
334	Extreme heat and lack of rain have been most noticeable to me.	1/30/2020 2:51 PM
335	THE CHANGES IN THE WEATHER PATTERNS, THE EXTREME HEAT DURING THE NEW SUMMER MONTHS AND THE WINTERS ONLY LASTING A COUPLE OF MONTHS NOT PROVIDING THE AMOUT OF RAIN WE NEED TO SUPPORT OUR CURRENT POPULATION	1/30/2020 2:50 PM
336	Drought conditions and extreme flooding	1/30/2020 2:49 PM
337	Summers have been more Hot and Winters been more cold.	1/30/2020 2:49 PM
338	warmer temps, change in rainfall-less, sea level rise	1/30/2020 2:48 PM

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339	sea level rise, high temperatures	1/30/2020 2:48 PM
340	Very dry this year, Crops very dry, may wild fires	1/30/2020 2:48 PM
341	Coastal erosion, increased stream flow, higher temperatures, more severe weather and flooding	1/30/2020 2:47 PM
342	Increasingly long periods of drought, significant coastal erosion, increasing amounts of hurricanes, extreme temperature shifts	1/30/2020 2:47 PM
343	Rising temperatures during summer time and longer summer periods.	1/30/2020 2:46 PM
344	Extreme temperature changes - Massive wildfires	1/30/2020 2:46 PM
345	Sea level rise, longer drought, more fires, weather pattern changes, warmer temperature of our ocean waters, landslides, flooding,	1/29/2020 4:10 PM
346	Rising sea levels	1/29/2020 12:23 PM
347	HIGH WINDS, Floods, FLOODING, EROSION	1/29/2020 7:55 AM
348	Coral bleaching, drought, deforestation/ negative impacts on watersheds, heat wave records.	1/29/2020 1:10 AM
349	Rising water, more fires	1/28/2020 10:43 PM
350	Extreme heat, floods, loss of power, gas rationing, water rationing, high winds, strange cloud patterns, loss of tradewinds, irregular weather and seasonal patterns (hot cold, tons of rain, no rain, flooding, fires)	1/28/2020 9:41 PM
351	Excessive amounts of fires.	1/28/2020 8:56 PM
352	If you were born and raised on Maui with heritage of born and raised on Maui, Just walking out your front door shows climate change in everyway possible.	1/28/2020 8:33 PM
353	More extreme storms and rain events. Increased coastal erosion and flooding. More prevalent drought and fire seasons.	1/28/2020 7:43 PM
354	Higher ocean surface waters, record breaking high temps	1/28/2020 7:24 PM
355	increased rainfall & flooding, coastal erosion, increased drought & wildfires	1/28/2020 7:21 PM
356	More rain, higher tides and sea level rise. Increased fires. Longer droughts, more weather extremes.	1/28/2020 7:15 PM
357	Hotter days, more erosion,	1/28/2020 6:58 PM
358	Rise in sea level, rise in temperature, losss of habitat for endemic species	1/28/2020 6:04 PM
359	Higher temps - record-setting	1/28/2020 4:45 PM
360	Sea rise, dry weather, droughts, severe storms	1/28/2020 3:34 PM
361	Extreme temps	1/28/2020 1:58 PM
362	Extreme heat this summer, a noted lack of rain this year.	1/28/2020 12:28 PM
363	Hysteria and the desire for regulation versus personal accountability. We cannot expect our government to manage us, we must solve this problem personally.	1/28/2020 4:42 AM
364	rising sea levels record breaking high temperatures more severe tropical storms	1/28/2020 4:01 AM
365	Higher temperatures, less rain/drought, sea level increases, shoreline erosion	1/28/2020 4:01 AM
366	Temperature is raising, summer is longer	1/28/2020 2:38 AM
367	Drought and too many temperature highs May thru Dec. 2019	1/28/2020 1:56 AM
368	Temperatures, incl. ocean heating. More unusual occurences: tidal, wind direction, etc. Rising sea levels.	1/28/2020 1:39 AM
369	Prolonged drought and higher temperatures	1/28/2020 1:37 AM
370	Extreme heat, fire, water level rising	1/28/2020 1:07 AM

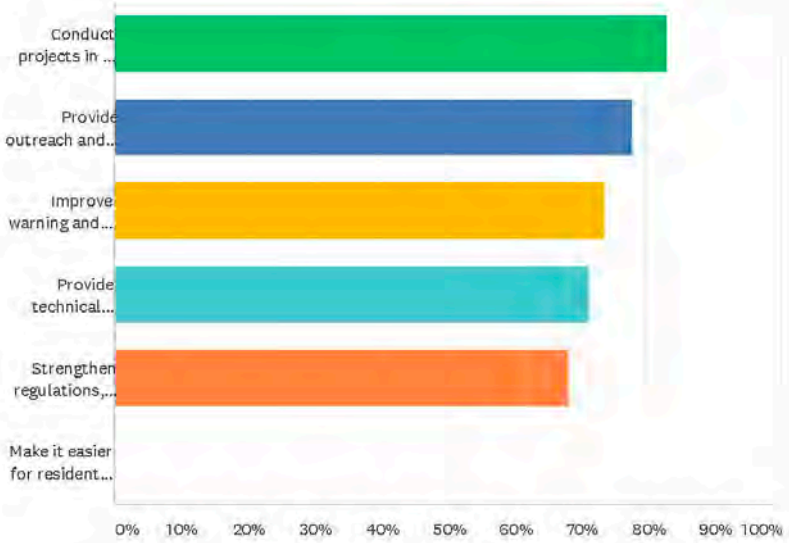
County of Maui Public Mitigation Planning Survey

371	Sea level changes, beach erosion, extreme heat, flooding	1/28/2020 12:57 AM
372	Temp extremes and rain patterns have changed over the past 20 years.	1/28/2020 12:54 AM
373	Higher temps, drought prone areas fiercer winds and increase in respiratory illnesses.	1/28/2020 12:38 AM
374	Hawaii's biggest change is about the Tradewinds. UH says that we have 20% less Tradewind days as we had 20 years ago. Sea levels are rising and ocean temps rising also.	1/28/2020 12:02 AM
375	none	1/27/2020 8:56 PM
376	erosion of beach	1/27/2020 7:24 PM
377	warmer days in general - I think .5 degrees over past 10-20 years. Other are minor, small potential sea level rise. Biggest climate change I've seen is the alarmist nonsense from our community leaders. We need good triggers for when we really see various levels of sea rise, smart design rules and roads and infrastructure with life over 30-50 years build inland and away from the shore.	1/27/2020 6:21 PM
378	shoreline erosion...weather changes (heat)...waves over the roadways...	1/27/2020 5:39 PM
379	Observations are only weather where as the climate is the lager picture. Any single observation does not prove or disprove that the global climate is changing	1/27/2020 4:00 PM
380	Drought, Sea Level Rise	1/27/2020 3:30 PM
381	Brush fires are making my husband sick. We've never seen this many fires before.	1/27/2020 3:17 PM

County of Maui Public Mitigation Planning Survey

Q7 How can Maui County support risk reduction in your community? Please choose all that apply.

Answered: 483 Skipped: 11



ANSWER CHOICES	RESPONSES	
Conduct projects in the community, such as drainage and flood control projects, to mitigate for hazards and minimize impacts from disasters.	83.02%	401
Provide outreach and education to residents and businesses to help them understand risks and be better prepared.	77.85%	376
Improve warning and response systems to improve disaster management.	73.71%	356
Provide technical assistance to residents and businesses to help them reduce losses from hazards and disasters.	71.43%	345
Strengthen regulations, codes, and ordinances - such as zoning regulations and building codes - designed to protect people from natural hazards and disasters.	68.12%	329
Make it easier for residents and businesses to take their own actions to mitigate risk and become more resilient to disasters.	0.00%	0
Total Respondents: 483		

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County of Maui Public Mitigation Planning Survey

#	OTHER (PLEASE SPECIFY)	DATE
1	Correct past mistakes i.e. diverting highway water into streams to small to handle.	6/29/2020 11:20 PM
2	Prioritize continued construction of alternative routes such as the Lahaina bypass to reduce traffic concerns on Keawe street and to provide an alternative to the single road access to the west side	6/28/2020 5:34 AM
3	Prioritize continued construction of alternative routes such as the Lahaina bypass to reduce traffic concerns on Keawe street and to provide an alternative to the single road access to the west side	6/27/2020 7:51 AM
4	Rehabilitate areas damaged by human use to restore ecological services.	6/26/2020 5:34 PM
5	regulation necessary, but needs to be more common sense and evenly applied	6/26/2020 12:15 PM
6	already have enough zoning regulation, needs to be evenly applied	6/26/2020 12:05 PM
7	Be aware that risks are not always predicable and restricting people is usually a response to something that happened as opposed to something that could have been prevented.	6/26/2020 2:10 AM
8	Collaborate with schools, teaching staff, and administrators to provide age-appropriate, sustained education as noted above.	6/25/2020 11:43 PM
9	Complete Lahaina Bypass so more options on west side; create alternate route from Lahaina to Kahului to prevent west side from being cut off by natural disasters	6/25/2020 7:50 PM
10	Provide more incentives to move to renewable energy	6/25/2020 5:52 PM
11	Changes to be set accordingly - as needed.	6/18/2020 5:58 PM
12	There needs to be greater communication between the EOC and the Lāna'i community with respect to COVID-19.	6/17/2020 5:57 PM
13	Using drones to map and share with community. LiDAR mapping is the most bang for data collection.	6/17/2020 5:24 PM
14	Evaluate long term threats to roads & communities.	6/16/2020 5:05 PM
15	A lot of things need to be updated to work with changes, resources and availability in each community.	6/16/2020 4:06 PM
16	Cap number of tourists on the road and block off hazardous areas to non residents	6/16/2020 2:59 PM
17	raise the speed limits all along the Hana Highway	6/16/2020 1:13 PM
18	Reactivate ancestral systems of governance to foster self-reliant villages	6/15/2020 9:53 PM
19	Work on funding for projects to mitigate risk.	6/15/2020 4:46 PM
20	Install Evacuation Route signs around shoreline roadways and ensure emergency and evacuation information is readily available in hotel rooms, B&Bs, VRBOs, air B&B, etc.	6/12/2020 11:19 PM
21	Encourage the formation of localized preparedness organizations throughout the County	6/12/2020 5:03 PM
22	Clean storm/rain drainage to avoud overflow and backing up of system during rain/stormz.	4/26/2020 1:57 AM
23	Work w communities to develop plans for each area	4/23/2020 7:44 PM
24	Informing our communities about these hazards or disasters and share knowledge of prevention and being prepared.	4/16/2020 12:06 PM
25	Food and energy independance is critical! Safeguard our water supply.	4/10/2020 2:45 PM
26	your warning system is old and hard to understand.	4/8/2020 7:18 PM
27	Have people go out. Talk to individuals/property owners	4/7/2020 5:02 PM
28	1. Prevent building subdivisions in wildfire hazard areas. 2.County ordinance to force rental car companies to declare 10% as smoker friendly cars. I have seen so many smokers flick burning butts out of rental car windows that I bet $2 Million in fire fighting budget would have been saved over the last two years. Smokers gonna smoke.	4/4/2020 5:21 PM

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County of Maui Public Mitigation Planning Survey

29	support food resilincy/sovereignty	4/3/2020 3:44 PM
30	strengthen internet infrastructure and online/remote communication networks and resources	4/3/2020 1:54 PM
31	stop zoning areas as residential that are hazards; have infrastructure support decisions/building/occupancy levels previously approved (e.g. exit routes were shown to be insufficient during 2019 fire evacuations). You cannot tell people to evacuate then shut off all means for doing so. And coordinate timely and accurate media updates.	4/1/2020 7:11 PM
32	Required registration of all cell phones so location can be monitored during emergencies like COVID 19, or future floods or tsunamis.	4/1/2020 7:03 PM
33	Disaster preparedness. West Maui has virtually no resources.	4/1/2020 6:58 PM
34	ENFORCE existing laws and regulations	4/1/2020 6:42 PM
35	Have the community be more involved in more sustainable practices. The county should come up with a county based recycling and composting program and have their own facility to accommodate these practices. Plant more trees to protect erosion.	4/1/2020 6:39 PM
36	Plant more trees and landscaping in strategic areas along streets and in towns to help manage drainage and mitigate climate change	4/1/2020 6:10 PM
37	control tourism and car rentals better, less cars on roads will help battle global warming, terminate all short term rentals that violate the zoning laws of the area	4/1/2020 5:52 PM
38	Provide solutions to fire prevention.	4/1/2020 5:51 PM
39	Fuel reduction measures in West Maui	3/18/2020 11:44 AM
40	Be more proactive in clearing slopes along the Hana Hwy.	3/14/2020 2:07 PM
41	enforce rules related to neglect of private property contibuting to hazards ie. bush abatement/wildfires	3/13/2020 7:42 PM
42	Ensure existing reservoirs have water during the dry season to combat fires	3/13/2020 6:52 PM
43	Stop developing in hazard prone areas. Slow growth and development - infrastructure and other improvements can't keep up.	3/5/2020 4:50 PM
44	FIX THE ROAD! It is our most significant hazard	2/28/2020 11:41 PM
45	Kaupo Community Association is building a resiliency hub at the old Kaupo School as a community resource center, shelter and hazard mitigation facility. Project is now stopped when halfway completed by COM. State GIA funds will lapse in September if project not allowed to proceed.	2/28/2020 3:52 PM
46	improve infrastructure	2/28/2020 2:59 PM
47	just want to let you know that I'm a renter (and suddenly having to more A LOT due to housing sales...so I couldn't say I was willing to make my home more disaster resistant...	2/26/2020 6:33 PM
48	Strenthening sodes, etc. doesn't do squat if they're never enforced, which seems to be the current status.	2/24/2020 1:22 AM
49	Strengthen cargo inspections for illegal fireworks	2/10/2020 3:08 PM
50	Be more involved with first responders and having community plans in place for specific areas that are prone to flooding	2/10/2020 2:41 PM
51	Some of the questions depends on your perspective. Coming from East Maui, we are not too concerned about fires because we have much rain, if you meant forest fires. However, if climate change keeps up & the forests get dryer, then that will be a concern. Same for droughts. We have much water in East Maui, but again, climate change could change that.	2/10/2020 12:24 AM
52	Encourage recycling & reuse and to minimize waste	2/7/2020 8:28 PM
53	Regulations must actually be enforced. Illegal developments should not be granted after-the-fact permits.	2/7/2020 6:04 PM
54	put pepole with local knowledge on the board not some one that don't know what going on	2/7/2020 1:44 PM

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County of Maui Public Mitigation Planning Survey

55	Revise codes instead of "strengthen" codes	2/6/2020 3:54 PM
56	Start protecting our shorelines! Science believes in plate tectonics - so one day all islands will be an atoll like Midway. We can't stop it but only slow it down. Need to start now. Need to agree that human life & safety is most important. We cannot take years to repair a road that is eroding - possibly hurting a person or family - because of some environmental rules. County & State need to work together for quicker action!	2/6/2020 1:46 PM
57	along the line of being better prepared, how about how to recover	2/6/2020 1:33 PM
58	Expand fire and EMS services-why has no new first station opened since the early 2000's, while ti overall population and visitor arrivals have increased immensely.	2/5/2020 7:40 PM
59	Support local Disaster Preparedness Groups	2/5/2020 6:14 PM
60	Tourism/tourists need to be part of preperation	2/5/2020 1:55 AM
61	Study past weather and climate changes. Restore waterways from irrigation..	2/5/2020 1:21 AM
62	Deal with threat from deer--wrecks, disease, ag losses	2/5/2020 1:11 AM
63	RSS or other feed for disaster preparedness and alerts that can be integrated into other websites.	2/5/2020 1:11 AM
64	Emergency and Evacuation plans for areas of the island of Maui that get cut-off from the rest of the island when crisis occur	2/4/2020 3:04 PM
65	I think educating the tourist would help with locals too. Maybe on flights or having videos in the hotels.	2/4/2020 1:49 PM
66	Don't change Ag zoned land to rural.	2/4/2020 10:42 AM
67	Develop access that will get people out of Kihei in the event of flooding of access major intersections in Kihei	2/4/2020 2:58 AM
68	Develop better and more widespread plans for disaster response. For example having supplies on the west side and other remote areas all the time. Coordinate with Red Cross so they have a place to store supplies too. During Hurricane Lane supplies were "at the kahului harbor" but what good does that do if the road is washed out and they can't get to Lahaina. MEMA seems good at setting up a command center and monitoring an event but they are severely lacking in their ability and willingness to respond to a disaster after it happened. They totally dropped the ball after the Lahaina fires and floods. That was a small event and if they struggled that much for a small isolated event I am afraid of what they will fail do do for a widespread large event. Now is the time to get serious and plan effectively for large scale disasters that could happen at any time.	2/3/2020 6:16 PM
69	Open the Wetlands and provide wide buffers for the native forests	2/3/2020 3:47 PM
70	Improve communication	2/3/2020 3:21 PM
71	Improve disaster recovery facilities, eg post-hurricane	2/3/2020 3:04 PM
72	Do not let foreign people an opportunity to but Hawaiian lands	2/3/2020 2:46 PM
73	move Honoapiilani Highway to reduce traffic	2/3/2020 2:09 PM
74	Construction industry labor shortage. Needs recruitment, education. Consider opportunities for homeowner level education so that homeowners can do basic things themselves. Consider options for females -recruit, basic education courses for working men/women.	2/3/2020 1:35 PM
75	eliminate sea walls, move coastal roads inland, show me the water for development	2/3/2020 12:42 PM
76	consider moving our town to a higher area. If we have a tsunami our main town in right on the coast. Our hospital, police station, stores, banks, will all be affected, perhaps wiped out. Moving our town or at least having another site for police, hospital, stores etc would be a relief for our people.	2/2/2020 12:41 PM
77	The huge empty lands needs to fire prevention	1/31/2020 4:18 PM
78	Create another road out of Kihei so that people are not trapped. Huge risk.	1/31/2020 2:03 PM
79	Increase the number of fully staffed fire stations to match community growth.	1/31/2020 12:59 PM

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County of Maui Public Mitigation Planning Survey

80	I think the county should focus on adaptaion to the climate change, and not try to control it, because nature will always win.	1/30/2020 8:28 PM
81	Make better and improve what we already have	1/30/2020 7:18 PM
82	Stop allowing beach front development.	1/30/2020 7:00 PM
83	no allow new construction in high hazard areas	1/30/2020 6:46 PM
84	So much of this has already been established. Plans should be made and then don't let offenders off with a slap of the wrist. Example Kaheawa wind farm. Gravel down drain to ocean.	1/30/2020 6:31 PM
85	Put electrical systems underground NOW and promote wireless systems wherever possible and make sure our Civil Servants are well trained and well qualified for the jobs they hold.	1/30/2020 5:30 PM
86	must manage the environment better, keeping streams cleared and open, remove envasive plants-trees-feral animals that redirect flows, clear the sand from blocking waterways into the ocean, and update the regulatory processes to allow for all these changes especially between the Federal, State and County which contradict of make it impossible to get anything done!!!	1/30/2020 4:48 PM
87	Enforcement of regulations, codes and ordinances	1/30/2020 4:12 PM
88	Reach out to school too so have the kids aware of what is going on.	1/30/2020 3:40 PM
89	Stop allowing construction in obvious hazard area close sea level.	1/30/2020 3:24 PM
90	Enforce Residential Aerial Fireworks ban NOW	1/30/2020 3:15 PM
91	Integrate risk reduction into land use + policy plans	1/30/2020 3:14 PM
92	do research and reports to show our government that climate change is real and is happening now!	1/30/2020 3:03 PM
93	Please work on having developers follow strict guidlines and having Planning and permitting department discontinue favoritism when it comes to issuing zoning and development permits!	1/30/2020 3:00 PM
94	Planning Department is ridiculous. Holding applicants' hands to allow them to get away with building illegal structures. They tell the applicants how to get away with things. Clean out the Planning Department from top to bottom.	1/30/2020 2:57 PM
95	Better road access for when emergencies do happen. Our road systems are not conducive to emergencies.	1/30/2020 2:53 PM
96	Address real concerns that can be mitigated.	1/30/2020 2:53 PM
97	Enhance the functions of natural features by regeneration of the aquifer, reforestation, restoration of fishponds and wetlands	1/29/2020 4:10 PM
98	Make food security and resiliency a high priority and fund programs that support self-sufficiency, including training	1/28/2020 9:41 PM
99	Understanding we live on an Island would automatically support risk reduction!!!!!!!	1/28/2020 8:33 PM
100	Strengthen the BUILDING codes and apply to BCEGS!!!	1/28/2020 7:21 PM
101	Reduce regulations, code, and ordinances	1/28/2020 4:42 AM
102	Why not flood control? Too often it works against nature. Don't build on a riverbank!	1/28/2020 1:39 AM
103	Bury more power lines (yes, it can be done, even with the lava rock 9 feet down), commit the state to follow through with the maintenance and upgrades needed at their schools to keep the children safe in an emergency (again, KKHS is a great example: the roof shingles fly off like Oddjob's hat in just 30 mph winds), promote coastal protection measures, and focus on getting our coral healthy to prevent storm erosion (and fix the land erosion to save the corals)	1/28/2020 1:37 AM
104	Tax incentive programs to halt development in disaster prone areas should contain a sunset clause. Conversely, higher taxes should be assessed with mandated requirements to include safety and evacuation elements into General Plan of development.	1/28/2020 12:38 AM
105	move the roads inland	1/27/2020 7:24 PM
106	keep this smart/real. Climate change is real, and its slow and doing the chicken little thing will	1/27/2020 6:21 PM

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only hurt real progress. Let's address wisely - nice start with this survey hopefully!

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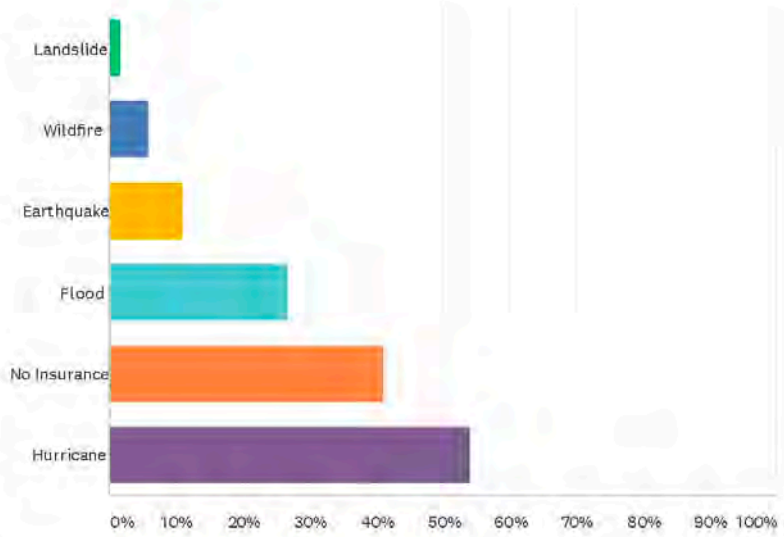
Q8 Have you purchased any insurance policies that cover losses from specific hazards not usually covered by homeowners insurance policies (i.e., flood, landslide, wildfire, earthquake, hurricane)? Check all that apply.

Answered: 458 Skipped: 36



ANSWER CHOICES	RESPONSES	
Landslide	1.75%	8
Wildfire	5.90%	27
Earthquake	11.14%	51
Flood	26.86%	123
No Insurance	41.27%	189
Hurricane	54.15%	248
Total Respondents: 458		

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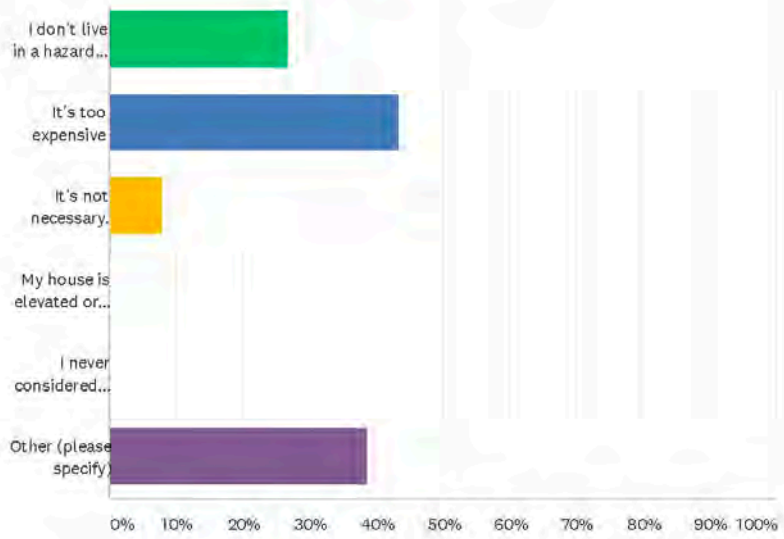
Q9 If not, why not?

Answered: 251 Skipped: 243



ANSWER CHOICES	RESPONSES	
I don't live in a hazard zone.	26.69%	67
It's too expensive	43.43%	109
It's not necessary.	7.97%	20
My house is elevated or otherwise protected	0.00%	0
I never considered flood insurance	0.00%	0
Other (please specify)	38.65%	97
Total Respondents: 251		

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#	OTHER (PLEASE SPECIFY)	DATE
1	n/a	6/26/2020 1:59 PM
2	don't live in a hazard zone	6/26/2020 12:16 PM
3	In many cases some of these are simply not available.	6/26/2020 3:18 AM
4	In the past, insurance has not paid out HI residents for hurricane damage, why would that change?	6/26/2020 2:12 AM
5	I rent, have a go-bag, and subscribe to an impermanence philosophy about life especially regarding material objects.	6/25/2020 11:55 PM
6	I was told by insurer it was not needed in this area; however I am wondering if that is still true, especially for fire	6/25/2020 7:53 PM
7	Insurance minimal coverage, specifications for coverage not adequate for different type of hazards in area of home	6/18/2020 6:06 PM
8	They won't cover any insurance for any of those on my house	6/16/2020 10:28 PM
9	I rent	6/16/2020 3:01 PM
10	Rent home	6/15/2020 8:53 PM
11	Done	6/13/2020 12:41 PM
12	I an a renter...	4/23/2020 7:18 PM
13	Didn't think I needed to.	4/16/2020 12:09 PM
14	renter	4/9/2020 8:31 PM
15	I am a renter	4/4/2020 7:44 PM
16	We rent. Hoolea Terraces condos. Not a lot of hazard in this particular spot. Not many assets.	4/4/2020 5:28 PM
17	Renting	4/2/2020 3:18 AM
18	Renting	4/1/2020 11:49 PM
19	I dont qualify due to no fire hydrant near my home	4/1/2020 8:01 PM
20	Rent	4/1/2020 7:51 PM
21	I rent and no available policy	4/1/2020 7:25 PM
22	wildfire wasn't a known risk factor until sugar co left Maui and sold off their land rather than returning it to the state!	4/1/2020 7:13 PM
23	live with parents	4/1/2020 6:50 PM
24	deductions too high	4/1/2020 6:44 PM
25	Renter	4/1/2020 6:13 PM
26	I rent my home	4/1/2020 6:04 PM
27	Renter not homeowner	4/1/2020 5:59 PM
28	I am a renter, living in an area with few potential hazards.	4/1/2020 5:51 PM
29	Had for 14 years then found NO other tenants had it, so cancelled due to cost.	4/1/2020 5:51 PM
30	Wild fire insurance	3/18/2020 11:47 AM
31	it is not available for my area	2/28/2020 3:01 PM
32	renter	2/26/2020 6:36 PM
33	Consulted with insurance agent and deemed not needed or too expensive	2/19/2020 3:36 PM
34	not a home owner	2/17/2020 1:15 PM

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County of Maui Public Mitigation Planning Survey

35	Insurance company requires hurricane exclusion waiver	2/12/2020 7:05 PM
36	do not own my home	2/10/2020 10:02 PM
37	I rent	2/10/2020 2:43 PM
38	Just moved in. I will buy hurricane soon.	2/8/2020 6:15 PM
39	Self insured risk	2/7/2020 6:29 PM
40	Haven't looked into it.	2/7/2020 6:06 PM
41	Home insurance is not available for our rural area	2/7/2020 4:29 PM
42	i rent	2/5/2020 2:14 PM
43	Not homeowner	2/5/2020 1:01 PM
44	Living in a high risk area	2/5/2020 2:43 AM
45	I self-insure	2/5/2020 2:09 AM
46	Not a homeowner	2/5/2020 1:13 AM
47	I don't own my residence	2/4/2020 3:59 PM
48	I am not the home owner	2/4/2020 2:33 PM
49	I Rent not own	2/4/2020 1:52 PM
50	I'm not the owner	2/4/2020 1:40 PM
51	I rent, do not own	2/4/2020 1:13 PM
52	I don't own my home	2/4/2020 10:45 AM
53	Maui hasn't been hit by hurricane in many years	2/4/2020 3:03 AM
54	I haven't thought about it.	2/3/2020 8:11 PM
55	Dont know - need to check!	2/3/2020 6:29 PM
56	I am a renter	2/3/2020 6:27 PM
57	Cost although we haven't checked...housing cost pressure. Also not sure but I think hurricane coverage will only apply to 75 mph...does that mean that if high wind event occurs that we will not be covered unless it's officially a hurricane?	2/3/2020 1:41 PM
58	I think my condo is covered	2/3/2020 12:50 PM
59	live on fixed income, too expensive	2/2/2020 12:45 PM
60	renting	1/31/2020 3:42 PM
61	Not required	1/31/2020 1:14 PM
62	Thought it was required!	1/30/2020 8:06 PM
63	I do not own the home	1/30/2020 8:06 PM
64	Goverments work w/Insurance co. for revenue people come 2nd	1/30/2020 7:27 PM
65	Not sure why, will discuss with the family	1/30/2020 7:04 PM
66	Have to update.	1/30/2020 6:33 PM
67	It's not part of the standard package that I know of	1/30/2020 5:32 PM
68	Dont own my house	1/30/2020 4:53 PM
69	only one company will insure us at our location	1/30/2020 4:51 PM
70	Inquired about purchasing flood insurance. Pending.	1/30/2020 3:55 PM
71	If it wasn't for my mortgage that requires hurricane insurance, I would not purchase insurance. It's too costly.	1/30/2020 3:47 PM

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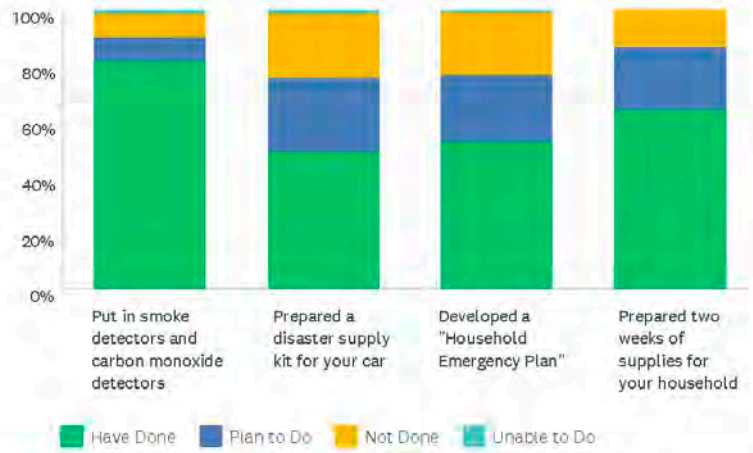
County of Maui Public Mitigation Planning Survey

72	Apartment insurance not available because I do live in a hazard zone.	1/30/2020 3:44 PM
73	I'm saving for that insurance.	1/30/2020 3:36 PM
74	Rent	1/30/2020 3:32 PM
75	NOT A HOMEOWNER	1/30/2020 3:27 PM
76	No good reason to not have earthquake insurance	1/30/2020 3:27 PM
77	Insurance is a complicated subject, wish there was more objective (not from companies) info and guidance on how to go about deciding what you need.	1/30/2020 3:26 PM
78	hyave insurance	1/30/2020 3:26 PM
79	hurricane is required	1/30/2020 3:25 PM
80	Little chance of owning a home on Maui due to cost	1/30/2020 3:17 PM
81	I'm currently renting	1/30/2020 3:14 PM
82	I don't live in a flood zone so I didn't buy flood insurance.	1/30/2020 3:10 PM
83	i rent a very small apartment, minimal loss would occur	1/30/2020 3:08 PM
84	not a homeowner	1/30/2020 3:07 PM
85	Not a home owner.	1/30/2020 3:04 PM
86	low likelyhood of other events	1/30/2020 2:56 PM
87	JUST HAVENT RECEIVED ENOUGH INFORMATION	1/30/2020 2:51 PM
88	Not too sure if homeowner have such insurance policies.	1/30/2020 2:48 PM
89	We are researching Landslide and Wildire presently	1/30/2020 2:48 PM
90	I am not a property owner	1/29/2020 1:11 AM
91	I don't own my home	1/28/2020 7:45 PM
92	Do not own a home.	1/28/2020 7:26 PM
93	I do not own the property	1/28/2020 7:23 PM
94	Cant afford with the cost of living easy tio high on minimum wage.	1/28/2020 1:47 AM
95	We rent, don't own.	1/28/2020 1:46 AM
96	I rent	1/28/2020 12:50 AM
97	We are not homeowners. We rent.	1/27/2020 3:20 PM

County of Maui Public Mitigation Planning Survey

Q10 Have you done, or plan to do any of the following activities?

Answered: 465 Skipped: 29



	HAVE DONE	PLAN TO DO	NOT DONE	UNABLE TO DO	TOTAL	WEIGHTED AVERAGE
Put in smoke detectors and carbon monoxide detectors	82.03% 379	8.23% 38	8.66% 40	1.08% 5	462	1.29
Prepared a disaster supply kit for your car	49.35% 229	26.72% 124	22.84% 106	1.08% 5	464	1.76
Developed a "Household Emergency Plan"	53.23% 247	23.92% 111	22.41% 104	0.43% 2	464	1.70
Prepared two weeks of supplies for your household	64.30% 299	22.58% 105	12.90% 60	0.22% 1	465	1.49

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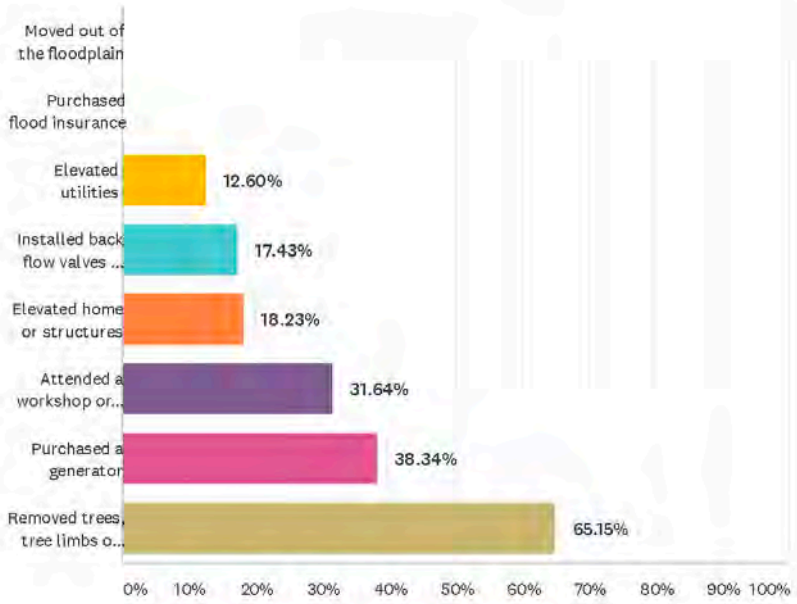
County of Maui Public Mitigation Planning Survey

Q11 What have you done to mitigate risks to your home? Please select all that apply.

Answered: 373 Skipped: 121



ANSWER CHOICES	RESPONSES	
Moved out of the floodplain	0.00%	0
Purchased flood insurance	0.00%	0
Elevated utilities	12.60%	47
Installed back flow valves to prevent reverse-flow flood damages	17.43%	65
Elevated home or structures	18.23%	68
Attended a workshop or class about disaster preparedness	31.64%	118
Purchased a generator	38.34%	143
Removed trees, tree limbs or brush around your home	65.15%	243
Total Respondents: 373		

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County of Maui Public Mitigation Planning Survey

#	OTHER (PLEASE SPECIFY)	DATE
1	keep drains clear	7/2/2020 4:04 PM
2	Both my husband and I are well versed in tree removal and flood mitigation having lived in Maliko Gulch for 4 decades. We are the first responders in the neighborhood. But we're all self reliant here. We can depend on each other in an emergency.	6/29/2020 10:59 PM
3	Metal roof. Little exposed wood. Retention basin.	6/26/2020 5:37 PM
4	live in a condo, these don't apply	6/26/2020 4:01 AM
5	I live in a condo. Homeowners do not control those decisions	6/25/2020 7:53 PM
6	I rent	6/16/2020 3:01 PM
7	We live a simple off-grid lifestyle so would be less impacted than others.	6/15/2020 9:54 PM
8	Purchased a fire extinguisher. Have a battery operated radio, solar lights	6/15/2020 8:53 PM
9	I would like to attend a disaster preparedness workshop.	6/15/2020 4:47 PM
10	Hurricane clips, pre-cut plywood covers for windows.	6/12/2020 11:21 PM
11	Rebuilt our permitted sea wall	6/12/2020 6:22 PM
12	Live in a condo	4/23/2020 3:10 PM
13	renter not done any, nor is it needed where i live	4/9/2020 8:31 PM
14	see 9 above	4/4/2020 5:28 PM
15	I am a renter	4/2/2020 7:18 PM
16	I live in a condominium.	4/1/2020 11:45 PM
17	Added structural reinforcing	4/1/2020 8:11 PM
18	Past member of CERT	4/1/2020 7:25 PM
19	I live in a condominium, which has done some of these items.	4/1/2020 7:01 PM
20	I rent my home	4/1/2020 6:04 PM
21	Do NOT own property, live in rental apartment	4/1/2020 5:51 PM
22	Created a fire break around property, fuel reduction measures.	3/18/2020 11:47 AM
23	Bought 4 fire hoses	3/13/2020 6:54 PM
24	Improved drainage patterns around home to reduce flooding.	3/5/2020 4:53 PM
25	na	2/26/2020 6:36 PM
26	CERT	2/19/2020 3:36 PM
27	People need to realize they need to take care of themselves, be more self sufficient.	2/13/2020 2:59 PM
28	Installed hurricane ties	2/10/2020 12:36 AM
29	regularly clear drainage	2/7/2020 8:15 PM
30	Hurricane clips, pre-cut and stored wood panels to cover windows	2/7/2020 6:29 PM
31	I live in a condo, so much of the above is done on my behalf.	2/7/2020 6:06 PM
32	We keep all the doors and windows closed. This kept out smoke during the fire in July 2019, when we couldn't get home to our pets.	2/6/2020 4:58 PM
33	Purchased firearms.	2/5/2020 7:41 PM
34	We are completely off the grid. We therefore have our own water supply and electrical supply, that includes solar panels, battery storage, and a backup generator with a month's supply of diesel. We grow our own food and have supplies that will last a month.	2/5/2020 3:42 PM

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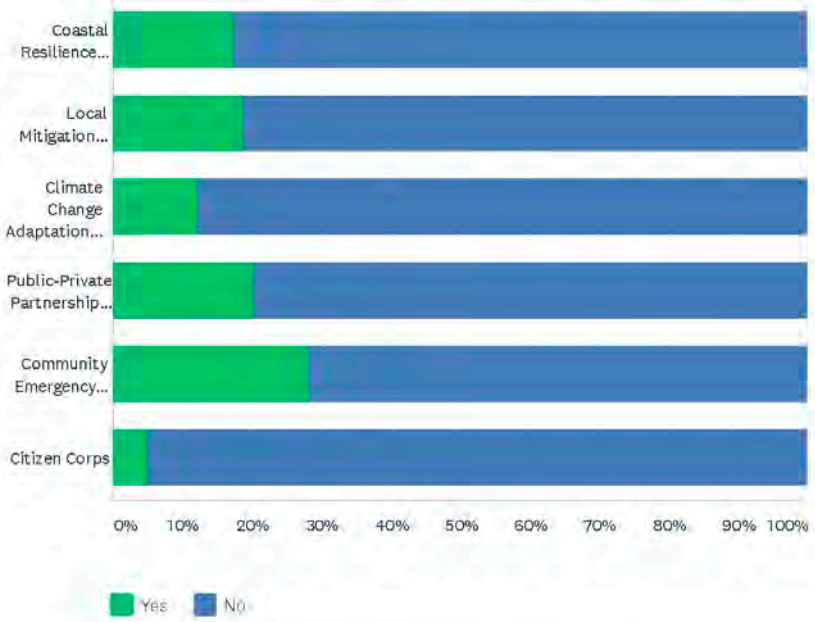
County of Maui Public Mitigation Planning Survey

35	secure large loose objects	2/5/2020 12:14 PM
36	UHMaui College sustainability classes. Ag bus classes Organic farming	2/5/2020 1:40 AM
37	Underground utilities, protective film on windows, additional hurricane clips	2/5/2020 1:14 AM
38	The manager in our building does prepare the property for all residents and leaves " to do" incase of emergencies	2/4/2020 1:52 PM
39	Purchased ply wood to board up home	2/4/2020 10:45 AM
40	Planted drought tolerant plants and trees that can also absorb a lot of water to look pretty while also helping with flooding.	2/3/2020 3:49 PM
41	Would like to purchase a solar type generator but haven't been able to find on island	2/3/2020 3:22 PM
42	Educate self about what is needed if a tsunami or hurricane came	2/3/2020 2:11 PM
43	Used high energy efficient appliances in my home.	2/3/2020 12:01 PM
44	Hurricane clips	1/31/2020 2:12 PM
45	Need education about these things.	1/30/2020 5:32 PM
46	Live in condo so much of this is handled by property management	1/30/2020 5:32 PM
47	none	1/30/2020 5:08 PM
48	reinforced bottom floor of home, tried to keep waterway nearby open but County keeps stopping me	1/30/2020 4:51 PM
49	The Church of Jesus Christ of Latter-day Saints Emergency Preparedness classes	1/30/2020 4:34 PM
50	Installed hurricane clips	1/30/2020 4:01 PM
51	Purchased PV with battery.	1/30/2020 3:51 PM
52	Installed hurricane clips	1/30/2020 3:41 PM
53	added hurricane straps	1/30/2020 3:37 PM
54	I live in a condo so I asked property manager to address the trees, limbs, etc to reduce risk	1/30/2020 3:36 PM
55	Our home was built in 1931 and is already elevated to a degree. Utilities are above ground.	1/30/2020 3:18 PM
56	Removed satellite dish from roof due to high winds possibly causing damage (had to change cable TV carriers)	1/30/2020 3:14 PM
57	I am looking into hurricane ties/straps for my roof as well as earthquake ties for my post and pier foundation; whether I have them or not and if they are needed for my home. I am also considering solar power with a battery in case power is out for several days or more.	1/30/2020 3:10 PM
58	read information about emergency preparedness	1/30/2020 3:07 PM
59	We will be purchasing a generator	1/30/2020 2:48 PM
60	bought a cat	1/28/2020 7:23 PM
61	In Oregon we were members of CERT -- community emergency response team.	1/28/2020 1:46 AM
62	Battery backup solar with grid tie	1/28/2020 12:58 AM

County of Maui Public Mitigation Planning Survey

Q12 Have you participated in any of the following activities to make your community safer?

Answered: 451 Skipped: 43



	YES	NO	TOTAL
Coastal Resilience Planning	17.47% 76	82.53% 359	435
Local Mitigation Planning	18.79% 81	81.21% 350	431
Climate Change Adaptation Planning	12.21% 52	87.79% 374	426
Public-Private Partnership Initiative to Address Disaster-Related Issues	20.28% 87	79.72% 342	429
Community Emergency Response Team	28.41% 123	71.59% 310	433
Citizen Corps	4.95% 20	95.05% 384	404

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County of Maui Public Mitigation Planning Survey

#	OTHER (PLEASE SPECIFY)	DATE
1	Volunteer for conservation groups.	6/26/2020 5:37 PM
2	CERT train the trainer	6/17/2020 5:26 PM
3	Red Cross	6/12/2020 11:21 PM
4	None because activities are in the evenings	4/7/2020 5:04 PM
5	Was unaware these existed.	4/4/2020 5:28 PM
6	Providing personal mask which can also be worn over N-95 to doctor and soon to hospital.	4/1/2020 8:36 PM
7	I have investigated some of those, and tried a few groups over the years. After all the work, absolutely nothing changed, and some groups get bogged down in process and never make progress.	4/1/2020 7:01 PM
8	I think these need to be made known and available to citizens.	4/1/2020 5:53 PM
9	I attend West Maui CPAC meetings, Mayor meetings relating to important issues, an the meetings after Hurricane Lane's wildfire in Lahaina	3/13/2020 7:48 PM
10	When are the above-listed activities available to the public?	3/3/2020 3:26 PM
11	Building a hazard mitigation facility/shelter with off grid infrastructure at Kaupo School. In past, DMAT team member, Maui Civil Defense & ARES/Races communications, etc.	2/28/2020 3:55 PM
12	I am filling out this survey	2/6/2020 4:58 PM
13	Girl scouts	2/5/2020 1:40 AM
14	With outreach to advise community about dates and times of such specific planning meetings, I or a member of my family would attend	2/4/2020 3:07 PM
15	Worked for 16 months on West Maui Disaster Emergency Plan and seeking inclusion from MEMA in Establishing West Maui Command Authority for communications and info.	1/31/2020 6:16 PM
16	Volunteer for County's Emergency Command Center	1/30/2020 9:00 PM
17	Assisted MFD (clerical & whatever else needed) during emergency situations, e.g., Hurricane Lane & Lahaina Fire.	1/30/2020 7:50 PM
18	BE ready to assist in any emergency	1/30/2020 7:27 PM
19	Most activities listed are not available in our community.	1/30/2020 7:02 PM
20	your kidding right, none of that happens and when anything close to it does it is all talk and delays any possibility of things being done	1/30/2020 4:51 PM
21	Just keeping others generally aware	1/30/2020 3:36 PM
22	Would love to know more about how to participate in those things.	1/30/2020 3:32 PM
23	Climate change education and awareness directed particularly toward under18 in the form of contributing to presentations and materials in schools	1/30/2020 3:29 PM
24	Disaster Planning for Seniors	1/30/2020 3:26 PM
25	I am hoping to participate in the next CERT training. I am interested in reading about the others to learn more about them before spending more time and energy on them.	1/30/2020 3:10 PM
26	only saw CERT training no other, would like it offered again. please promote others more	1/30/2020 3:07 PM
27	The climate will always be changing! Please research Climate Engineering...it's worth the time and effort and it's happening right above you in the air with airplanes. What goes up must come down. This poison is polluting air, land , and sea. Look in to it!!!!!!!!!!!!!! geoengineeringwatch.org	1/30/2020 3:04 PM
28	Recommending to have the activities not on business hours. So actual locals can attend.	1/28/2020 8:35 PM
29	Held and taught classes on disaster preparedness	1/28/2020 1:39 AM
30	Amateur Radii Emergency Services (ARES), Voluntary Organizations Active in Disaster	1/28/2020 12:58 AM

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County of Maui Public Mitigation Planning Survey

	(VOAD), Civil Air Patrol	
31	CERT Certified	1/28/2020 12:41 AM
32	deeply involved in community and emergency response planning.	1/27/2020 6:24 PM
33	Team Rubicon	1/27/2020 4:01 PM

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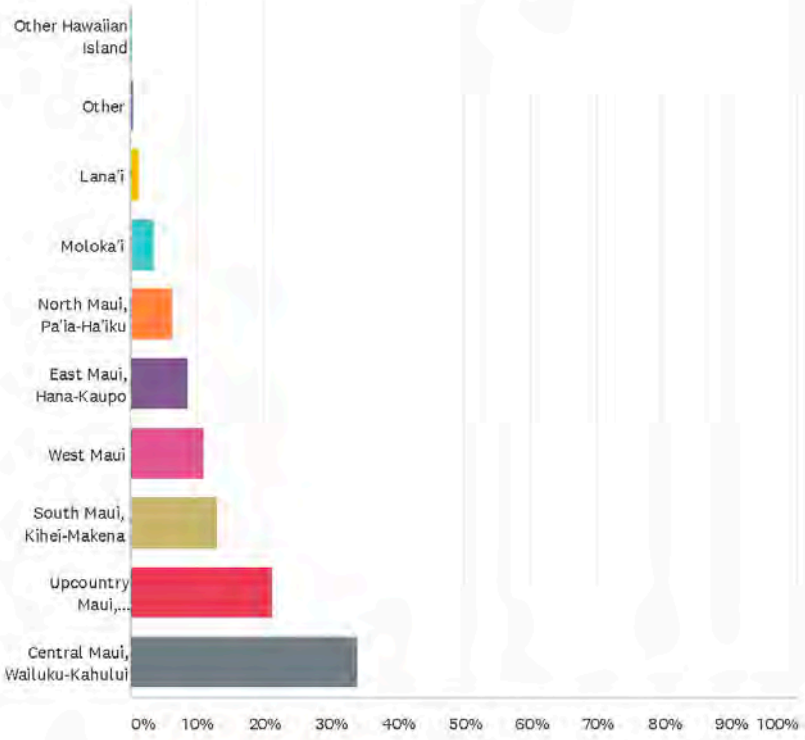
County of Maui Public Mitigation Planning Survey

Q13 Where do you live?

Answered: 459 Skipped: 35



ANSWER CHOICES	RESPONSES	
Other Hawaiian Island	0.22%	1
Other	0.44%	2
Lana'i	1.31%	6
Moloka'i	3.49%	16
North Maui, Pa'ia-Ha'iku	6.32%	29
East Maui, Hana-Kaupo	8.50%	39
West Maui	11.11%	51
South Maui, Kihei-Makena	13.07%	60
Upcountry Maui, Makawao-Pukalani-Kula	21.35%	98
Central Maui, Wailuku-Kahului	34.20%	157
TOTAL		459

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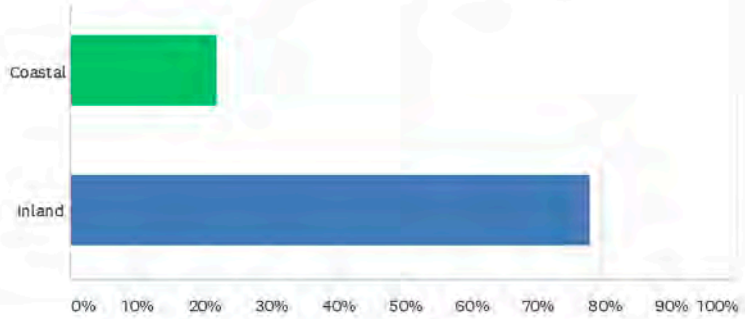
County of Maui Public Mitigation Planning Survey

Q14 Do you consider your home to be coastal or inland?

Answered: 461 Skipped: 33



ANSWER CHOICES	RESPONSES	
Coastal	21.91%	101
Inland	78.09%	360
TOTAL		461

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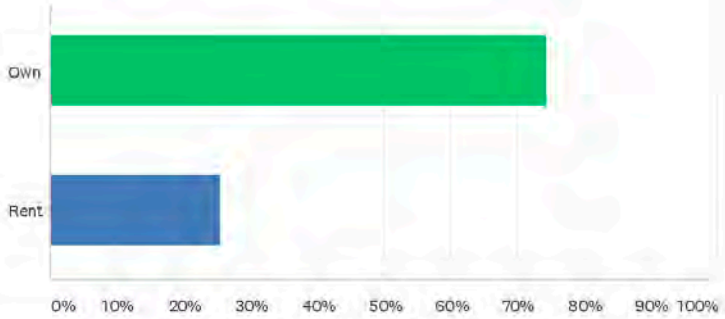
County of Maui Public Mitigation Planning Survey

Q15 Do you own or rent your home?

Answered: 460 Skipped: 34



ANSWER CHOICES	RESPONSES	
Own	74.57%	343
Rent	25.43%	117
TOTAL		460

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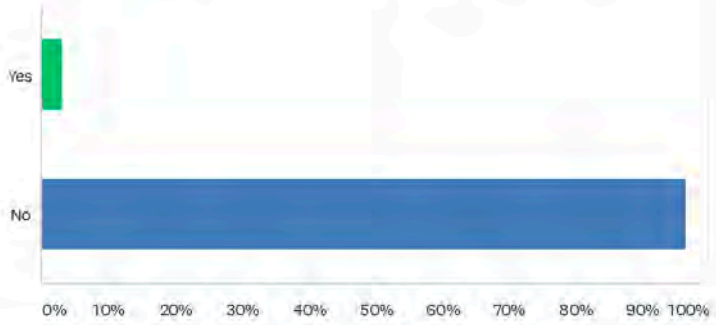
County of Maui Public Mitigation Planning Survey

Q16 Are you a part-time or seasonal resident?

Answered: 459 Skipped: 35



ANSWER CHOICES	RESPONSES	
Yes	3.05%	14
No	96.95%	445
TOTAL		459

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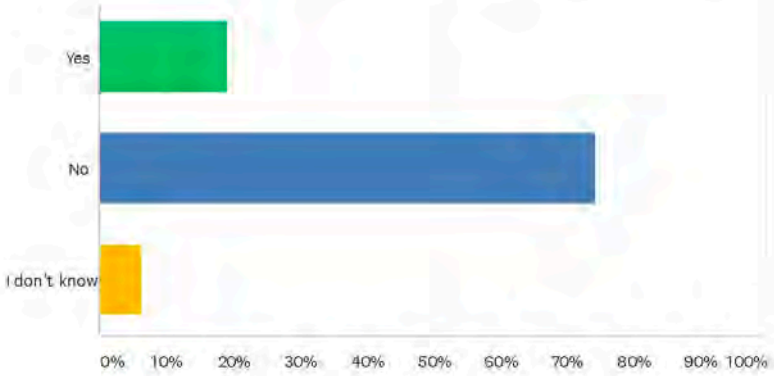
County of Maui Public Mitigation Planning Survey

Q17 Do you live in a tsunami evacuation zone?

Answered: 461 Skipped: 33



ANSWER CHOICES	RESPONSES	
Yes	19.31%	89
No	74.40%	343
I don't know	6.29%	29
TOTAL		461

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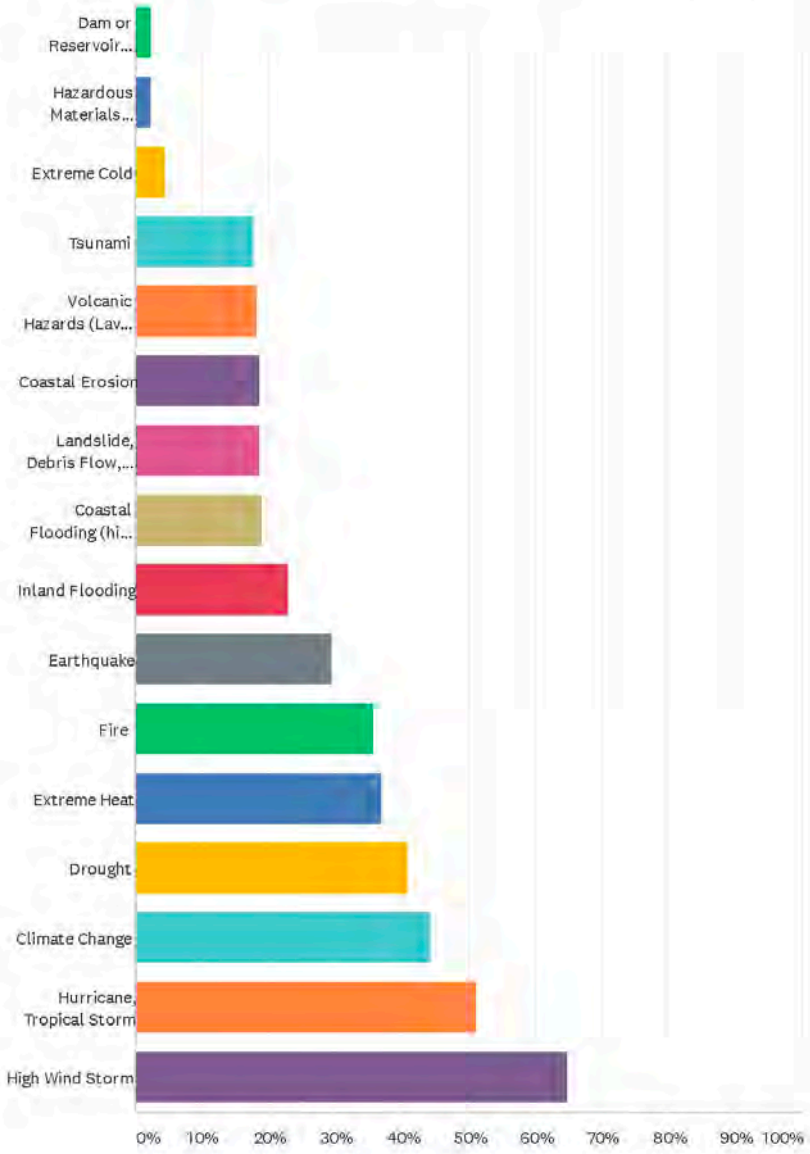
County of Maui Public Mitigation Planning Survey

Q18 In the past 20 years, have any of the following hazards impacted you, a member of your household or your property? Check all that apply.

Answered: 383 Skipped: 111



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County of Maui Public Mitigation Planning Survey

ANSWER CHOICES	RESPONSES	
Dam or Reservoir Failure	2.35%	9
Hazardous Materials Incidents	2.35%	9
Extreme Cold	4.44%	17
Tsunami	17.75%	68
Volcanic Hazards (Lava, Vog)	18.28%	70
Coastal Erosion	18.54%	71
Landslide, Debris Flow, Rockfall	18.54%	71
Coastal Flooding (high surf, sea level rise)	19.06%	73
Inland Flooding	22.98%	88
Earthquake	29.50%	113
Fire	35.77%	137
Extreme Heat	37.08%	142
Drought	40.73%	156
Climate Change	44.39%	170
Hurricane, Tropical Storm	51.17%	196
High Wind Storm	64.75%	248
Total Respondents: 383		

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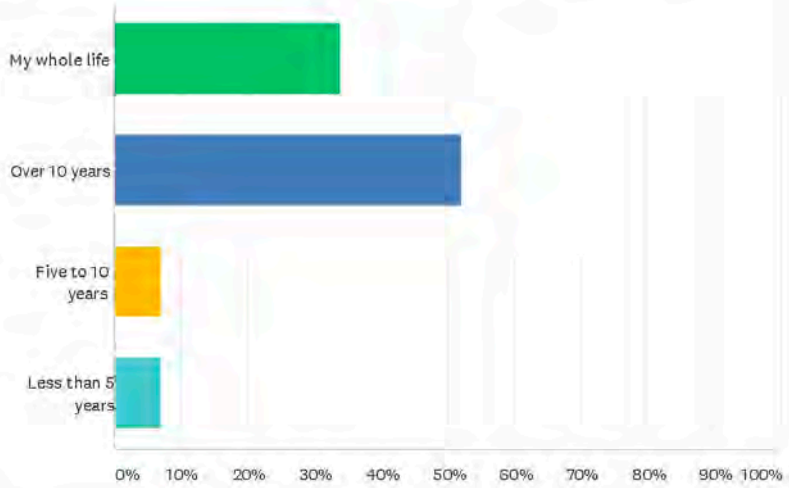
County of Maui Public Mitigation Planning Survey

Q19 How long have you lived in Maui County?

Answered: 459 Skipped: 35



ANSWER CHOICES	RESPONSES	
My whole life	33.99%	156
Over 10 years	52.07%	239
Five to 10 years	6.97%	32
Less than 5 years	6.97%	32
TOTAL		459

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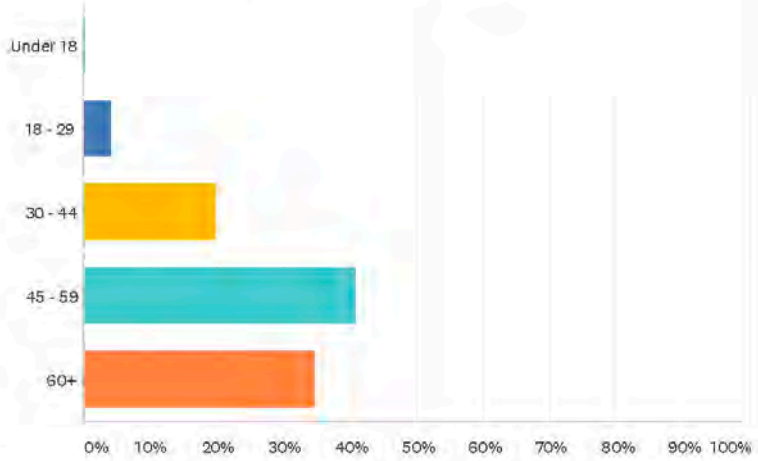
County of Maui Public Mitigation Planning Survey

Q20 What is your age?

Answered: 452 Skipped: 42



ANSWER CHOICES	RESPONSES	
Under 18	0.22%	1
18 - 29	4.20%	19
30 - 44	19.91%	90
45 - 59	40.93%	185
60+	34.73%	157
TOTAL		452

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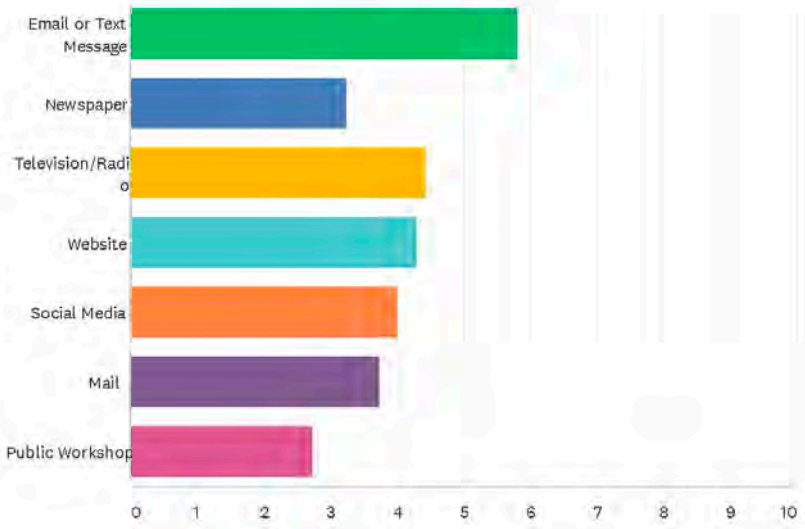
County of Maui Public Mitigation Planning Survey

Q21 What is the most effective way for you to receive information about how to make your home or neighborhood safer? Please rank the following from best to worst (1-7).

Answered: 452 Skipped: 42



	1	2	3	4	5	6	7	TOTAL	SCORE
Email or Text Message	60.68% 250	10.68% 44	8.74% 36	4.85% 20	5.10% 21	5.10% 21	4.85% 20	412	5.82
Newspaper	4.27% 17	9.30% 37	12.81% 51	17.34% 69	15.08% 60	18.84% 75	22.36% 89	398	3.24
Television/Radio	12.32% 50	19.95% 81	22.91% 93	14.78% 60	12.32% 50	9.61% 39	8.13% 33	406	4.44
Website	7.84% 32	17.65% 72	21.57% 88	22.06% 90	15.20% 62	11.52% 47	4.17% 17	408	4.30
Social Media	8.98% 37	22.57% 93	15.05% 62	13.11% 54	12.38% 51	10.68% 44	17.23% 71	412	4.02
Mail	9.48% 40	14.69% 62	9.48% 40	18.25% 77	16.82% 71	18.25% 77	13.03% 55	422	3.75
Public Workshop	3.11% 13	5.02% 21	10.53% 44	10.05% 42	19.38% 81	20.10% 84	31.82% 133	418	2.75

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County of Maui Public Mitigation Planning Survey

Q22 Please feel free to provide additional comments in the space provided.

Answered: 44 Skipped: 456

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County of Maui Public Mitigation Planning Survey

#	RESPONSES	DATE
1	Older folks are not going to go to social media or email for how to prepare. Would be more useful in a disaster	6/26/2020 12:24 PM
2	Not all adults have facebook. Need additional methods to communicate.	6/25/2020 11:16 PM
3	Public workshops designed for different areas of the island would be most helpful.	6/25/2020 5:26 PM
4	Mahalo for involving the public. However, most people I have talked to don't know about this survey and I would encourage wider participation. I will place the link on my social media sites.	6/15/2020 4:50 PM
5	Lahaina is one of the most important economic areas of Maui County. More should be done to protect/help us...	4/23/2020 7:20 PM
6	Knowledge is power. This Covid19 pandemic operation has been a PERFECT example of WHY we need to educate and continue to share information to Our communities about the "what if's". It hurts to know our "Triumph" President wouldn't give a shit, if a hazard or disaster came thru Maui. Let's think of different ways to share and educate knowledge even when our neighbors don't take it serious. Someways to keep our communities educated in a more fun way, is to get	4/16/2020 12:39 PM
7	You were not clear about the numbering system above. Email is by far the best way to reach me. Mail will work too, but the other options will not reach me at all.	4/10/2020 2:52 PM
8	Offer Public Workshop signups on voting day. Would get many volunteers regardless of party affiliation.	4/4/2020 5:31 PM
9	I assume "best" is 1 and 7 is "worst". Most survey scales are just the opposite.	4/3/2020 1:51 PM
10	The most effective way to make my home and neighborhood safer would be to move Honoapiilani Highway inland,and build 2 more lanes over the pali.	4/1/2020 7:04 PM
11	it seems that all the meetings we attend, we speak of the same solutions, yet zero gets done.	4/1/2020 5:58 PM
12	end the vacation rentals, take control of tourism so we can control the amount of rental cars that can be on the road and the amount of guests that are on the island at one time	4/1/2020 5:56 PM
13	I'd like to know whether these issues are being addressed. Many citizens are in the dark. There should be a website with information.	4/1/2020 5:56 PM
14	The wild fires seem to be getting worse each year. We need an action plan before a calamity happens.	3/13/2020 6:57 PM
15	We live in a very remote part of maui, susceptible to natural processes. My home & family is well prepared and very secure, but there are many in SouthEast Maui who are regularly affected by weather and other events. They have no drinking water availability and are in trouble when the road closes. Also there are buses and cars of tourists traversing the area, who get stuck in the area when rivers rise or brushfires occur. We would like assistance to prepare our Kaupo community to be more able to support & educate residents & visitors when conditions require.	2/28/2020 4:01 PM
16	The fire department saved our house during the July 2019 fire because they quickly created a firebreak in the vacant field behind our house. Efforts like those prevented loss of life and property because roads were closed and we could not get home.	2/6/2020 5:04 PM
17	County & State agencies need to take action. I have been thru bunches of "planning" meetings. Nothing ever seems to come of it. After several years, roads & shorelines are still eroding away - we just get more planning & discussion meetings. At what point are these plans put into physical action? Yesterday's meeting was a perfect example.	2/6/2020 2:17 PM
18	No more strict building codes! They're onerous enough as they are!	2/6/2020 6:07 AM
19	It is time to open more fire stations around Maui to serve the growing community: Waiehu/Wainee, Haiku, Kaupo, Waikapu, Olowalu/Launiopoko, Manele all need to be built and staffed.	2/5/2020 7:46 PM
20	Operate by the laws of the Hawaiian kingdom. Respect the aina Reconigise we are an ecosystem. Do not depend pillage for profit. Ban toxic chemical on food production. Use biodiversity planing to support a healthy ecosystem.	2/5/2020 1:47 AM
21	We should find a way to make it easy and promote how visitors can get connected to our	2/5/2020 1:21 AM

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County of Maui Public Mitigation Planning Survey

	emergency alert services while they're here, like alerts they can easily opt into when they arrive at the airport. Put posters and displays and information in the airport exit area and baggage claim with QR code, URL, twitter @ etc to quickly subscribe to alert services while in Hawaii. We have these services for residents to sign up for, and we can promote that more too, but it seems like an easy way to sign up for these while visiting should be heavily promoted to all arrivals so our visitor population can be informed and less likely to suffer from lack of preparedness and awareness (and less likely to cost the taxpayers to rescue them).	
22	Neighborhood meetings	2/4/2020 8:55 PM
23	Again, There Will be a Sink Hole Open up on the Hwy near Olowalu. I have driven that Hwy for 29 years and recently (the last couple years) there is a humming sound similar to that which you hear when going over a bridge. It occurs close to the Olowalu general store and camp Olowalu, on Both the South Side of that area and the North Side.	2/4/2020 3:12 PM
24	I think increading building is such a failure for our island and community. Its clear greed is more important then anything else, Ocean, safety Land, its causing major Issues and more roads is just bringing more cars Which is such a hazard for everyone on the roads. Accidents daily, dirty water, corrosion's	2/4/2020 1:56 PM
25	I rated Newspaper the worst, but the Lahaina News is very effective as most of my family reads it. Protect full-time residents of Maui before part time and off island property owners.	2/3/2020 3:53 PM
26	no public funds should be spent to bail out people with homes/property at risk from erosion. It's a natural process, they should expect that it will occur, that's what you get if you live or build your hotel/condo on the coastline or choose to live on a river	2/3/2020 12:49 PM
27	Please include West Maui for meetings and have them in West Maui not elsewhere please.	1/31/2020 6:18 PM
28	During the wildfires I was separated from my 5 year old daughter, there was no way to pick her up from school. It's unacceptable that an entire town can be cut-off when there is an easy way to create another road out of town (to upcountry).	1/31/2020 2:14 PM
29	The problems are occurring and no one seems to notice what is happening on East Molokai or care. It is a one lane road already, flooding is worse and more frequent, and we can explain what is happening and why - no need a big study - but between Corps of Engineers, State Hwy & DOH Clean Water, EPA, County Planning & Public Works, DLNR - it is ridiculous how responsibility gets passed off between agencies. Then factor in absentee land owners, out of State land owner (vacation rentals), unpaid taxes, those of us who live here and do pay taxes are having to do all the leg work and paying more and more. If you do not live here, do not pay your taxes, then you should not be compensated for your loss. Only those who do live, work and retire here should be compensated	1/30/2020 4:58 PM
30	I really enjoy public seminars, workshops, classes. I enjoy Webinars as well	1/30/2020 4:37 PM
31	For the elderly or those that do not use computers; pls ask to say phone/contact info. on announcements and not refer to website only	1/30/2020 4:17 PM
32	Elderly people don't have access or use the internet to get information and usually stay at home so won't attend workshops. Family need to get involved to help the elderly or physically challenged people.	1/30/2020 3:58 PM
33	Please offer workshops continuously because some people have busy schedule.	1/30/2020 3:46 PM
34	For Q4 "...the use of tax dollars (federal and/or local) to compensate land owners for not developing in areas subject to natural hazards." I selected disagree but I would agree to offering land owners tax incentives or density bonuses for development outside of areas subject to natural hazards. But I wouldn't agree to giving them cash to develop outside of an area subject to natural hazards. Secondly, I'd like to qualify my answer that I support the "... use of local tax dollars to reduce risks and losses from natural disasters.," for the public good. Like protecting or moving the WWTF out of the SFHA, but not for private entities. Thanks for the opportunity.	1/30/2020 3:28 PM
35	County needs better outreach, promote classes and workshops more. get the mayor to talk about climate change and emergency and safety preparedness for the public. my family has been here over 20 years and during that time i have seen a big difference on the island that climate change has effected. Hazards have happened and the response is not always coordinated well or quickly. i've lived across different areas of the island and seen how some of the hazards and climate change have impacted them. there should be more outreach into the	1/30/2020 3:19 PM

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County of Maui Public Mitigation Planning Survey

	community, churches, schools, centers, government workers, etc to reach people and teach them preventative actions and safety measures to do in times needed.	
36	I am concerned about the maintenance of water reservoirs statewide and keeping them from collapse.	1/30/2020 3:12 PM
37	I'm tired of seeing newbies complain about losing their investment in their shoreline properties. They took the risk and they have to live with it. They should not be helped out by using our tax dollars to save their investment. If they can't afford to mitigate on their own, well tough luck for them. Yes, save local beaches. But don't save the beaches that are now only used by these newbies. Local people were driven away from these beaches LONG AGO.	1/30/2020 3:06 PM
38	We need to consider an increase in our public safety staff. In the event of disaster, our local resources will be overrun very quickly. We should also increase the quantities of generators and emergency supplies since we would have to wait for things to be sent here from the mainland.	1/30/2020 2:57 PM
39	I have lived on Maui for almost 50 years and the change in our climate the last few years is tremendous.	1/30/2020 2:54 PM
40	I feel the maui police department Fire department & D.N.L.R need more money to create more education for our community to help understand couses&prevention& to protect&rescue as they do.	1/28/2020 9:16 PM
41	Do presentation to community organization.	1/28/2020 3:43 PM
42	Glad you're asking!	1/28/2020 1:50 AM
43	Protect coastal areas, it provides sustenance for people who fish and leisure for all to enjoy. Bridges and roadway on Hana Hwy. should be inspected for safety and overhanging brush should be cleared on regular basis. Though they don't happen as often, why are we allowing massive free burns releasing so many carcinogens into the air.	1/28/2020 12:49 AM
44	Great survey - would be so please to take a calculated, engineering approach to climate change and less of the horrible fear mongering you hear from half of the county council. Wish people would stop scaring the daylights out of kids too ... we can solve anything that comes at us, true in the past, true in the future.	1/27/2020 6:27 PM

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Appendix B: Risk Assessment Supporting Materials

Vulnerability Subcomponents and Data Sources

Household Composition and Special Needs			
Field Name	***Description***	***Source***	***Census ACS Table***
Population_65Plus	Count of population aged 65 years and older.	US Census ACS 5-Year Estimates, 2014 - 2018	S0101
Percent_65Plus	Percentage of the total population that is aged 65 and older.		S0101
Population_Under18	Count of population aged 17 years and younger.		S0101
Percent_Under18	Percentage of the total population that is aged 17 and younger.		S0101
Disabled_Population	Count of civilian non-institutionalized population that has a disability.		DP02
Percent_Disabled	Percentage of the civilian non-institutionalized population that has a disability.		DP02
Single_Parent_HH_w_Children	Count of single-parent households with children at home.		DP04
Percent_Single_Parent_HH_w_Children	Percentage of total households that are single parents with children at home.		DP04

Socioeconomic Status			
Field Name	***Description***	***Source***	***Census ACS Table***
Population_in_Poverty	Count of population with income below poverty level.	US Census ACS 5-Year Estimates, 2014 - 2018	B17001
Percent_Poverty	Percentage of the population (for whom poverty status has been determined) with income below poverty level.		B17001
Unemployed_Civilian_Labor_Force	Count of unemployed persons in the civilian labor force.		DP03

Unemployed_Rate_Civilian_Labor_Force	Unemployment rate of the civilian labor force.		DP03
Population_25Plus_Non_HS_Grad	Count of persons aged 25 and older that did not complete high school.		B06009
Percent_25Plus_Non_HS_Grad	Percentage of persons aged 25 and older that did not complete high school.		B06009
Percapita_Income	Per capita income (total income/ total population).		B19301
Households_Receiving_Public_Assistance_Food_Stamps_SNAP	Count of total households receiving public assistance income, food stamps, or Supplemental Nutrition Assistance Program (SNAP) benefits.		B19058
Percent_Households_Public_Assistance	Percentage of total households receiving public assistance income, food stamps, or Supplemental Nutrition Assistance Program (SNAP) benefits.		B19058

Access to Information			
Field Name	***Description***	***Source***	***Census ACS Table***
Population_English_Less_than_Well	Count of population that speaks English "not well" or "not at all."	US Census ACS 5-Year Estimates, 2014 - 2018	B16005
Percent_Population_English_Less_than_Well	Percentage of total of total population that speaks English "not well" or "not at all."		B16005
Occupied_Housing_No_Telephone_Service	Count of occupied housing units that do not have telephone service.		B28011
Percent_No_Telephone_Service	Percentage of occupied housing units that do not have telephone service.		B28011
Household_No_Internet	Count of households that do not have internet access.		B25043
Percent_No_Internet_Access	Percentage of total households that do not have internet access.		B25043

Housing Characteristics

Field Name	*Description*	*Source*	*Census ACS Table*
Housing_10_or_More_Units	Count of housing structures that are comprised of 10 or more total housing units.	US Census ACS 5-Year Estimates, 2014 - 2018	DP04
Percent_Housing_10_or_More_Units	Percentage of total units in structure that are comprised of 10 or more total housing units.		DP04
Group_Quarters_Population	Count of population living in group quarters (e.g., nursing homes)		B26001
Percent_Group_Quarters_Population	Percentage of total population living in group quarters (e.g., nursing homes)		B26001
Housing_Units_Over_1_Persons_per_Room	Count of occupied housing units with more than 1 person per room.		DP04
Percent_Over_1_Persons_per_Room	Percentage of occupied housing units with more than 1 person per room.		DP04
Housing_Built_Before_1950	Count of total units built before 1950.		B25034
Percent_Built_Before_1950	Percentage of total housing units built before 1950.		B25034

Access to Lifelines			
Field Name	***Description***	***Source***	***Census ACS Table***
Uninsured_Civilian_NonInstitutionalized_Pop	Count of the civilian non-institutionalized population that does not have health insurance.	US Census ACS 5-Year Estimates, 2014 - 2018	S2701
Percent_Uninsured_Civilian_NonInstitutionalized_Pop	Percentage of the civilian non-institutionalized population that does not have health insurance.		S2701
Occupied_Housing_No_Vehicle	Count of occupied housing units that do not have a vehicle.		DP04
Percent_Housing_No_Vehicle	Percentage of occupied housing units that do not have a vehicle.		DP04
Road_Length_Mi	Total miles of road in the community planning area.	State of Hawaii, Office of Planning, Statewide GIS Office, 2018	N/A
Road_Density_Mi_Per_SqMi	Ratio of miles of road per total sq. miles of area.		

		(Assessed only at Community Planning Area Level)	

Census Tract Aggregation

NAME	Island	Planning Area
Census Tract 301	Maui	Hana
Census Tract 307.08	Maui	Kihei-Makena
Census Tract 307.10	Maui	Kihei-Makena
Census Tract 307.09	Maui	Kihei-Makena
Census Tract 307.06	Maui	Kihei-Makena
Census Tract 307.07	Maui	Kihei-Makena
Census Tract 303.03	Maui	Kihei-Makena
Census Tract 307.05	Maui	Kihei-Makena
Census Tract 316.01	Lanai	Lanai
Census Tract 304.02	Maui	Makawao-Pukalani-Kula
Census Tract 303.01	Maui	Makawao-Pukalani-Kula
Census Tract 304.03	Maui	Makawao-Pukalani-Kula
Census Tract 304.04	Maui	Makawao-Pukalani-Kula (93% by population); Paia-Haiku (7% by population)
Census Tract 319	Moloka'i	Moloka'i
Census Tract 317	Moloka'i	Moloka'i
Census Tract 318.01	Moloka'i	Moloka'i
Census Tract 9800	Kaho'olawe	N/A (no population living on-island)
Census Tract 305.01	Maui	Paia-Haiku
Census Tract 302.02	Maui	Paia-Haiku
Census Tract 302.01	Maui	Paia-Haiku
Census Tract 310	Maui	Wailuku-Kahului
Census Tract 311.03	Maui	Wailuku-Kahului
Census Tract 309.01	Maui	Wailuku-Kahului
Census Tract 309.02	Maui	Wailuku-Kahului

Census Tract 309.03	Maui	Wailuku-Kahului
Census Tract 311.02	Maui	Wailuku-Kahului
Census Tract 308	Maui	Wailuku-Kahului
Census Tract 311.01	Maui	Wailuku-Kahului
Census Tract 319	Maui	Wailuku-Kahului
Census Tract 314.04	Maui	West Maui
Census Tract 315.01	Maui	West Maui
Census Tract 314.05	Maui	West Maui
Census Tract 314.02	Maui	West Maui
Census Tract 315.02	Maui	West Maui
Census Tract 315.03	Maui	West Maui
Census Tract 320	Maui	West Maui (66% by population); Kihei-Makena (34% by population)

Appendix C: Capability Assessment Supporting Materials

Community Rating System

NFIP/CRS

COMMUNITY RATING SYSTEM

VERIFICATION REPORT

Maui County, HI

NFIP Number: 150003

Date of Verification Visit: July 20, 2017

Verified Class 7

Cycle

This Verification Report is provided to explain the recommendations of Insurance Services Office, Inc. (ISO) to DHS/FEMA concerning credits under the Community Rating System (CRS) for the above named community.

A total of 1794 credit points are verified which results in a recommendation that the community improve from a CRS Class 8 to a CRS Class 7. The following is a summary of our findings with the total credit points for each activity noted in parenthesis:

Activity 310 – Elevation Certificates: The Department of Planning maintains elevation certificates for new and substantially improved buildings. Copies of elevation certificates are made available upon request. Elevation Certificates are also kept for post-FIRM buildings. (55 points)

Activity 320 – Map Information Service: Credit is provided for furnishing inquirers with basic flood zone information from the community's latest Flood Insurance Rate Map (FIRM). Credit is also provided for the community furnishing additional FIRM information, flood depth data and special flood related hazards (coastal erosion and tsunami zones). The service is publicized annually and records are maintained. (90 points)

Activity 330 – Outreach Projects: Credit is provided for general outreach projects that include evacuation route signs, no dumping signs and "Subject to Flooding" signs. These projects are disseminated annually. (14 points)

Activity 340 – Hazard Disclosure: Credit is provided for state and community regulations requiring disclosure of flood hazards. Real estate agents provide a brochure advising prospective buyers about insurance and checking property flood hazards. (18 points)

Activity 350 – Flood Protection Information: Documents relating to floodplain management are available in the reference section of the Wailuku Public Library. Credit is also provided for floodplain information displayed on the community's website. (84 points)

Activity 410 – Floodplain Mapping: Credit is provided for conducting and adopting flood studies for areas not included on the FIRMs and that exceed minimum mapping standards. (28 points)

Activity 420 – Open Space Preservation: Credit is provided for preserving approximately 38 percent of the Special Flood Hazard Area (SFHA) as open space and preserving open space land in a natural state. Credit is also provided for regulations and incentives that minimize development in the SFHA. (709 points)

Activity 430 – Higher Regulatory Standards: Credit is provided for enforcing regulations that require freeboard for new and substantial improvement construction, cumulative substantial improvement, and enclosure limits. Credit is also provided for regulations administration. (158 points)

Activity 440 – Flood Data Maintenance: Credit is provided for maintaining and using digitized maps in the day to day management of the floodplain. Credit is also provided for establishing and maintaining a system of benchmarks and maintaining copies of all previous FIRMs and Flood Insurance Study Reports. (140 points)

Activity 450 – Stormwater Management: The community enforces regulations for stormwater management, soil and erosion control, and water quality. (162 points)

Section 502 – Repetitive Loss Category: Based on the updates made to the NFIP Report of Repetitive Losses as of January 31, 2017, Maui County, HI has 34 repetitive loss properties and is a Category B community for CRS purposes. All requirements for a Category B community have been met. (No credit points are applicable to this section)

Activity 510 – Floodplain Management Planning: Credit is provided for the adoption and implementation of the Maui County Hazard Mitigation Plan, adopted on August 26, 2015. A progress report must be submitted on an annual basis. An update to the credited plan will be due by October 1, 2020. Credit is also provided for the adoption and implementation of a statewide Natural Floodplains Functions Plan. (291 points)

Activity 630 – Dams: Credit is provided for a State Dam Safety Program. (45 points)

Activity 710 – County Growth Adjustment: All credit in the 400 series is multiplied by the growth rate of the county to account for growth pressures. The growth rate for Maui County, HI is 1.04.

Maui County, HI
NFIP #: 150003

Page 3

Attached is the Community Calculations Worksheet that lists the verified credit points for the Community Rating System.

CEO Name / Address:

Alan Arkawa
Mayor of Maui County
200 South High Street
Wailuku, Hawaii 96793

CRS Coordinator Name / Address:

Carolyn Cortez, CFM
Planner V
2200 Main Street, Suite 315
Wailuku, Hawaii 96793
(808) 270-7813

Date Report Prepared: January 3, 2018

Community : Maui County, HI **NFIP Number :** 150003

720 COMMUNITY CREDIT CALCULATIONS (Cycle):

CALCULATION SECTION :

Verified Activity Calculations:					Credit
c310	55				55
c320	90				90
c330	14				14
c340	18				18
c350	84				84
c360					
c370					
c410	27	x CGA	1.04	=	28
c420	682	x CGA	1.04	=	709
c430	152	x CGA	1.04	=	158
c440	135	x CGA	1.04	=	140
c450	156	x CGA	1.04	=	162
c510	291				291
c520					
c530					
c540					
c610					
c620					
c630	45				45

Community Classification Calculation:

cT = total of above cT = 1794

Community Classification (from Table 110-1): Class = 7

CEO Name/Address:

Alan Arkawa
Mayor of Maui County
200 South High Street
Wailuku, Hawaii 96793

CRS Coordinator Name/Address:

Carolyn Cortez, CFM
Planner V
2200 Main Street, Suite 315
Wailuku, Hawaii 96793
(808) 270-7813

Date Report Prepared: January 3, 2018

AW-720

Appendix D: Mitigation Strategy Supporting Materials

2018 Annual Progress Report

Maui County Hazard Mitigation Plan Annual Progress Report

Reporting Period: January 1, 2018 - December 31, 2018

Background: Maui County developed a hazard mitigation plan to reduce risk from natural hazards by identifying resources, information, and strategies for risk reduction. The federal Disaster Mitigation Act of 2000 requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. To prepare the plan, Maui County organized resources, replacement risks from natural hazards, developed planning goals and objectives, reviewed mitigation alternatives, and developed an initiative action plan to address probable impacts from natural hazards. By completing this process, Maui County maintained compliance with the Disaster Mitigation Act, achieving eligibility for mitigation grant funding opportunities afforded under the Robert T. Stafford Act. The plan can be viewed on-line at:

https://www.mauicounty.gov/DocumentCenter/View/100053

This document is currently in the process of being updates for 2020. Expected completion is before August 2020.

Summary Overview of the Plan's Progress: The performance period for the Hazard Mitigation Plan became effective August, 2015, with the final approval of the plan by FEMA. The initial performance period for this plan will be 5 years, with an anticipated update to the plan to occur before August, 2020. As of this reporting period, the performance period for this plan is considered to be 13 percent complete. The Hazard Mitigation Plan has targeted 62 hazard mitigation initiatives to be pursued during the 5-year performance period. As of the reporting period, the following overall progress can be reported:

- 18 out of 62 initiatives (29%) reported ongoing action toward completion.
- 8 out of 62 initiatives (13%) were reported as being complete.
- 36 out of 62 initiatives (58%) reported no action taken.

Purpose: The purpose of this report is to provide an annual update on the implementation of the initiative action plan identified in the Maui County Hazard Mitigation Plan. The objective is to ensure that there is a continuing and responsive planning process that will keep the Hazard Mitigation Plan dynamic and responsive to the needs and capabilities of Maui County. This report discusses the following:

- Continued public outreach related to hazard mitigation that has occurred within the last year
- Natural hazard events that have occurred within the last year
- Changes in risk exposure within the planning area (all of Maui County)
- Review of any hazard mitigation grant funding opportunities pursued within the last year
- Mitigation success stories
- Review of the initiative action plan and incorporation of new initiatives
- Changes in capabilities that could impact plan implementation
- Recommendations for changes/enhancement.

The Hazard Mitigation Plan Working Group: The Hazard Mitigation Plan Working Group, made up of stakeholders within the planning area, reviewed and approved this progress report. It was determined through the plan's development process that a working group would remain in service to oversee the implementation and maintenance of the plan. At a minimum, the working group provides technical review and oversight on the development of the annual progress report. It is anticipated that there will be turnover in the membership annually, which will be documented in the progress reports. For this reporting period, the working group membership is as indicated in Table 1.

TABLE 1.
HAZARD MITIGATION WORKING GROUP MEMBERS

Name	Title	Jurisdiction/Agency
Sharon Mielbrencht	Hazard Mitigation Specialist	Pacific Disaster Center
Jim Buika	Coastal Resource Manager	COM – Planning Department
Jarvis Chun	Building Plans Review	COM – Public Works
Carolyn Cortez	Floodplain Manager	COM – Planning Department
Rowena Dagdag-Andaya	Deputy Director	COM – Public Works
Bruce Moore	Area Superintendent	SOH - DOE
Rebecca King	GIS Analyst	COM – Managing Director
Janet Kuwarara	Director of Aloha	Maui Visitors Bureau
Michele Liberty	Maui County Director	American Red Cross
Sybil Lopez		COM – Planning Department
Mahina Martin	Government Relations	Maui Electric Company
Mike Miyamoto	Deputy Director	COM – Environmental Mgmt.
Tara Owens	Coastal Process and Hazards Specialist	UH – Sea Grant
Pam Eaton	Planning Program Administrator	COM – Planning Department

• **Continued Hazard Mitigation Public Outreach in the Planning Area:** During the reporting period, the following events in the planning area contributed to furthering continued public involvement in hazard mitigation in the planning area:

- Continuation of the Hawaii Hazards Awareness and Resilience Program (HAARP) for Lahaina residents. The HAARP program enable communities to prepare for self-resiliency during and after natural hazard events. Residents participate in workshops and presentations to understand and select appropriate hazard mitigation measures.

- MEMA hosted a Disaster Preparedness Expo with representation from University of Hawaii Sea Grant to provide homeowners with mitigation strategies for residential structures. Other agencies represented include but are not limited to:
  - Maui Emergency Management Agency
  - Hawaii Emergency Management Agency
  - National Weather Service
  - American Red Cross
  - Citizen Emergency Response Team
  - Department of Land and Natural Resources – Dam Safety Division – National Flood Insurance Program
  - Maui County Health Volunteers
  - Maui Police Department & SWAT
  - Maui Search and Rescue
  - County of Maui Department of Housing and Human Concerns – Office on Ageing
  - Pacific Disaster Center
  - Simpson Strong Ties
  - Maui Humane Society
  - Civil Air Patrol
- MEMA hosted a booth at the Maui County Fair and distributed community disaster preparedness information. These information pamphlets included material from Maui County's Hazard Mitigation Plan.
- Meetings with the Community Emergency Response Team (CERT) are ongoing. Maui County Emergency Management is actively involved.

Natural Hazard Events within the Planning Area: During the reporting period, there were six natural hazard events in the planning area that had a measurable impact on people or property. A summary of these events is as follows:

- Tsunami watch issued and county was on alert – January 22nd, 2018
- Snowfall on Haleakala damaging repeaters, substations and affecting telescope operation at the summit – February 18th, 2018
- Maui Flooding – March 14th, 2018
- Maui Flooding – April 2nd, 2018
- Tropical Storm Olivia – September 9th, 2018
- Hurricane Lane – August 23rd, 2018

Changes in Risk Exposure in the Planning Area: Risk of landslide increased due to fire (during Hurricane Lane) reducing the amount of natural vegetation on hillsides.

Pursuit of Mitigation Grant Opportunities: The County of Maui applied for a Pre-Disaster Mitigation Grant for the 2020 update of the Multi-Hazard Mitigation Plan. Total awarded to the County of Maui, $141,000. As of current, a contractor has been identified, selected and is in the process of being rewarded a contract to complete the update. Full completion and acceptance by FEMA is estimated to be October 2020.

Mitigation Success Stories: none

Review of the Action Plan: Table 2 reviews the action plan, reporting the status of each initiative. Reviewers of this report should refer to the Hazard Mitigation Plan for more detailed descriptions of each initiative and the prioritization process.

TABLE 2.
INITIATIVE ACTION PLAN MATRIX

Action Taken? (Yes or No)	Time Line	Priority	Comments	Status (N, X, O,✓)
Initiative #AH-1 - Update and maintain an inventory of critical facilities and lifelines including County buildings.				
Yes	One year for development and ongoing for maintenance.	High	2017 MEMA focus on hardening public sheltering. 2018 MEMA will focus on hardening wastewater and water facilities.	O
Initiative #AH-2—Relocate and/or retrofit vulnerable critical facilities in high hazard areas. Harden facilities to withstand future natural hazard events.				
Yes	3-5 years	Medium	Backup power generation for the Wailuku Base Yard. HMGP awarded.	✓
Yes	3-5 years	Medium	MECO is determining the viability of building an alternate Power Generation Plant outside of the hazard area.	O
Yes	1-2 years	Medium	Backup power generation for the Lahaina Wastewater Treatment Plant HMGP application in process.	O
Initiative #AH-3 —Acquire residential and privately owned structures in high hazard areas.				
No	Over 5 years	Medium		X
Initiative #AH-4—Evaluate existing shelter and other critical facilities needs for redundant power generation.				
Yes	3 years	High	All facilities were evaluated. Hannibal Tavares Community Center and Kihei Community Center redundant power generation installed. Future projects identified, subject to funding.	O
Yes	3 years	High	Backup power generation for Lahaina Civic Center HMGP application in process.	O
Initiative #AH-5—Acquire portable emergency generators of identified critical facilities.				
Yes	2 years	High	Mobile generator HMGP application in process for Central Maui area.	O
Initiative #AH-6—Develop a Maui, Lanai and Molokai island-wide evacuation routes plan.				
No	2 years	High		X

TABLE 2.
INITIATIVE ACTION PLAN MATRIX

Action Taken? (Yes or No)	Time Line	Priority	Comments	Status (N, X, O,✓)
Initiative #AH-7—Work with telecommunications providers to provide more reliable and continued services.				
Yes	Ongoing	High	The State of Hawaii has opted into FirstNet and will begin exploring options through the designated service provider AT&T. Strong relationships are established with local telecommunications providers and MPD Radio Shop.	O
Initiative #AH-8—Work with school complexes to develop a hazard awareness component.				
Yes	2 Years	High	Department of Health led initiative to elementary schools of vector borne illnesses.	O
Initiative #AH-9—Develop and formalize MOUs for emergency barge and ferry service.				
No	2 – 4 Years	High		X
Initiative #AH-10—Continue to include hazard mitigation initiatives in future Capital Improvements Planning.				
Yes	Ongoing	High	County of Maui Budget Office established a line item to provide matching funds for grant projects.	O
Yes	Ongoing	High	The Hazard Mitigation steering committee meets to discuss potential Capital Improvement Projects for HMGP, FMA and PDM grant funding.	O
Initiative #AH-11—Develop and annually maintain an updated list of emergency shelters.				
Yes	1 Year	High	Emergency shelter list updated and current.	O
			Identified and recorded POCs for emergency shelter facilities.	✓
			Emergency Operations Plan includes list of potential emergency shelter locations.	O
Initiative #AH-12—Develop a system for capturing historical data related to hazard events.				
Yes	1 Year	High	Historical data from hazard events are captured. Data is available to partners upon request.	✓
Initiative #AH-13—Promote and implement existing education and outreach programs on all hazards.				
Yes	Ongoing	High	HHAARP is ongoing for the West Maui Community.	O
			CERT continues to expand training throughout Maui County.	O
			ARC continues to review and exercise plans.	O
			ARC continues to provide training opportunities to volunteers.	O
Initiative #CE-1 — Realign Honoapiilani Highway outside of coastal hazard area.				
Yes	3 Years for Planning, then ongoing toward	Medium	A West Maui Transportation Working Group was established and will strategize possible solutions.	O

TABLE 2.
INITIATIVE ACTION PLAN MATRIX

Action Taken? (Yes or No)	Time Line implementation	Priority	Comments	Status (N, X, O,✓)
Initiative #CE-2 — Identify vulnerable coastal roads that are susceptible to destruction from natural hazards.				
No	3 Years for Planning, then ongoing toward implementation	Medium		X
Initiative #CE-3 – Expand Beach and Dune Restoration Projects- Identify and prioritize erosion hotspots.				
Yes	Immediate and ongoing	High	The Planning Department is coordinating with stakeholders at several sites around Maui where development has been impacted by coastal erosion, including Kahana Beach and North Kaanapali/Honokowai in West Maui, and Halama Street in South Maui. At Kahana Beach in West Maui, where several eight to twelve-story condominiums are imminently threatened, the County and stakeholders are pursuing planning for regional beach restoration and progress includes: a completed County-sponsored feasibility study for regional beach nourishment; formation of a steering committee for coordination among condominium associations; intention to develop an improvement district to fund project construction.	O
Initiative #CE-4 – Expand Dune Restoration Projects – Develop and/or update dune restoration guidance.				
No	3 Years	High		X
Initiative #CE-5 — Study and/or pilot offshore wave attenuation devices.				
No	2 Years	Medium		X
Initiative #CE-6 — Support University of Hawaii sea level rise mapping for all islands.				
No	1 Year	Medium		X
Initiative #CE-7 — Consider sea level rise impacts on existing and future developments by conducting community based vulnerability assessments.				
Yes	2-3 Years	Medium	Maui County participated in the Interagency Climate Adaptation Committee (ICAC) to develop a statewide Sea Level Rise and Vulnerability Assessment and Adaptation Report completed, December 2017. This report provides new data for exposure of	✓

TABLE 2.
INITIATIVE ACTION PLAN MATRIX

Action Taken? (Yes or No)	Time Line	Priority	Comments	Status (N, X, O,✓)
			development to flooding, wave inundation, and erosion from sea level rise.	
Initiative #CE-8 — Develop a 5-Year Strategic Plan for integrating coastal erosion mitigation projects into each community plan and County FY budget.				
No	1 Year	High		x
Initiative #CE-9 — Continue to support a public awareness campaign to minimize impact of coastal erosion.				
Yes	1 Year	High	MEMA conducted a public awareness campaign targeted to properties along the coastline subject to coastal erosion from the King Tides event.	✓
Initiative #CE-10 — Expand University of Hawaii shoreline erosion studies to include Molokai and Lanai.				
No	Ongoing	Low		X
Initiative #DR-1 — Support structural and non-structural elements related to the certification/re-certification of the Kaunakakai levee.				
Yes	3-5 Years	High	Portions of the Kaunakakai levee have been recertified by FEMA by a Letter of Map Revision, Case No. 16-09-0721P, effective March 14, 2017.	✓
Initiative #DR-2 — Develop a public outreach awareness campaign targeting residents located within a dam inundation area.				
Yes	Ongoing	High	DLNR will publish Dam Inundation Maps. MEMA will work on the public messaging campaign to complement the publication.	O
Initiative #DR-3 — Regularly exercise the current emergency action plan focusing on evacuation with participation from police, public/private dam owners and state/federal dam operators.				
No	Ongoing	Low		X
Initiative #D-1 —Update the Water Use and Development Plan to include comprehensive monitoring, repair, and replacement strategy.				
No	5 Years	High		X
Initiative #D-2 – Encourage drought-tolerant landscape design into landscaping ordinances.				
No	Ongoing	High		X
Initiative #D-3 – Coordinate with industry stakeholders to develop alternative sources of irrigation water.				
No	2 Years	Low		X
Initiative #D-4 - Explore options and necessary code and regulation changes to allow greywater reuse.				
No	1 Year	High		X
Initiative #E-1 – Reduce potential damage to critical facilities and infrastructure from seismic events through structural retrofits.				
No	3 Years	Medium		X
Initiative #E-2 - Conduct and engineering survey on all bridges to ensure structural stability.				
No	4 Years	Medium		X

TABLE 2.
INITIATIVE ACTION PLAN MATRIX

Action Taken? (Yes or No)	Time Line	Priority	Comments	Status (N, X, O,✓)
Initiative #FL-1 – Flood proof wastewater treatment facilities located in flood hazard areas.				
No	5 Years	Medium		X
Initiative #FL-2 – Flood proof water treatment facilities located in flood hazard areas.				
No	5 Years	Medium		X
Initiative #FL-3 – Inspect, and if necessary, repair stormwater drainage swales and culverts.				
Yes	2 Years	Medium		O
Initiative #FL-4 – Increase drainage and absorption capabilities with detention and retention basins, relief drains, and spillways.				
No	3-5 Years	Low		X
Initiative #FL-5 – Where appropriate, support retrofitting, purchase or relocation of structures located in hazard-prone areas to protect structures from future damage.				
No	Ongoing	Medium		X
Initiative #FL-6 – Remain in good standing and in compliance with NFIP.				
Yes	Ongoing	High	The County of Maui participates in the NFIP, as such, we are audited annually to ensure that we are compliant to FEMA codes.	O
Initiative #FL-7 – Continue to participate in the CRS program and continually identify opportunities to improve CRS class.				
Yes	Ongoing	High	The County of Maui participates in the CRS program and is audited annually, as well as every 5 years to ensure that we are compliant to FEMA codes. We are in the midst of our 5 year audit and are hoping to improve our category from an 8 to a 7.	O
Initiative #FL-8 – Identify key planning, public works, and/or emergency management personnel who could benefit from advanced knowledge as a Certified Floodplain Manager.				
Yes	1 Year	High	Invited staff from DPW - DSA and Engineering division to our annual Floodplain Managers Conference in August.	✓
Initiative #FL-9 – Develop a Flood Acquisition/Elevation Plan that may be used to identify and prioritize acquisitions and elevation of RL/SRL properties.				
No	3-5 Years	Low		X
Initiative #FL-10 – Identify and place operational stream gauges where needed.				
Yes	1 Year	Medium	The September flood damaged the Wailuku River stream gauge. MEMA has identified that it is critical for another measuring device be installed. The USGS indicated that another measuring device will be installed once the river has stabilized (approximately 3 - 5 years).	O

TABLE 2.
INITIATIVE ACTION PLAN MATRIX

Action Taken? (Yes or No)	Time Line	Priority	Comments	Status (N, X, O,✓)
Initiative #FL-11 – Identify potential areas for open space than could double as detention basins during major flooding events.				
No	1 Year	High		X
Initiative #FL-12 – Seek community information on possible hazardous waste sites, not identified by the LEPC.				
No	5 Years	High		X
Initiative #FL-13 – Harden the Island Petroleum Fuel Pipeline at the Molokai Kaunakakai Wharf in a trench with grating cover.				
Yes	5 Years	High	MEMA is working with Par Hawaii to harden the Molokai Fuel Pipeline through either the HMGP or PDM grant program.	O
Initiative #HW-1 – Encourage retrofit of identified critical facilities and infrastructure.				
No	5 Years	Medium		X
Initiative #HW-2 – Encourage modifications or retrofits to residential buildings.				
Yes	Ongoing	High	MEMA continues to encourage residents to retrofit homes to minimize risk to structures.	O
			Distribute the *Homeowners Book to Prepare for Natural Hazards* published by the University of Hawaii Sea Grant.	O
Initiative #HW-3 – Develop a public outreach initiative that illustrates the benefits of steel poles for communities that opted out of new poles.				
No	1 Year	High		X
Initiative #L-1 – Install concrete foundations for rockfall barrier fences in areas prone to landslides and rockfalls.				
No	5 Years	Medium		X
Initiative #L-2 – Improve drainage opportunities along steeps areas that are prone to fail due to soil saturation.				
No	1 Year	Medium		X
Initiative #L-3 – Identify areas at risk for rockfall and acquire/install netting to minimize impact.				
Yes	1-3 Years	Medium	Areas at risk for rockfall were identified.	✓
Initiative #TC-1 – Harden emergency shelter throughout the planning area to ensure that they are able to withstand 111-129 mph windspeeds.				
Yes	5 Years	Medium	MEMA submitted ranked emergency shelters throughout Maui County for State of Hawaii Hurricane Sheltering Retrofit Program.	✓
			Molokai High School is currently funded for retrofit.	✓
Initiative #TC-2 – Conduct engineering surveys on the ability of emergency shelters and potential emergency shelters to withstand hurricane force wind speed.				
No	2 Years	Medium		X

TABLE 2.
INITIATIVE ACTION PLAN MATRIX

Action Taken? (Yes or No)	Time Line	Priority	Comments	Status (N, X, O,✓)
Initiative #TC-3 – Develop joint MOUs with private sheltering facilities to continue working together towards a common emergency shelter goal for tropical cyclone evacuation.				
No	1 Year	High		X
Initiative #TC-4 – Prioritize and pursue activities identified as unmet needs in the post-disaster reconstruction guidelines and protocols project.				
No	1 – 5 Years	Medium		X
Initiative #T-1 – Install signage delineating tsunami evacuation routes and tsunami hazard zones.				
	2 – 3 Years	Medium		X
Initiative #T-2 – Develop an outreach plan on the development and distribution of tsunami awareness material.				
Yes	1 Year	High	Tsunami awareness materials are identified and were developed for distribution.	✓
Yes	2 Years	High	MEMA will participate in Tsunami Awareness month (April) to promote development material.	O
Initiative #VH-1 – Develop a public outreach program for both residents and visitors informing them about VOG.				
No	5 Years	High		X
Initiative #VH-2 – Work with the University of Hawaii – VOG Measurement and Prediction Project to develop danger levels and trigger points for exposure.				
No	5 Years	High		X
Initiative #W-1 – Retrofit at-risk County structures with ignition-resistant materials.				
No	5 Years	Medium		X
Initiative #W-2 – Implement mitigation action items as identified in the Western Maui Community Wildfire Protection Plan.				
No	3 Years	Medium		X
Initiative #W-3 – Revitalize the Firewise Program.				
No	5 Years	High		X

Completion status legend:
✓= Project Completed
O = Action ongoing toward completion
X = No progress at this time
N = New initiative added

Changes That May Impact Implementation of the Plan: The staffing shortages continue to affect the implementation of the plan. In year 2018, additional HMGP funding is available for DR-4365 (Hawaii Severe Storms, Flooding, Landslides, and Mudslides), DR-4366 (Hawaii Kilauea Volcanic Eruption and

Earthquakes) and DR-4395 (Hawaii Hurricane Lane). Added HMGP funding will enable the County of Maui to fund additional mitigation measures identified in the plan.

Recommendations for Changes or Enhancements: Based on the review of this report by the Hazard Mitigation Plan Working Group, the following recommendations will be noted for future updates or revisions to the plan:

- The Hazard Mitigation Plan Working Group must meet regularly to discuss initiatives and progress.
- Include a Capital Improvement Project (CIP) coordinator into the Hazard Mitigation Working Group to better identify and fund projects. The addition of CIP personnel will also enable the Hazard Mitigation Working Group to better direct investments to ensure the project is maximizing any mitigation activities.
- In 2019, the Hazard Mitigation Plan should be updated as directed by FEMA.

Public review notice: The contents of this report are considered to be public knowledge and have been prepared for total public disclosure. Any questions or comments regarding the contents of this report should be directed to:

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Mitigation Actions Attributed to Each Goal Statement

RESILIENCE

Action #	Mitigation Action	Implementation Priority*	Lead Department	Timeline	Cost
1	Explore options and necessary code and regulation changes to allow greywater reuse systems for irrigation and toilet flushing.	High	Department of Environmental Management, Department of Water Supply	September 2020 - October 2021	Low
3	Develop a water conservation ordinance to include xeriscaping regulations to promote water conservation (Maui Island Plan Action 6.3.2)	High	Department of Water Supply	September 2020 - October 2023	Low
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	High	Emergency Management Agency	September 2020 - October 2025	Low
14	Expand Beach and Dune Restoration Projects 1) Identify and prioritize erosion hotspots for mitigation via beach nourishment where applicable. 2) Pursue	High	Planning Department	September 2020 - October 2025	Very High

	Federal/State/County funding for beach nourishment and restoration (including pre-positioning for post-disaster financial assistance). 3) Work with State regulatory agencies to streamline permitting for beach restoration. 4) Promote living shoreline projects instead of shoreline hardening where feasible. 5) Protect/restore coral reefs as they provide a barrier for erosion, high surf/coastal flooding and tsunamis.				
15	Update dune restoration guidance. Provide dune restoration training. Develop an outreach initiative to encourage or establish new dune restoration volunteers/stewards. Install ADA compliant dune walkovers in identified locations.	High	Planning Department	September 2020 - October 2023	High
17	Conduct a multivariate GIS analysis to identify and categorize open spaces for the County of Maui to purchase and preserve based on highest ROI for hydrological capacity and positive impact on flood mitigation.	High	Planning Department	September 2020 - October 2021	Low
19	Encourage Low Impact Development (LID) approach to site development and stormwater management through development of best practices guide.	High	Planning Department, Department of Water Supply	September 2020 - October 2025	Medium

35	Develop a Master Plan for the use of County owned land along the Honoapiilani Highway.	Medium	Mayor's Office	September 2020 - October 2023 (for Planning, then ongoing for implementation)	Medium
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Medium	Mayor's Office	September 2020 - October 2025	Medium
43	Coordinate with industry stakeholders to develop alternative sources of irrigation water including wastewater reuse, recycled stormwater runoff, and brackish well water.	Low	Department of Environmental Management, Department of Water Supply	2 Years	High
44	Increase water storage and development of additional capacity in Upcountry Maui and other areas susceptible to drought and encourage efficiency in conservation programs. Maui Island Plan 3.1.2 -Action 10	Low	Department of Environmental Management, Department of Water Supply	September 2020 - October 2025	High
48	Provide funding support to the University of Hawaiʻi (Coastal Geology Group) to complete shoreline erosion	Low	Planning Department	September 2020 - October 2025	High

	studies to include Molokaʻi and Lānaʻi and continue to update studies for Maui.				

PROPERTY

Action #	Mitigation Action	Implementation Priority*	Lead Department	Timeline	Cost
2	Adopt the most current building codes to mitigate risk associated with flooding.	High	Department of Public Works	September 2020 - October 2022	Low
6	Share funding sources for building retrofits or other modifications with owners of residential buildings to mitigate the effects of high winds. Encourage the use of load path connectors, hurricane shutters, safe rooms, reinforced garage doors, replacement of non-ductile	High	Emergency Management Agency	September 2020 - October 2025	Low

	infrastructure, strengthen structural frames, inspect and retrofit roofs, gable end walls for wind resistance.				
10	Support the revitalization and expansion of the Firewise USA program to additional communities.	High	Fire Prevention Bureau	September 2020 - October 2025	Low
12	Coordinate with the State to adapt State Highway Route 450 in Moloka'i at MM 15-16 (east side experiencing major erosion and undermining in the last few years).	High	Mayor's Office and Council	September 2020 - October 2025	Very High
20	Flood proof water and wastewater treatment facilities located in flood hazard areas and identified as vulnerable to future damage or disruption. This includes but is not limited to the Kaunakakai Wastewater Treatment Facility.	Medium	Department of Environmental Management	September 2020 - October 2025	Very High
21	Develop a strategy to mitigate risk to coastal roads.	Medium	Department of Public Works	September 2020 - October 2023 (for Planning, then ongoing for implementation)	High
22	Prepare an inventory of non-NBIS bridges using GIS and create a framework for an inspections schedule to help ensure that all bridges are assessed for their structural stability during a natural disaster, and to identify and prioritize the implementation of improvements for long-	Medium	Department of Public Works	September 2020 - October 2024	Medium

	term resiliency (with an emphasis on bridges serving potentially isolated communities (e.g., East Maui).				
23	Identify and inventory areas at risk using GIS to landslides and rockfalls and mitigate risk to these areas. Specific areas to address include Kalepa (East Maui), Kahakuloa (Central/West Maui), and Hāna Highway (in/downslope of high landslide susceptibility areas or that have experienced past rockfalls).	Medium	Department of Public Works	September 2020 - October 2025	Medium
24	Improve drainage and slope stabilization along steeps areas that are prone to fail due to soil saturation, including the Kahekili Slope Repair project and other locations identified as priorities for hazard risk reduction. These include projects that protect critical facilities and infrastructure such as Pi'ilani Highway (through East Maui) and Kahekili Highway (through Kahakuloa). Develop a GIS data layer for hazard areas.	Medium	Department of Public Works	September 2020 - October 2021	High
25	Replace aging stormwater infrastructure at the end of its life cycle with new infrastructure designed to future, more extreme events (i.e., above code).	Medium	Department of Public Works	September 2020 - October 2025	High
26	Identify critical infrastructure, lifelines, roads, and populations that are vulnerable to coastal hazards, and	Medium	Emergency Management Agency	September 2020 - October 2025	Very High

	encourage strategic retreat, relocation or retrofit. Maui Island Plan 3.1.2.a				
27	Where appropriate and feasible, provide technical assistance and administer financial support to willing property owners for the completion of projects to protect structures located in hazard-prone areas from future damage, with repetitive loss and severe repetitive loss properties as priority.	Medium	Emergency Management Agency	September 2020 - October 2025	Low
33	Research, promote, and support the implementation of wildfire mitigation practices for Wildland Urban Interface (WUI) and other areas identified as high risk but not covered by a current Community Wildfire Protection Plan (CWPPs). Practices may include but not be limited to the following: • Retrofit at-risk County structures with ignition-resistant materials • Initiating programs aimed at reducing fuel loads (removing non-native grasses and shrubs with native/fire-resistant species) • Prevent wildfire burn areas from being replanted with non-native vegetation • Implementing defensible space and firebreaks in rural developments through existing codes and development standards	Medium	Fire Prevention Bureau	September 2020 - October 2025	Medium

34	Support the Hawai'i Wildfire Management Organization, the Maui Wildfire Coordinating Group, local fire task forces, and other stakeholder organizations with the implementation of mitigation action items as identified in all current Community Wildfire Protection Plans (CWPPs).	Medium	Fire Prevention Bureau	September 2020 - October 2023	Medium
36	Mitigate the impacts of saltwater intrusion, exacerbated by flooding and/or erosion from Sea Level Rise, on utilities, ecosystems and other public facilities.	Medium	Mayor's Office	September 2020 - October 2025	Very High
45	Implement the mitigation actions identified in the existing and future drainage master plans.	Low	Department of Public Works	September 2020 - October 2025	Very High
49	Propose an amendment to the Zoning Code to prohibit building schools, daycare centers or other facilities that serve vulnerable populations, in tsunami evacuation zones.	Low	Planning Department	September 2020 - October 2024	Staff time

PEOPLE

Action #	Mitigation Action	Implementation Priority*	Lead Department	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.	High	Emergency Management Agency	September 2020 - October 2024	Low
5	Identify alternative locations for emergency supply of diesel, gas, and propane on Molokaʻi for a minimum of 30 days.	High	Emergency Management Agency	September 2020 - October 2025	Medium
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	High	Emergency Management Agency	September 2020 - October 2025	Medium
11	Establish an alternative route to and from West Maui for use during disasters.	High	Mayor's Office	September 2020 - October 2025	Very High
28	Implement the guidance and tools identified in the 2019 Guidance for Disaster Recovery Preparedness in Hawaiʻi, which was supported by Maui County. (https://seagrant.soest.Hawaiʻi.edu/wp-content/uploads/2019/07/HI_Disaster_Recovery_Preparedness_Guidance_Final_26June2019.pdf)	Medium	Emergency Management Agency	September 2020 - October 2021	High

30	Conduct a detailed needs assessment and capital planning/feasibility study for additional emergency shelters for both residents and visitors. This includes retrofitting existing public facilities and structures to withstand up to a Category 3 hurricane (e.g., high school gym on Moloka'i).	Medium	Emergency Management Agency	September 2020 - October 2025	Very High
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Medium	Emergency Management Agency	September 2020 - October 2022	Low
46	Identify permanent and temporary facilities that could be used as cooling centers for vulnerable populations as extreme heat events become more intense/more frequent.	Low	Emergency Management Agency	September 2020 - October 2025	Low
50	Establish an ad-hoc mobile application allowing "on-the-ground" recorded observations of flooding from citizens to create a high-resolution GIS layer of flooding spanning all county parcels.	Low	Planning Department	September 2020 - October 2025	Staff time

IMPLEMENTATION

Action #	Mitigation Action	Implementation Priority*	Lead Department	Timeline	Cost
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	High	Emergency Management Agency	September 2020 - October 2025	Low
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low
16	NR	High	Planning Department	September 2020 - October 2025	Low
18	Adopt internal protocols for how to intake, process, approve and file all new FDPs in order to ensure consistent and clear records for upcoming CRS audits. Having a more thorough digital record of approved FDPs will facilitate the	High	Planning Department	September 2020 - March 2021	Low

	Floodplain Manager achieving a greater score during the CRS Audits.				
29	Obtain FEMA's Substantial Damage Estimator and attend training to be prepared to use it when damage occurs; and develop mutual aid agreements with other jurisdictions to augment local inspection personnel after major disasters.	Medium	Emergency Management Agency	September 2020 - October 2023	Medium
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Medium	Emergency Management Agency	September 2020 - October 2022	Medium
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Medium	Mayor's Office	September 2020 - October 2025	Medium
39	Increase the number of NFIP-trained staff members, including those who are Coastal Zone Management planners, working to support the County's floodplain management program to build administrative capacity and increase performance efficiencies. Have each plan reviewer and building inspector attend a training or workshop related to floodplain management. Sponsor a periodic NFIP workshop for local surveyors and builders. Encourage or require more County staff positions to obtain and maintain Certified Floodplain Manager (CFM)	Medium	Planning Department	September 2020 - October 2022	Low

	certification, ideally having 2-3 dedicated CFMs optimizing the flood program.				
41	Maintain NFIP Compliance. Continue to maintain good standing and compliance under the NFIP through implementation of floodplain management programs that, at a minimum, meet the NFIP requirements: enforce the flood damage prevention ordinance, participate in floodplain identification and mapping updates, provide public assistance/information on floodplain requirements and impacts.	Medium	Planning Department	September 2020 - October 2025	Low

EDUCATION

Action #	Mitigation Action	Implementation Priority*	Lead Department	Timeline	Cost
40	Conduct information sessions regarding the NFIP for public officials and appointees of the Flood Management Program with an emphasis on the importance of the County's participation in the NFIP and the impact of failing to enforce requirements.	Medium	Planning Department	September 2020 - October 2025	Staff time

42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low
47	Promote the availability of flood insurance to property owners in areas subject to flooding but not located within FEMA-mapped special flood hazard areas, with an emphasis on the ability to purchase for lower premium rates (via preferred risk policies).	Low	Emergency Management Agency	September 2020 - October 2025	Low

Mitigation Actions Sorted by Lead Department

DEPT. ENVIRONMENTAL MANAGEMENT

Action #	Mitigation Action	Implementation Priority*	Lead Department	Supporting Agency(ies)	Timeline	Cost
1	Explore options and necessary code and regulation changes to allow greywater	High	Department of Environmental Management,	Maui Farm Bureau, Department of Parks & Recreation, HDOA	September 2020 - October 2021	Low

	reuse systems for irrigation and toilet flushing.		Department of Water Supply	Agricultural Resource Management		
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	High	Mayor's Office, Department of Environmental Management	Emergency Management Agency, Planning Department	September 2020 - October 2025	Low
20	Flood proof water and wastewater treatment facilities located in flood hazard areas and identified as vulnerable to future damage or disruption. This includes but is not limited to the Kaunakakai Wastewater Treatment Facility.	Medium	Department of Environmental Management	Emergency Management Agency, Maui Floodplain Manager	September 2020 - October 2025	Very High
43	Coordinate with industry stakeholders to develop alternative sources of irrigation water including wastewater reuse, recycled stormwater runoff, and brackish well water.	Low	Department of Environmental Management, Department of Water Supply	Maui Farm Bureau, Department of Parks & Recreation, HDOA Agricultural Resource Management	2 Years	High
44	Increase water storage and development of additional capacity in Upcountry Maui and other areas susceptible to drought and encourage efficiency in conservation	Low	Department of Environmental Management,	Planning Department, Department of Public Works	September 2020 - October 2025	High

	programs. Maui Island Plan 3.1.2 -Action 10		Department of Water Supply			

DEPT. OF WATER SUPPLY

Action #	Mitigation Action	Implementation Priority*	Lead Department	Supporting Agency(ies)	Timeline	Cost
1	Explore options and necessary code and regulation changes to allow greywater reuse systems for irrigation and toilet flushing.	High	Department of Environmental Management, Department of Water Supply	Maui Farm Bureau, Department of Parks & Recreation, HDOA Agricultural Resource Management	September 2020 - October 2021	Low
3	Develop a water conservation ordinance to include xeriscaping regulations to promote water conservation (Maui Island Plan Action 6.3.2)	High	Department of Water Supply	Mayor's Office, Emergency Management Agency	September 2020 - October 2023	Low
19	Encourage Low Impact Development (LID) approach to site development and stormwater management through development of best practices guide.	High	Planning Department, Department of Water Supply	Department of Public Works, Emergency Management Agency	September 2020 - October 2025	Medium

43	Coordinate with industry stakeholders to develop alternative sources of irrigation water including wastewater reuse, recycled stormwater runoff, and brackish well water.	Low	Department of Environmental Management, Department of Water Supply	Maui Farm Bureau, Department of Parks & Recreation, HDOA Agricultural Resource Management	2 Years	High
44	Increase water storage and development of additional capacity in Upcountry Maui and other areas susceptible to drought and encourage efficiency in conservation programs. Maui Island Plan 3.1.2 -Action 10	Low	Department of Environmental Management, Department of Water Supply	Planning Department, Department of Public Works	September 2020 - October 2025	High

DEPT. OF PUBLIC WORKS

Action #	Mitigation Action	Implementation Priority*	Lead Department	Supporting Agency(ies)	Timeline	Cost
2	Adopt the most current building codes to mitigate risk associated with flooding.	High	Department of Public Works	Mayor's Office, Planning Department	September 2020 - October 2022	Low

21	Develop a strategy to mitigate risk to coastal roads.	Medium	Department of Public Works	Department of Transportation, Department of Parks & Recreation, Emergency Management Agency	September 2020 - October 2023 (for Planning, then ongoing for implementation)	High
22	Prepare an inventory of non-NBIS bridges using GIS and create a framework for an inspections schedule to help ensure that all bridges are assessed for their structural stability during a natural disaster, and to identify and prioritize the implementation of improvements for long-term resiliency (with an emphasis on bridges serving potentially isolated communities (e.g., East Maui).	Medium	Department of Public Works	Department of Transportation, Hawai‘i DOT	September 2020 - October 2024	Medium
23	Identify and inventory areas at risk using GIS to landslides and rockfalls and mitigate risk to these areas. Specific areas to address include Kalepa (East Maui), Kahakuloa (Central/West Maui), and Hāna Highway (in/downslope of high landslide susceptibility areas or that have experienced past rockfalls).	Medium	Department of Public Works	Department of Management/GIS	September 2020 - October 2025	Medium

24	Improve drainage and slope stabilization along steeps areas that are prone to fail due to soil saturation, including the Kahekili Slope Repair project and other locations identified as priorities for hazard risk reduction. These include projects that protect critical facilities and infrastructure such as Pi'ilani Highway (through East Maui) and Kahekili Highway (through Kahakuloa). Develop a GIS data layer for hazard areas.	Medium	Department of Public Works	Department of Parks and Recreation	September 2020 - October 2021	High
25	Replace aging stormwater infrastructure at the end of its life cycle with new infrastructure designed to future, more extreme events (i.e., above code).	Medium	Department of Public Works	Department of Environmental Management	September 2020 - October 2025	High
45	Implement the mitigation actions identified in the existing and future drainage master plans.	Low	Department of Public Works	Planning Department	September 2020 - October 2025	Very High

EMERGENCY MANAGEMENT AGENCY

Action #	Mitigation Action	Implementation Priority*	Lead Department	Supporting Agency(ies)	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.	High	Emergency Management Agency	Planning Department, Department of Transportation	September 2020 - October 2024	Low
5	Identify alternative locations for emergency supply of diesel, gas, and propane on Molokaʻi for a minimum of 30 days.	High	Emergency Management Agency	Island Petroleum Fuel Pipeline	September 2020 - October 2025	Medium
6	Share funding sources for building retrofits or other modifications with owners of residential buildings to mitigate the effects of high winds. Encourage the use of load path connectors, hurricane shutters, safe rooms, reinforced garage doors, replacement of non-ductile infrastructure, strengthen structural frames, inspect and retrofit roofs, gable end walls for wind resistance.	High	Emergency Management Agency	Department of Public Works, UH Sea Grant	September 2020 - October 2025	Low

7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	High	Emergency Management Agency	Planning Department	September 2020 - October 2025	Mediu m
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	High	Emergency Management Agency	Planning Department, Department of Public Works	September 2020 - October 2025	Low
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	High	Emergency Management Agency	Mayor's Office, Planning Department	September 2020 - October 2025	Low
26	Identify critical infrastructure, lifelines, roads, and populations that are vulnerable to coastal hazards, and encourage strategic retreat, relocation or retrofit. Maui Island Plan 3.1.2.a	Medium	Emergency Management Agency	Planning Department, Department of Public Works, Department of Transportation, Facility Owners	September 2020 - October 2025	Very High

27	Where appropriate and feasible, provide technical assistance and administer financial support to willing property owners for the completion of projects to protect structures located in hazard-prone areas from future damage, with repetitive loss and severe repetitive loss properties as priority.	Medium	Emergency Management Agency	Homeowners, County Council	September 2020 - October 2025	Low
28	Implement the guidance and tools identified in the 2019 Guidance for Disaster Recovery Preparedness in Hawai‘i, which was supported by Maui County. (https://seagrant.soest.Hawai‘i.edu/wp-content/uploads/2019/07/HI_Disaster_Recovery_Preparedness_Guidance_Final_26June2019.pdf)	Medium	Emergency Management Agency	UH Sea Grant, HI-EMA	September 2020 - October 2021	High
29	Obtain FEMA’s Substantial Damage Estimator and attend training to be prepared to use it when damage occurs; and develop mutual aid agreements with other jurisdictions to augment local inspection personnel after major disasters.	Medium	Emergency Management Agency	Department of Public Works, Planning Department	September 2020 - October 2023	Medium

30	Conduct a detailed needs assessment and capital planning/feasibility study for additional emergency shelters for both residents and visitors. This includes retrofitting existing public facilities and structures to withstand up to a Category 3 hurricane (e.g., high school gym on Moloka'i).	Medium	Emergency Management Agency	American Red Cross	September 2020 - October 2025	Very High
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Medium	Emergency Management Agency	Emergency Management Agency, Mayor's Office	September 2020 - October 2022	Low
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Medium	Emergency Management Agency	Mayor's Office, Department of Public Works	September 2020 - October 2022	Mediu m
42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Medium	Planning Department, Emergency Management Agency	Mayor's Office, Department of Public Works, Department of Water Supply (collaborate with	September 2020 - October 2025	Low

				some of their events?)		
46	Identify permanent and temporary facilities that could be used as cooling centers for vulnerable populations as extreme heat events become more intense/more frequent.	Low	Emergency Management Agency	American Red Cross, Department of Parks & Recreation	September 2020 - October 2025	Low
47	Promote the availability of flood insurance to property owners in areas subject to flooding but not located within FEMA-mapped special flood hazard areas, with an emphasis on the ability to purchase for lower premium rates (via preferred risk policies).	Low	Emergency Management Agency	Planning Department	September 2020 - October 2025	Low

FIRE PREVENTION BUREAU

Action #	Mitigation Action	Implementation Priority*	Lead Department	Supporting Agency(ies)	Timeline	Cost

10	Support the revitalization and expansion of the Firewise USA program to additional communities.	High	Fire Prevention Bureau	Emergency Management Agency, West Maui Fire Task Force, Molokaʻi Wildfire Task Force, MCDA, HWMO	September 2020 - October 2025	Low
33	Research, promote, and support the implementation of wildfire mitigation practices for Wildland Urban Interface (WUI) and other areas identified as high risk but not covered by a current Community Wildfire Protection Plan (CWPPs). Practices may include but not be limited to the following: • Retrofit at-risk County structures with ignition-resistant materials • Initiating programs aimed at reducing fuel loads (removing non-native grasses and shrubs with native/fire-resistant species) • Prevent wildfire burn areas from being replanted with non-native vegetation • Implementing defensible space and firebreaks in rural developments through	Medium	Fire Prevention Bureau	Department of Land and Natural Resources, Hawaiʻi Wildfire Management Organization, Molokaʻi and West Maui Fire Task Force	September 2020 - October 2025	Medium

	existing codes and development standards					
34	Support the Hawai'i Wildfire Management Organization, the Maui Wildfire Coordinating Group, local fire task forces, and other stakeholder organizations with the implementation of mitigation action items as identified in all current Community Wildfire Protection Plans (CWPPs).	Medium	Fire Prevention Bureau	Fire & Public Safety, Maui Farm Bureau, Watershed Partners, Department of Land and Natural Resources, Division of Forestry and Wildlife	September 2020 - October 2023	Medium

MAYOR'S OFFICE

Action #	Mitigation Action	Implementation Priority*	Lead Department	Supporting Agency(ies)	Timeline	Cost
11	Establish an alternative route to and from West Maui for use during disasters.	High	Mayor's Office	Planning Department, Department of Public Works	September 2020 - October 2025	Very High
12	Coordinate with the State to adapt State Highway Route 450 in Moloka'i at	High	Mayor's Office and Council	Department of Transportation,	September 2020 - October 2025	Very High

	MM 15-16 (east side experiencing major erosion and undermining in the last few years).			Department of Public Works, Hawai'i DOT		
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	High	Mayor's Office, Department of Environmental Management	Emergency Management Agency, Planning Department	September 2020 - October 2025	Low
35	Develop a Master Plan for the use of County owned land along the Honoapiilani Highway.	Medium	Mayor's Office	Planning Department, Department of Parks & Recreation, Emergency Management Agency	September 2020 - October 2023 (for Planning, then ongoing for implementation)	Medium
36	Mitigate the impacts of saltwater intrusion, exacerbated by flooding and/or erosion from Sea Level Rise, on utilities, ecosystems and other public facilities.	Medium	Mayor's Office	Department of Water Supply, Department of Environmental Management, Department of Parks & Recreation	September 2020 - October 2025	Very High
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Medium	Mayor's Office	Emergency Management Agency, Planning Department, Department of	September 2020 - October 2025	Medium

				Environmental Management		
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Medium	Mayor's Office	Emergency Management Agency, Planning Department	September 2020 - October 2025	Medium

PLANNING DEPT.

Action #	Mitigation Action	Implementation Priority*	Lead Department	Supporting Agency(ies)	Timeline	Cost
14	Expand Beach and Dune Restoration Projects 1) Identify and prioritize erosion hotspots for mitigation via beach nourishment where applicable. 2) Pursue Federal/State/County funding for beach nourishment and restoration (including pre-positioning for post-disaster financial assistance). 3) Work with State regulatory agencies to streamline permitting for beach	High	Planning Department	Department of Parks & Recreation, Department of Environmental Management	September 2020 - October 2025	Very High

	restoration. 4) Promote living shoreline projects instead of shoreline hardening where feasible. 5) Protect/restore coral reefs as they provide a barrier for erosion, high surf/coastal flooding and tsunamis.					
15	Update dune restoration guidance. Provide dune restoration training. Develop an outreach initiative to encourage or establish new dune restoration volunteers/stewards. Install ADA compliant dune walkovers in identified locations.	High	Planning Department	Department of Parks & Recreation, Hawai'i Department of Land and Natural Resources, UH-Sea Grant	September 2020 - October 2023	High
16	NR	High	Planning Department	Department of Public Works, Emergency Management Agency	September 2020 - October 2025	Low
17	Conduct a multivariate GIS analysis to identify and categorize open spaces for the County of Maui to purchase and preserve based on highest ROI for hydrological capacity and positive impact on flood mitigation.	High	Planning Department	Department of Public Works, Department of Parks and Recreation, Department of Land and Natural Resources	September 2020 - October 2021	Low

18	Adopt internal protocols for how to intake, process, approve and file all new FDPs in order to ensure consistent and clear records for upcoming CRS audits. Having a more thorough digital record of approved FDPs will facilitate the Floodplain Manager achieving a greater score during the CRS Audits.	High	Planning Department	Department of Public Works (DSA) for building permits	September 2020 - March 2021	Low
19	Encourage Low Impact Development (LID) approach to site development and stormwater management through development of best practices guide.	High	Planning Department, Department of Water Supply	Department of Public Works, Emergency Management Agency	September 2020 - October 2025	Medium
39	Increase the number of NFIP-trained staff members, including those who are Coastal Zone Management planners, working to support the County's floodplain management program to build administrative capacity and increase performance efficiencies. Have each plan reviewer and building inspector attend a training or workshop related to floodplain management. Sponsor a periodic NFIP workshop for local surveyors and builders. Encourage or	Medium	Planning Department	Mayor's Office, FEMA Training Center, Association of State Floodplain Managers (ASFPM)	September 2020 - October 2022	Low

	require more County staff positions to obtain and maintain Certified Floodplain Manager (CFM) certification, ideally having 2-3 dedicated CFMs optimizing the flood program.					
40	Conduct information sessions regarding the NFIP for public officials and appointees of the Flood Management Program with an emphasis on the importance of the County's participation in the NFIP and the impact of failing to enforce requirements.	Medium	Planning Department	County Council	September 2020 - October 2025	Staff time
41	Maintain NFIP Compliance. Continue to maintain good standing and compliance under the NFIP through implementation of floodplain management programs that, at a minimum, meet the NFIP requirements: enforce the flood damage prevention ordinance, participate in floodplain identification and mapping updates, provide public	Medium	Planning Department	County Council, Department of Public Works	September 2020 - October 2025	Low

	assistance/information on floodplain requirements and impacts.					
42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Medium	Planning Department, Emergency Management Agency	Mayor's Office, Department of Public Works, Department of Water Supply (collaborate with some of their events?)	September 2020 - October 2025	Low
48	Provide funding support to the University of Hawaiʻi (Coastal Geology Group) to complete shoreline erosion studies to include Molokaʻi and Lānaʻi and continue to update studies for Maui.	Low	Planning Department	Emergency Management Agency	September 2020 - October 2025	High
49	Propose an amendment to the Zoning Code to prohibit building schools, daycare centers or other facilities that serve vulnerable populations, in tsunami evacuation zones.	Low	Planning Department	Emergency Management Agency	September 2020 - October 2024	Staff time
50	Establish an ad-hoc mobile application allowing "on-the-ground" recorded observations of flooding from citizens	Low	Planning Department	Department of Public Works, Department of Water Supply, Department of	September 2020 - October 2025	Staff time

	to create a high-resolution GIS layer of flooding spanning all county parcels.			Environmental Management, Emergency Management Agency, Department of Parks & Recreation, Division of Forestry and Wildlife, Department of Land and Natural Resources, County GIS		

Mitigation Actions for Each Natural Hazard

DROUGHT						
Action #	**Mitigation Action**	**Hazards Addressed**	**Implementation Priority***	**Lead Department**	**Timeline**	**Cost**
1	Explore options and necessary code and regulation changes to allow greywater	Drought	High	Department of Environmental Management,	September 2020 -	Low

	reuse systems for irrigation and toilet flushing.			Department of Water Supply	October 2021	
3	Develop a water conservation ordinance to include xeriscaping regulations to promote water conservation (Maui Island Plan Action 6.3.2)	Drought	High	Department of Water Supply	September 2020 - October 2023	Low
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2024	Low
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Medium
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low

9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low
19	Encourage Low Impact Development (LID) approach to site development and stormwater management through development of best practices guide.	Drought, Extreme Heat, Flood	High	Planning Department, Department of Water Supply	September 2020 - October 2025	Medium
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low

32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Medium
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low

FLOOD						
Action #	**Mitigation Action**	**Hazards Addressed**	**Implementation Priority***	**Lead Department**	**Timeline**	**Cost**
2	Adopt the most current building codes to mitigate risk associated with flooding.	Flood	High	Department of Public Works	September 2020 - October 2022	Low
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2024	Low
5	Identify alternative locations for emergency supply of diesel, gas, and propane on Molokaʻi for a minimum of 30 days.	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis	High	Emergency Management Agency	September 2020 - October 2025	Medium
7	Support Emergency Preparedness Working Groups to form and hold annual	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides,	High	Emergency Management Agency	September 2020 -	Medium

	preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks			October 2025	
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
11	Establish an alternative route to and from West Maui for use during disasters.	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office	September 2020 - October 2025	Very High
12	Coordinate with the State to adapt State Highway Route 450 in Molokaʻi at MM 15-16 (east side experiencing major erosion and undermining in the last few years).	Coastal Erosion, Flood	High	Mayor's Office and Council	September 2020 - October 2025	Very High

13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low
14	Expand Beach and Dune Restoration Projects 1) Identify and prioritize erosion hotspots for mitigation via beach nourishment where applicable. 2) Pursue Federal/State/County funding for beach nourishment and restoration (including pre-positioning for post-disaster financial assistance). 3) Work with State regulatory agencies to streamline permitting for beach restoration. 4) Promote living shoreline projects instead of shoreline hardening where feasible. 5) Protect/restore coral reefs as they provide a barrier for erosion, high surf/coastal flooding and tsunamis.	Coastal Erosion, Flood, Hurricane, Tsunamis	High	Planning Department	September 2020 - October 2025	Very High
15	Update dune restoration guidance. Provide dune restoration training. Develop an outreach initiative to encourage or establish new dune restoration volunteers/stewards. Install ADA	Coastal Erosion, Flood, Hurricane, Tsunamis	High	Planning Department	September 2020 - October 2023	High

	compliant dune walkovers in identified locations.					
16	NR	Flood	High	Planning Department	September 2020 - October 2025	Low
17	Conduct a multivariate GIS analysis to identify and categorize open spaces for the County of Maui to purchase and preserve based on highest ROI for hydrological capacity and positive impact on flood mitigation.	Flood	High	Planning Department	September 2020 - October 2021	Low
18	Adopt internal protocols for how to intake, process, approve and file all new FDPs in order to ensure consistent and clear records for upcoming CRS audits. Having a more thorough digital record of approved FDPs will facilitate the Floodplain Manager achieving a greater score during the CRS Audits.	Flood	High	Planning Department	September 2020 - March 2021	Low
19	Encourage Low Impact Development (LID) approach to site development and stormwater management through development of best practices guide.	Drought, Extreme Heat, Flood	High	Planning Department, Department of Water Supply	September 2020 - October 2025	Medium

20	Flood proof water and wastewater treatment facilities located in flood hazard areas and identified as vulnerable to future damage or disruption. This includes but is not limited to the Kaunakakai Wastewater Treatment Facility.	Flood	Medium	Department of Environmental Management	September 2020 - October 2025	Very High
21	Develop a strategy to mitigate risk to coastal roads.	Coastal Erosion, Flood, Hurricane, Tsunamis	Medium	Department of Public Works	September 2020 - October 2023 (for Planning, then ongoing for implementation)	High
22	Prepare an inventory of non-NBIS bridges using GIS and create a framework for an inspections schedule to help ensure that all bridges are assessed for their structural stability during a natural disaster, and to identify and prioritize the implementation of improvements for long-term resiliency (with an emphasis on bridges serving potentially isolated communities (e.g., East Maui).	Earthquake, Flood	Medium	Department of Public Works	September 2020 - October 2024	Medium

25	Replace aging stormwater infrastructure at the end of its life cycle with new infrastructure designed to future, more extreme events (i.e., above code).	Flood, Hurricane	Medium	Department of Public Works	September 2020 - October 2025	High
26	Identify critical infrastructure, lifelines, roads, and populations that are vulnerable to coastal hazards, and encourage strategic retreat, relocation or retrofit. Maui Island Plan 3.1.2.a	Coastal Erosion, Flood, Hurricane, Tsunamis	Medium	Emergency Management Agency	September 2020 - October 2025	Very High
27	Where appropriate and feasible, provide technical assistance and administer financial support to willing property owners for the completion of projects to protect structures located in hazard-prone areas from future damage, with repetitive loss and severe repetitive loss properties as priority.	Coastal Erosion, Flood, Hurricane, Tsunami	Medium	Emergency Management Agency	September 2020 - October 2025	Low
28	Implement the guidance and tools identified in the 2019 Guidance for Disaster Recovery Preparedness in Hawai‘i, which was supported by Maui County. (https://seagrant.soest.Hawai‘i.edu/wp-content/uploads/2019/07/HI_Disaster_Recovery_Preparedness_Guidance_Final_26June2019.pdf)	Coastal Erosion, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2021	High

29	Obtain FEMA's Substantial Damage Estimator and attend training to be prepared to use it when damage occurs; and develop mutual aid agreements with other jurisdictions to augment local inspection personnel after major disasters.	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2023	Medium
30	Conduct a detailed needs assessment and capital planning/feasibility study for additional emergency shelters for both residents and visitors. This includes retrofitting existing public facilities and structures to withstand up to a Category 3 hurricane (e.g., high school gym on Moloka'i).	Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2025	Very High
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides,	Medium	Emergency Management Agency	September 2020 - October 2022	Medium

	departments or agencies to implement mitigation actions.	Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks				
35	Develop a Master Plan for the use of County owned land along the Honoapiilani Highway.	Coastal Erosion, Flood, Hurricane, Tsunamis	Medium	Mayor's Office	September 2020 - October 2023 (for Planning, then ongoing for implementation)	Medium
36	Mitigate the impacts of saltwater intrusion, exacerbated by flooding and/or erosion from Sea Level Rise, on utilities, ecosystems and other public facilities.	Coastal Erosion, Flood	Medium	Mayor's Office	September 2020 - October 2025	Very High
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides,	Medium	Mayor's Office	September 2020 -	Medium

	preparedness, response and recovery efforts of the MEMA.	Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks			October 2025	
39	Increase the number of NFIP-trained staff members, including those who are Coastal Zone Management planners, working to support the County's floodplain management program to build administrative capacity and increase performance efficiencies. Have each plan reviewer and building inspector attend a training or workshop related to floodplain management. Sponsor a periodic NFIP workshop for local surveyors and builders. Encourage or require more County staff positions to obtain and maintain Certified Floodplain Manager (CFM) certification, ideally having 2-3 dedicated CFMs optimizing the flood program.	Flood	Medium	Planning Department	September 2020 - October 2022	Low
40	Conduct information sessions regarding the NFIP for public officials and appointees of the Flood Management Program with an emphasis on the importance of the County's participation in the NFIP and the impact of failing to enforce requirements.	Flood	Medium	Planning Department	September 2020 - October 2025	Staff time
41	Maintain NFIP Compliance. Continue to maintain good standing and compliance	Flood	Medium	Planning Department	September 2020 -	Low

	under the NFIP through implementation of floodplain management programs that, at a minimum, meet the NFIP requirements: enforce the flood damage prevention ordinance, participate in floodplain identification and mapping updates, provide public assistance/information on floodplain requirements and impacts.				October 2025	
42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low
45	Implement the mitigation actions identified in the existing and future drainage master plans.	Flood	Low	Department of Public Works	September 2020 - October 2025	Very High
47	Promote the availability of flood insurance to property owners in areas subject to flooding but not located within FEMA-mapped special flood hazard areas, with an emphasis on the ability to purchase for lower premium rates (via preferred risk policies).	Flood	Low	Emergency Management Agency	September 2020 - October 2025	Low

50	Establish an ad-hoc mobile application allowing "on-the-ground" recorded observations of flooding from citizens to create a high-resolution GIS layer of flooding spanning all county parcels.	Flood	Low	Planning Department	September 2020 - October 2025	Staff time
COASTAL EROSION						
Action #	**Mitigation Action**	**Hazards Addressed**	**Implementation Priority***	**Lead Department**	**Timeline**	**Cost**
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2024	Low
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Medium

8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
11	Establish an alternative route to and from West Maui for use during disasters.	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office	September 2020 - October 2025	Very High
12	Coordinate with the State to adapt State Highway Route 450 in Moloka'i at MM 15-16 (east side experiencing major erosion and undermining in the last few years).	Coastal Erosion, Flood	High	Mayor's Office and Council	September 2020 - October 2025	Very High

13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low
14	Expand Beach and Dune Restoration Projects 1) Identify and prioritize erosion hotspots for mitigation via beach nourishment where applicable. 2) Pursue Federal/State/County funding for beach nourishment and restoration (including pre-positioning for post-disaster financial assistance). 3) Work with State regulatory agencies to streamline permitting for beach restoration. 4) Promote living shoreline projects instead of shoreline hardening where feasible. 5) Protect/restore coral reefs as they provide a barrier for erosion, high surf/coastal flooding and tsunamis.	Coastal Erosion, Flood, Hurricane, Tsunamis	High	Planning Department	September 2020 - October 2025	Very High
15	Update dune restoration guidance. Provide dune restoration training. Develop an outreach initiative to encourage or establish new dune restoration volunteers/stewards. Install	Coastal Erosion, Flood, Hurricane, Tsunamis	High	Planning Department	September 2020 - October 2023	High

	ADA compliant dune walkovers in identified locations.					
21	Develop a strategy to mitigate risk to coastal roads.	Coastal Erosion, Flood, Hurricane, Tsunamis	Medium	Department of Public Works	September 2020 - October 2023 (for Planning, then ongoing for implementation)	High
26	Identify critical infrastructure, lifelines, roads, and populations that are vulnerable to coastal hazards, and encourage strategic retreat, relocation or retrofit. Maui Island Plan 3.1.2.a	Coastal Erosion, Flood, Hurricane, Tsunamis	Medium	Emergency Management Agency	September 2020 - October 2025	Very High
27	Where appropriate and feasible, provide technical assistance and administer financial support to willing property owners for the completion of projects to protect structures located in hazard-prone areas from future damage, with repetitive loss and severe repetitive loss properties as priority.	Coastal Erosion, Flood, Hurricane, Tsunami	Medium	Emergency Management Agency	September 2020 - October 2025	Low

28	Implement the guidance and tools identified in the 2019 Guidance for Disaster Recovery Preparedness in Hawai‘i, which was supported by Maui County. (https://seagrant.soest.Hawai‘i.edu/wp-content/uploads/2019/07/HI_Disaster_Recovery_Preparedness_Guidance_Final_26June2019.pdf)	Coastal Erosion, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2021	High
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Medium
35	Develop a Master Plan for the use of County owned land along the Honoapiilani Highway.	Coastal Erosion, Flood, Hurricane, Tsunamis	Medium	Mayor's Office	September 2020 - October 2023 (for	Medium

					Planning, then ongoing for implementation)	
36	Mitigate the impacts of saltwater intrusion, exacerbated by flooding and/or erosion from Sea Level Rise, on utilities, ecosystems and other public facilities.	Coastal Erosion, Flood	Medium	Mayor's Office	September 2020 - October 2025	Very High
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
42	Promote public education and involvement related to natural hazards	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High	Medium	Planning Department, Emergency	September 2020 -	Low

	awareness preparedness. (Maui Island Policy 3.1.4a)	Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire		Management Agency	October 2025	
48	Provide funding support to the University of Hawaiʻi (Coastal Geology Group) to complete shoreline erosion studies to include Molokaʻi and Lānaʻi and continue to update studies for Maui.	Coastal Erosion	Low	Planning Department	September 2020 - October 2025	High

EXTREME COLD

Action #	Mitigation Action	Hazards Addressed	Implementation Priority*	Lead Department	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2024	Low

7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Medium
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low

31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Medium
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium

42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low

DAM/RESERVOIR FAILURE

Action #	Mitigation Action	Hazards Addressed	Implementation Priority*	Lead Department	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2024	Low
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Medium

8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
11	Establish an alternative route to and from West Maui for use during disasters.	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office	September 2020 - October 2025	Very High
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low

30	Conduct a detailed needs assessment and capital planning/feasibility study for additional emergency shelters for both residents and visitors. This includes retrofitting existing public facilities and structures to withstand up to a Category 3 hurricane (e.g., high school gym on Moloka'i).	Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2025	Very High
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Medium
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides,	Medium	Mayor's Office	September 2020 - October 2025	Medium

		Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks				
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low

EXTREME HEAT

Action #	Mitigation Action	Hazards Addressed	Implementation Priority*	Lead Department	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides,	High	Emergency Management Agency	September 2020 - October 2024	Low

	communities that may become isolated as a consequence of disaster.	Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks				
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Medium
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides,	High	Mayor's Office, Department of	September 2020 - October 2025	Low

		Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks		Environmental Management		
19	Encourage Low Impact Development (LID) approach to site development and stormwater management through development of best practices guide.	Drought, Extreme Heat, Flood	High	Planning Department, Department of Water Supply	September 2020 - October 2025	Medium
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Medium
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides,	Medium	Mayor's Office	September 2020 - October 2025	Medium

		Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks				
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low
46	Identify permanent and temporary facilities that could be used as cooling centers for vulnerable populations as extreme heat events become more intense/more frequent.	Extreme Heat	Low	Emergency Management Agency	September 2020 - October 2025	Low

EARTHQUAKE

Action #	Mitigation Action	Hazards Addressed	Implementation Priority*	Lead Department	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2024	Low
5	Identify alternative locations for emergency supply of diesel, gas, and propane on Molokaʻi for a minimum of 30 days.	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis	High	Emergency Management Agency	September 2020 - October 2025	Mediu m
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Mediu m
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides,	High	Emergency Management Agency	September 2020 - October 2025	Low

	programs, the general plan, recovery plans and strategic plans.	Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks				
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
11	Establish an alternative route to and from West Maui for use during disasters.	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office	September 2020 - October 2025	Very High
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low
22	Prepare an inventory of non-NBIS bridges using GIS and create a framework for an inspections schedule to help ensure that all bridges are assessed for their structural stability during a natural disaster, and to identify	Earthquake, Flood	Medium	Department of Public Works	September 2020 - October 2024	Medium

	and prioritize the implementation of improvements for long-term resiliency (with an emphasis on bridges serving potentially isolated communities (e.g., East Maui).					
28	Implement the guidance and tools identified in the 2019 Guidance for Disaster Recovery Preparedness in Hawai'i, which was supported by Maui County. (https://seagrant.soest.Hawai'i.edu/wp-content/uploads/2019/07/HI_Disaster_Recovery_Preparedness_Guidance_Final_26June2019.pdf)	Coastal Erosion, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2021	High
29	Obtain FEMA's Substantial Damage Estimator and attend training to be prepared to use it when damage occurs; and develop mutual aid agreements with other jurisdictions to augment local inspection personnel after major disasters.	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2023	Mediu m
30	Conduct a detailed needs assessment and capital planning/feasibility study for additional emergency shelters for both residents and visitors. This includes retrofitting existing public facilities and	Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2025	Very High

	structures to withstand up to a Category 3 hurricane (e.g., high school gym on Moloka'i).					
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Medium
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium

38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low

HIGH WINDSTORM

Action #	Mitigation Action	Hazards Addressed	Implementation Priority*	Lead Department	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides,	High	Emergency Management Agency	September 2020 - October 2024	Low

	or communities that may become isolated as a consequence of disaster.	Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks				
5	Identify alternative locations for emergency supply of diesel, gas, and propane on Molokaʻi for a minimum of 30 days.	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis	High	Emergency Management Agency	September 2020 - October 2025	Medium
6	Share funding sources for building retrofits or other modifications with owners of residential buildings to mitigate the effects of high winds. Encourage the use of load path connectors, hurricane shutters, safe rooms, reinforced garage doors, replacement of non-ductile infrastructure, strengthen structural frames, inspect and retrofit roofs, gable end walls for wind resistance.	High Windstorm, Hurricane	High	Emergency Management Agency	September 2020 - October 2025	Low
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Medium

8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
11	Establish an alternative route to and from West Maui for use during disasters.	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office	September 2020 - October 2025	Very High
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low

28	Implement the guidance and tools identified in the 2019 Guidance for Disaster Recovery Preparedness in Hawai'i, which was supported by Maui County. (https://seagrant.soest.Hawai'i.edu/wp-content/uploads/2019/07/HI_Disaster_Recovery_Preparedness_Guidance_Final_26June2019.pdf)	Coastal Erosion, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2021	High
29	Obtain FEMA's Substantial Damage Estimator and attend training to be prepared to use it when damage occurs; and develop mutual aid agreements with other jurisdictions to augment local inspection personnel after major disasters.	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2023	Mediu m
30	Conduct a detailed needs assessment and capital planning/feasibility study for additional emergency shelters for both residents and visitors. This includes retrofitting existing public facilities and structures to withstand up to a Category 3 hurricane (e.g., high school gym on Moloka'i).	Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2025	Very High

31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Mediu m
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Mediu m
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Mediu m

42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low

HURRICANE

Action #	Mitigation Action	Hazards Addressed	Implementation Priority*	Lead Department	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2024	Low

5	Identify alternative locations for emergency supply of diesel, gas, and propane on Molokaʻi for a minimum of 30 days.	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis	High	Emergency Management Agency	September 2020 - October 2025	Medium
6	Share funding sources for building retrofits or other modifications with owners of residential buildings to mitigate the effects of high winds. Encourage the use of load path connectors, hurricane shutters, safe rooms, reinforced garage doors, replacement of non-ductile infrastructure, strengthen structural frames, inspect and retrofit roofs, gable end walls for wind resistance.	High Windstorm, Hurricane	High	Emergency Management Agency	September 2020 - October 2025	Low
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Medium
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High	High	Emergency Management Agency	September 2020 - October 2025	Low

	capital improvement programs, the general plan, recovery plans and strategic plans.	Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks				
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
11	Establish an alternative route to and from West Maui for use during disasters.	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office	September 2020 - October 2025	Very High
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low

14	Expand Beach and Dune Restoration Projects 1) Identify and prioritize erosion hotspots for mitigation via beach nourishment where applicable. 2) Pursue Federal/State/County funding for beach nourishment and restoration (including pre-positioning for post-disaster financial assistance). 3) Work with State regulatory agencies to streamline permitting for beach restoration. 4) Promote living shoreline projects instead of shoreline hardening where feasible. 5) Protect/restore coral reefs as they provide a barrier for erosion, high surf/coastal flooding and tsunamis.	Coastal Erosion, Flood, Hurricane, Tsunamis	High	Planning Department	September 2020 - October 2025	Very High
15	Update dune restoration guidance. Provide dune restoration training. Develop an outreach initiative to encourage or establish new dune restoration volunteers/stewards. Install ADA compliant dune walkovers in identified locations.	Coastal Erosion, Flood, Hurricane, Tsunamis	High	Planning Department	September 2020 - October 2023	High
21	Develop a strategy to mitigate risk to coastal roads.	Coastal Erosion, Flood, Hurricane, Tsunamis	Medium	Department of Public Works	September 2020 - October 2023 (for Planning, then ongoing	High

					for implementation)	
25	Replace aging stormwater infrastructure at the end of its life cycle with new infrastructure designed to future, more extreme events (i.e., above code).	Flood, Hurricane	Medium	Department of Public Works	September 2020 - October 2025	High
26	Identify critical infrastructure, lifelines, roads, and populations that are vulnerable to coastal hazards, and encourage strategic retreat, relocation or retrofit. Maui Island Plan 3.1.2.a	Coastal Erosion, Flood, Hurricane, Tsunamis	Medium	Emergency Management Agency	September 2020 - October 2025	Very High
27	Where appropriate and feasible, provide technical assistance and administer financial support to willing property owners for the completion of projects to protect structures located in hazard-prone areas from future damage, with repetitive loss and severe repetitive loss properties as priority.	Coastal Erosion, Flood, Hurricane, Tsunami	Medium	Emergency Management Agency	September 2020 - October 2025	Low
28	Implement the guidance and tools identified in the 2019 Guidance for Disaster Recovery Preparedness in Hawai'i, which was supported by Maui County. (https://seagrant.soest.Hawai'i.edu/wp-	Coastal Erosion, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2021	High

	content/uploads/2019/07/HI_Disaster_Recovery_Preparedness_Guidance_Final_26June2019.pdf)					
29	Obtain FEMA's Substantial Damage Estimator and attend training to be prepared to use it when damage occurs; and develop mutual aid agreements with other jurisdictions to augment local inspection personnel after major disasters.	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2023	Medium
30	Conduct a detailed needs assessment and capital planning/feasibility study for additional emergency shelters for both residents and visitors. This includes retrofitting existing public facilities and structures to withstand up to a Category 3 hurricane (e.g., high school gym on Moloka'i).	Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2025	Very High
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low

32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Medium
35	Develop a Master Plan for the use of County owned land along the Honoapiilani Highway.	Coastal Erosion, Flood, Hurricane, Tsunamis	Medium	Mayor's Office	September 2020 - October 2023 (for Planning, then ongoing for implementation)	Medium
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium

38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low

LANDSLIDE

Action #	Mitigation Action	Hazards Addressed	Implementation Priority*	Lead Department	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2024	Low
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Medium
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards,	High	Emergency Management Agency	September 2020 - October 2025	Low

		Wildfire, Hazardous Materials, Health Risks				
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
11	Establish an alternative route to and from West Maui for use during disasters.	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office	September 2020 - October 2025	Very High
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low

23	Identify and inventory areas at risk using GIS to landslides and rockfalls and mitigate risk to these areas. Specific areas to address include Kalepa (East Maui), Kahakuloa (Central/West Maui), and Hāna Highway (in/downslope of high landslide susceptibility areas or that have experienced past rockfalls).	Landslide	Medium	Department of Public Works	September 2020 - October 2025	Medium
24	Improve drainage and slope stabilization along steeps areas that are prone to fail due to soil saturation, including the Kahekili Slope Repair project and other locations identified as priorities for hazard risk reduction. These include projects that protect critical facilities and infrastructure such as Pi'ilani Highway (through East Maui) and Kahekili Highway (through Kahakuloa). Develop a GIS data layer for hazard areas.	Landslide	Medium	Department of Public Works	September 2020 - October 2021	High
28	Implement the guidance and tools identified in the 2019 Guidance for Disaster Recovery Preparedness in Hawaiʻi, which was supported by Maui County. (https://seagrant.soest.Hawaiʻi.edu/wp-content/uploads/2019/07/HI_Disaster_Re	Coastal Erosion, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2021	High

	covery_Preparedness_Guidance_Final_26June2019.pdf)					
30	Conduct a detailed needs assessment and capital planning/feasibility study for additional emergency shelters for both residents and visitors. This includes retrofitting existing public facilities and structures to withstand up to a Category 3 hurricane (e.g., high school gym on Moloka'i).	Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2025	Very High
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Medium

37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low

TSUNAMIS

Action #	Mitigation Action	Hazards Addressed	Implementation Priority*	Lead Department	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High	High	Emergency Management Agency	September 2020 - October 2024	Low

	communities that may become isolated as a consequence of disaster.	Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks				
5	Identify alternative locations for emergency supply of diesel, gas, and propane on Molokaʻi for a minimum of 30 days.	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis	High	Emergency Management Agency	September 2020 - October 2025	Medium
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Medium
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low

9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
11	Establish an alternative route to and from West Maui for use during disasters.	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office	September 2020 - October 2025	Very High
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low
14	Expand Beach and Dune Restoration Projects 1) Identify and prioritize erosion hotspots for mitigation via beach nourishment where applicable. 2) Pursue	Coastal Erosion, Flood, Hurricane, Tsunamis	High	Planning Department	September 2020 - October 2025	Very High

	Federal/State/County funding for beach nourishment and restoration (including pre-positioning for post-disaster financial assistance). 3) Work with State regulatory agencies to streamline permitting for beach restoration. 4) Promote living shoreline projects instead of shoreline hardening where feasible. 5) Protect/restore coral reefs as they provide a barrier for erosion, high surf/coastal flooding and tsunamis.					
15	Update dune restoration guidance. Provide dune restoration training. Develop an outreach initiative to encourage or establish new dune restoration volunteers/stewards. Install ADA compliant dune walkovers in identified locations.	Coastal Erosion, Flood, Hurricane, Tsunamis	High	Planning Department	September 2020 - October 2023	High
21	Develop a strategy to mitigate risk to coastal roads.	Coastal Erosion, Flood, Hurricane, Tsunamis	Medium	Department of Public Works	September 2020 - October 2023 (for Planning, then ongoing for implementation)	High

26	Identify critical infrastructure, lifelines, roads, and populations that are vulnerable to coastal hazards, and encourage strategic retreat, relocation or retrofit. Maui Island Plan 3.1.2.a	Coastal Erosion, Flood, Hurricane, Tsunamis	Medium	Emergency Management Agency	September 2020 - October 2025	Very High
27	Where appropriate and feasible, provide technical assistance and administer financial support to willing property owners for the completion of projects to protect structures located in hazard-prone areas from future damage, with repetitive loss and severe repetitive loss properties as priority.	Coastal Erosion, Flood, Hurricane, Tsunami	Medium	Emergency Management Agency	September 2020 - October 2025	Low
28	Implement the guidance and tools identified in the 2019 Guidance for Disaster Recovery Preparedness in Hawai'i, which was supported by Maui County. (https://seagrant.soest.Hawai'i.edu/wp-content/uploads/2019/07/HI_Disaster_Recovery_Preparedness_Guidance_Final_26June2019.pdf)	Coastal Erosion, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2021	High
29	Obtain FEMA's Substantial Damage Estimator and attend training to be prepared to use it when damage occurs; and develop mutual aid agreements with	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2023	Medium

	other jurisdictions to augment local inspection personnel after major disasters.					
30	Conduct a detailed needs assessment and capital planning/feasibility study for additional emergency shelters for both residents and visitors. This includes retrofitting existing public facilities and structures to withstand up to a Category 3 hurricane (e.g., high school gym on Moloka'i).	Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2025	Very High
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Medium

35	Develop a Master Plan for the use of County owned land along the Honoapiilani Highway.	Coastal Erosion, Flood, Hurricane, Tsunamis	Medium	Mayor's Office	September 2020 - October 2023 (for Planning, then ongoing for implementation)	Medium
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium

42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low
49	Propose an amendment to the Zoning Code to prohibit building schools, daycare centers or other facilities that serve vulnerable populations, in tsunami evacuation zones.	Tsunami	Low	Planning Department	September 2020 - October 2024	Staff time

WILDFIRE

Action #	Mitigation Action	Hazards Addressed	Implementation Priority*	Lead Department	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides,	High	Emergency Management Agency	September 2020 - October 2024	Low

	communities that may become isolated as a consequence of disaster.	Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks				
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Medium
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards,	High	Emergency Management Agency	September 2020 - October 2025	Low

		Wildfire, Hazardous Materials, Health Risks				
10	Support the revitalization and expansion of the Firewise USA program to additional communities.	Wildfire	High	Fire Prevention Bureau	September 2020 - October 2025	Low
11	Establish an alternative route to and from West Maui for use during disasters.	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office	September 2020 - October 2025	Very High
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low
28	Implement the guidance and tools identified in the 2019 Guidance for Disaster Recovery Preparedness in Hawaiʻi, which was supported by Maui County. (https://seagrant.soest.Hawaiʻi.edu/wp-content/uploads/2019/07/HI_Disaster_Re	Coastal Erosion, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2021	High

	covery_Preparedness_Guidance_Final_26June2019.pdf)					
29	Obtain FEMA's Substantial Damage Estimator and attend training to be prepared to use it when damage occurs; and develop mutual aid agreements with other jurisdictions to augment local inspection personnel after major disasters.	Earthquake, Flood, High Windstorm, Hurricane, Tsunamis, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2023	Medium
30	Conduct a detailed needs assessment and capital planning/feasibility study for additional emergency shelters for both residents and visitors. This includes retrofitting existing public facilities and structures to withstand up to a Category 3 hurricane (e.g., high school gym on Moloka'i).	Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2025	Very High
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low

32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Medium
33	Research, promote, and support the implementation of wildfire mitigation practices for Wildland Urban Interface (WUI) and other areas identified as high risk but not covered by a current Community Wildfire Protection Plan (CWPPs). Practices may include but not be limited to the following: • Retrofit at-risk County structures with ignition-resistant materials • Initiating programs aimed at reducing fuel loads (removing non-native grasses and shrubs with native/fire-resistant species) • Prevent wildfire burn areas from being replanted with non-native vegetation • Implementing defensible space and firebreaks in rural developments through existing codes and development standards	Wildfire	Medium	Fire Prevention Bureau	September 2020 - October 2025	Medium

34	Support the Hawai‘i Wildfire Management Organization, the Maui Wildfire Coordinating Group, local fire task forces, and other stakeholder organizations with the implementation of mitigation action items as identified in all current Community Wildfire Protection Plans (CWPPs).	Wildfire	Medium	Fire Prevention Bureau	September 2020 - October 2023	Medium
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium

42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low

VOLCANIC HAZARDS

Action #	Mitigation Action	Hazards Addressed	Implementation Priority*	Lead Department	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2024	Low
7	Support Emergency Preparedness Working Groups to form and hold annual	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High	High	Emergency Management Agency	September 2020 - October 2025	Mediu m

	preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks				
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
11	Establish an alternative route to and from West Maui for use during disasters.	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office	September 2020 - October 2025	Very High

13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low
28	Implement the guidance and tools identified in the 2019 Guidance for Disaster Recovery Preparedness in Hawai‘i, which was supported by Maui County. (https://seagrant.soest.Hawai‘i.edu/wp-content/uploads/2019/07/HI_Disaster_Recovery_Preparedness_Guidance_Final_26June2019.pdf)	Coastal Erosion, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2021	High
30	Conduct a detailed needs assessment and capital planning/feasibility study for additional emergency shelters for both residents and visitors. This includes retrofitting existing public facilities and structures to withstand up to a Category 3 hurricane (e.g., high school gym on Moloka’i).	Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Emergency Management Agency	September 2020 - October 2025	Very High

31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Medium
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium

38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Mediu m
42	Promote public education and involvement related to natural hazards awareness preparedness. (Maui Island Policy 3.1.4a)	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire	Medium	Planning Department, Emergency Management Agency	September 2020 - October 2025	Low

HAZARDOUS MATERIALS

Action #	Mitigation Action	Hazards Addressed	Implementation Priority*	Lead Department	Timeline	Cost
4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides,	High	Emergency Management Agency	September 2020 - October 2024	Low

	communities that may become isolated as a consequence of disaster.	Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks				
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Medium
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as the Covid-19 pandemic, that are beyond the current scope of consideration.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low

11	Establish an alternative route to and from West Maui for use during disasters.	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office	September 2020 - October 2025	Very High
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low
32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards,	Medium	Emergency Management Agency	September 2020 - October 2022	Medium

	departments or agencies to implement mitigation actions.	Wildfire, Hazardous Materials, Health Risks				
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium

HEALTH RISKS						
Action #	**Mitigation Action**	**Hazards Addressed**	**Implementation Priority***	**Lead Department**	**Timeline**	**Cost**

4	To identify and establish MOUs for emergency evacuation and supply chain management for isolated communities or communities that may become isolated as a consequence of disaster.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2024	Low
7	Support Emergency Preparedness Working Groups to form and hold annual preparedness workshops for families in Molokaʻi, Lānaʻi and Hāna.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Medium
8	Plan Integration. Integrate the hazard mitigation plan into other plans, ordinances and programs that dictate land use decisions in the community, including capital improvement programs, the general plan, recovery plans and strategic plans.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Emergency Management Agency	September 2020 - October 2025	Low
9	The County of Maui will consider and adapt to all of the hazards listed in this plan as well as emerging hazards, such as	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards,	High	Emergency Management Agency	September 2020 - October 2025	Low

	the Covid-19 pandemic, that are beyond the current scope of consideration.	Wildfire, Hazardous Materials, Health Risks				
11	Establish an alternative route to and from West Maui for use during disasters.	Coastal Erosion, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office	September 2020 - October 2025	Very High
13	Support cross-departmental collaboration and planning in resilience and climate action efforts.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	High	Mayor's Office, Department of Environmental Management	September 2020 - October 2025	Low
31	Implement the Teen Cert Hero Project and promote the culture and resiliency of youth in Maui County.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Low

32	Hire a Capital Improvement Project Coordinator. Promote the availability of hazard mitigation grant funding sources (including but not limited to FEMA's HMA or BRIC programs) to all appropriate departments or agencies to implement mitigation actions.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Emergency Management Agency	September 2020 - October 2022	Medium
37	Establish a revolving fund that can support grant matching funds for hazard mitigation and climate action strategies.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium
38	Support the development of a network of community resilience hubs across Maui County that complements the emergency preparedness, response and recovery efforts of the MEMA.	Coastal Erosion, Drought, Extreme Cold, Extreme Heat, Dam/Reservoir Failure, Earthquake, Flood, High Windstorm, Hurricane, Landslides, Tsunamis, Volcanic Hazards, Wildfire, Hazardous Materials, Health Risks	Medium	Mayor's Office	September 2020 - October 2025	Medium

Appendix E: Implementation Plan Supporting Materials

Bi-Annual Progress Report Questionnaire

Mitigation Action Progress Worksheet				
Progress Report Period	From Date		To Date	
Action/Project Title				
Responsible Department				
Contact Name				
Contact Phone/Email				
Project Description				
Project Goal				
Project Objective				
Project Cost				
Project Status				
Date of Project Approval	Date of Project Start	Anticipated Date of Completion	Project Canceled	Project Delayed
Explanation of Delay or Cost Overruns				
Project Report Summary				

What was accomplished for this project during this reporting period?
What obstacles, problems, or delays did the project encounter?
Plans for next reporting period.

Mitigation Plan Evaluation Worksheet

Plan Section	Considerations	Explanation
Planning Process	Should the town invite any additional stakeholders to participate in the planning process? What public outreach activities have occurred? How can public involvement be improved?	
Risk Assessment	What disasters has the town, or the region experienced? Should the list of hazards be modified? Are new data sources, maps or studies available? If so, what have they revealed, and should the information be incorporated into the plan update? Has development in the region occurred and could it create or reduce risk?	
Capability Assessment	Has the town adopted new policies, plans, regulations, or reports that could be incorporated into this plan?	

Plan Section	Considerations	Explanation
	Are there different or additional administrative, human, technical, and financial resources available for mitigation planning? Are there different or new education and outreach programs and resources available for mitigation activities?	
Mitigation Strategy	Is the mitigation strategy being implemented as anticipated? Were the cost and timeline estimate accurate? Should new mitigation actions be added to the Action Plan? Should existing mitigation actions be revised or removed from the plan? Are there new obstacles that were not anticipated in the plan that will need to be considered in the next plan update? Are there new funding sources to consider? Have elements of the plan been incorporated into other planning mechanisms?	
Implementation Plan	Was the plan monitored and evaluated as anticipated? What are needed improvements to the plan implementation procedures?	

Annual Progress Report Template

Maui County

Hazard Mitigation Plan

Annual Progress Report

Reporting Period: *(Insert reporting period)*

Background: Maui County developed a hazard mitigation plan to reduce risk from natural hazards by identifying resources, information, and strategies for risk reduction. The federal Disaster Mitigation Act of 2000 requires state and local governments to develop hazard mitigation plans as a condition for federal disaster grant assistance. To prepare the plan, Maui County organized resources, replacement risks from natural hazards, developed planning goals and objectives, reviewed mitigation alternatives, and developed an initiative action plan to address probable impacts from natural hazards. By completing this process, Maui County maintained compliance with the Disaster Mitigation Act, achieving eligibility for mitigation grant funding opportunities afforded under the Robert T. Stafford Act. The plan can be viewed on-line at: https://www.mauicounty.gov/1832/Multi-Hazard-Mitigation-Plan.

Summary Overview of the Plan's Progress: The performance period for the Hazard Mitigation Plan became effective on ____, 2020, with the final approval of the plan by FEMA. The initial performance period for this plan will be 5 years, with an anticipated update to the plan to occur before _____, 2025. As of this reporting period, the performance period for this plan is considered to be __-percent complete. The Hazard Mitigation Plan has targeted 50 hazard mitigation initiatives to be pursued during the 5-year performance period. As of the reporting period, the following overall progress can be reported:

__ out of __ initiatives (__%) reported ongoing action toward completion.

__ out of __ initiatives (__%) were reported as being complete.

__ out of __ initiatives (___%) reported no action taken.

Purpose: The purpose of this report is to provide an annual update on the implementation of the initiative action plan identified in the Maui County Hazard Mitigation Plan. The objective is to ensure that there is a continuing and responsive planning process that will keep the Hazard Mitigation Plan dynamic and responsive to the needs and capabilities of Maui County. This report discusses the following:

- Continued public outreach related to hazard mitigation that has occurred within the last year
- Natural hazard events that have occurred within the last year

- Changes in risk exposure within the planning area (all of Maui County)
- Review of any hazard mitigation grant funding opportunities pursued within the last year
- Mitigation success stories
- Review of the initiative action plan and incorporation of new initiatives
- Changes in capabilities that could impact plan implementation
- Recommendations for changes/enhancement.

The Steering Committee: The Hazard Mitigation Plan Steering Committee, made up of stakeholders within the planning area, reviewed and approved this progress report at its meeting held on _____, 201_. It was determined through the plan's development process that the Steering Committee would remain in service to oversee the implementation and maintenance of the plan. At a minimum, the Steering Committee provides technical review and oversight on the development of the annual progress report. It is anticipated that there will be turnover in the membership annually, which will be documented in the progress reports. For this reporting period, the Steering Committee membership is as indicated in the table below. Also included in the table are additional stakeholders the Steering Committee would like to add.

Name	**Title**	**Department/Agency**
Additional Stakeholders to add to the Steering Committee		

Continued Public Outreach (Describe below, what events contributed to furthering continued public involvement in hazard mitigation in the planning area? Also, how can public involvement be improved?)

Natural Hazard Events and Risk Exposure (Describe below a summary of hazard events that occurred during the reporting period and the associated impact to people and property in Maui County. Include what new hazards or data sources the Steering Committee considered for the mitigation plan. What does the Steering Committee recommend adding to the mitigation plan in terms of plans, maps, studies, and hazards. Finally, include what new development occurred in Maui County)

Capabilities (Describe any new policies, plans, regulations or reports that the County has adopted that should be incorporated into this plan. Also describe any additional human or technical resources are available to the County.)

Review of the Mitigation Action Plan: (Insert brief overview of any grant funding that was pursued for mitigation initiatives during the reporting period. Describe any new or revised mitigation actions that the Steering Committee has added to the Mitigation Plan. Include reports generated by updating the Mitigation Action Tracker. The updated Mitigation Action Tracker includes the following information:

- Mitigation Action Status
- Was any element of the initiative carried out during the reporting period?
- If no action was completed, why?
- Is the timeline for implementation for the initiative still appropriate?
- Is the priority for the initiative still appropriate?
- If the initiative was completed, does it need to be changed or removed from the action plan?

Mitigation Strategy: (Insert below if any changes in priorities have taken place that may impact the priority order of mitigation actions or the goal statements.)

Mitigation Success Stories: (Insert brief overview of mitigation accomplishments during the reporting period.)

Changes That May Impact Implementation of the Plan: (Insert brief overview of any significant changes in the planning area that would have a profound impact on the implementation of the plan. Specify any changes in technical, regulatory and financial capabilities identified during the plan's development.)

Recommendations for Changes or Enhancements: (Based on the review of this report by the Steering Committee, the following recommendations will be noted for future updates or revisions to the plan.)

Public review notice: *The contents of this report are considered to be public knowledge and have been prepared for total public disclosure. Copies of the report have been provided to the Maui County Council and to local media outlets and the report is posted on the Maui County Hazard Mitigation Plan website.*