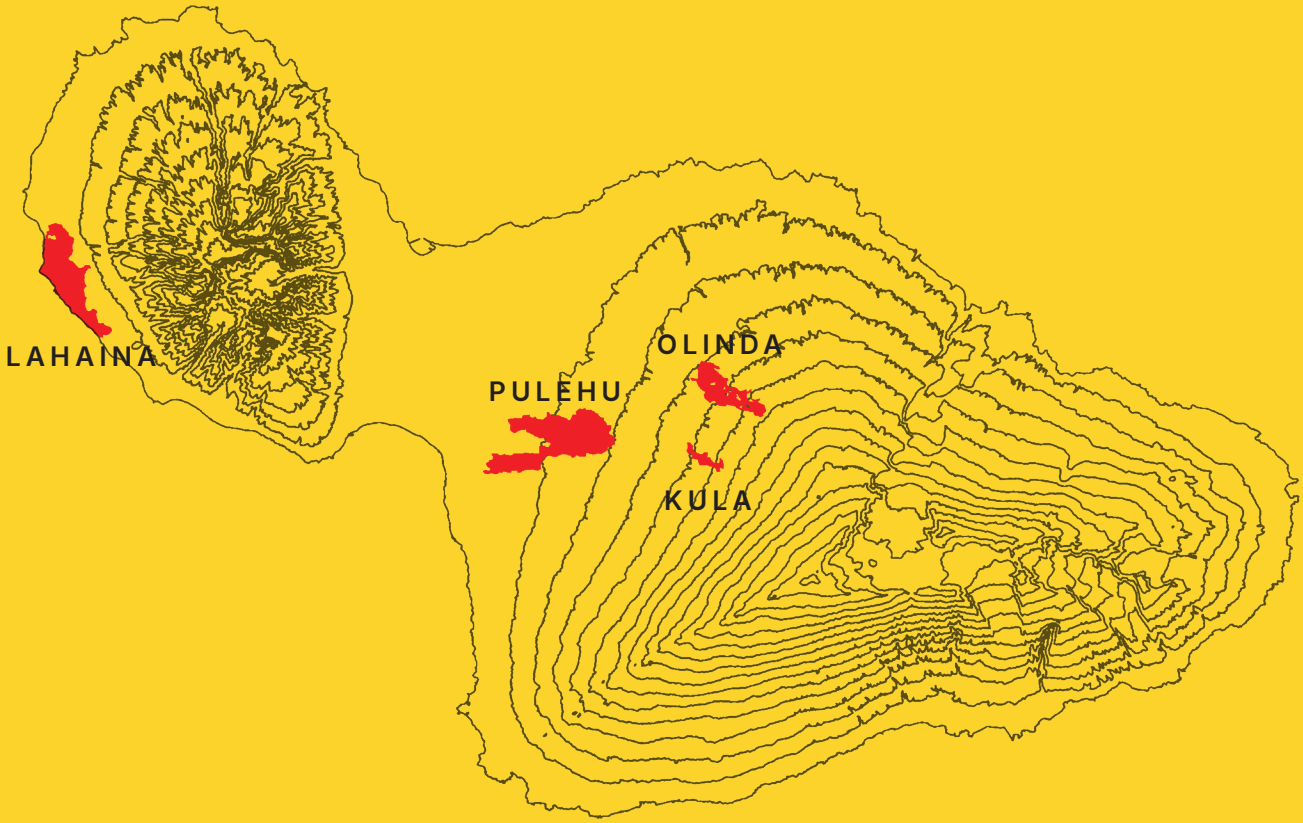
COUNTY OF MAUI
DEPARTMENT OF FIRE AND PUBLIC SAFETY

AFTER-ACTION REPORT

MAUI WILDFIRES

AUGUST 7-11, 2023



WESTERN FIRE CHIEFS ASSOCIATION

PRODUCED BY THE WESTERN FIRE CHIEFS ASSOCIATION

APRIL 18, 2024

DEDICATION

This After-Action Report is dedicated to those who lost their lives, suffered injuries, the families mourning loved ones, and the people who lost their homes, businesses, cherished memories, historical values, and livelihoods. This report acknowledges the courageous efforts of firefighters, law enforcement, and community members assisting one another. We trust that this report will contribute to the recovery process, prompting actions and public policies that enhance preparedness for future major incidents.

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EXECUTIVE SUMMARY

This After-Action Report (AAR) focuses on the County of Maui Department of Fire and Public Safety (MFD) and was commissioned by MFD Fire Chief Bradford Ventura. The primary objective of this report is to enable future enhancements to mitigate the impacts of the next major event. While this AAR focuses on the collective Olinda, Kula, Pulehu, and Lahaina fires, the recommendations can apply to any large-scale incident.

The AAR examines the whole island's limited resources, which were extremely challenged by the scope and scale of the collective incidents. The four main wildfires, which ignited on August 8, 2023, had a catastrophic impact, claiming 101 lives, extensive property damage, and causing numerous injuries. The fires led to numerous missing persons, burned 6,721 acres, and resulted in the loss of 2,173 structures, with many more damaged. The financial toll is staggering, with property damages exceeding six billion dollars. Additionally, these fires caused the loss of historic and cultural heritage sites and led to significant economic, infrastructure, and environmental losses. The aftermath of the fires also resulted in severe housing shortages. After conducting over 200 interviews and reviewing numerous data sets, it is clear that the four major wildfires pushed the MFD to an unprecedented level of strain. Despite this, the collective actions by MFD and law enforcement saved many lives and property across the island.

There are 111 recommendations in this AAR, which are organized into four main sections: Preparation, Mitigation, Response, and Recovery. Each section contains the following elements:

- Challenge: A brief statement of the main issue or problem that MFD faced or needs to address.
- Observations: A description of the current situation, facts, and data related to the challenge.
- Recommendations: A list of specific steps that MFD can consider to improve its performance and capabilities.

The insights are based upon the foundational elements that MFD, Maui County, the State of Hawaii, and the Hawaii Wildfire Management Organization have been striving to implement since 2010. Achieving collective success relies on support from first responders, policy makers and the public. The insights gained from this AAR should not be confined to Maui alone; instead, they can serve as a guide for other islands, or isolated communities on the mainland with limited emergency resources.

While nothing can replace the lives lost, or reduce the number of injuries or properties destroyed, the community will rebuild and can emerge more resilient than ever. As unprecedented and extreme weather conditions continue to persist, the lessons learned from this experience will pave the way for MFD to effectively respond to future challenges.

INTRODUCTION

The largest and most extensive deployment in the history of the County of Maui Department of Fire and Public Safety (MFD) occurred during the unprecedented series of wildfires that began on August 8, 2023. The Pulehu Fire was the largest acreage loss at 3,268 acres, followed by the Lahaina Fire at 2,170 acres, then the Olinda Fire at 1,081 acres, and the Kula Fire at 202 acres. Their collective property loss is estimated at six billion dollars. The Lahaina Fire resulted in the tragic loss of 101 lives, inflicted numerous injuries on both the public and first responders, and caused unparalleled economic, societal, historical, and cultural losses.

Nearly every staff member and vehicle resource of MFD on Maui was deployed. The emergency response system did not break but rather it found itself outmatched by the extreme weather and fire conditions. Staff members endured shifts of 36 hours or more and risked their lives in a valiant effort to stop the spread of the fires and save lives. Staff members have been grappling with questions about what they could have done differently, a reflection that will likely persist throughout the rest of their careers. It is from these introspective questions that leadership, mentoring, and command enhancements will emerge over time.

The purpose of this AAR is to identify key facts and lessons learned, laying the groundwork for forwarding recommendations that will effectively address future challenges. Fire Chief Bradford Ventura, recognizing the need for an impartial evaluation, engaged the Western Fire Chiefs Association, an organization that represents the fire service in the 11 western states and Pacific Islands, to conduct the review and produce this report. MFD staff members are intentionally not named, allowing the focus to center on the collective nature of the incidents and the lessons learned from the actions taken. Numerous people were interviewed and the narratives of these incidents are summarized. Additionally, the AAR does not address the cause or origin of the fires, as these details are being reviewed by other entities.

The AAR is based upon the latest data available at the time of the final document's printing, fully recognizing that specific data may be updated as other investigations and reviews are conducted.

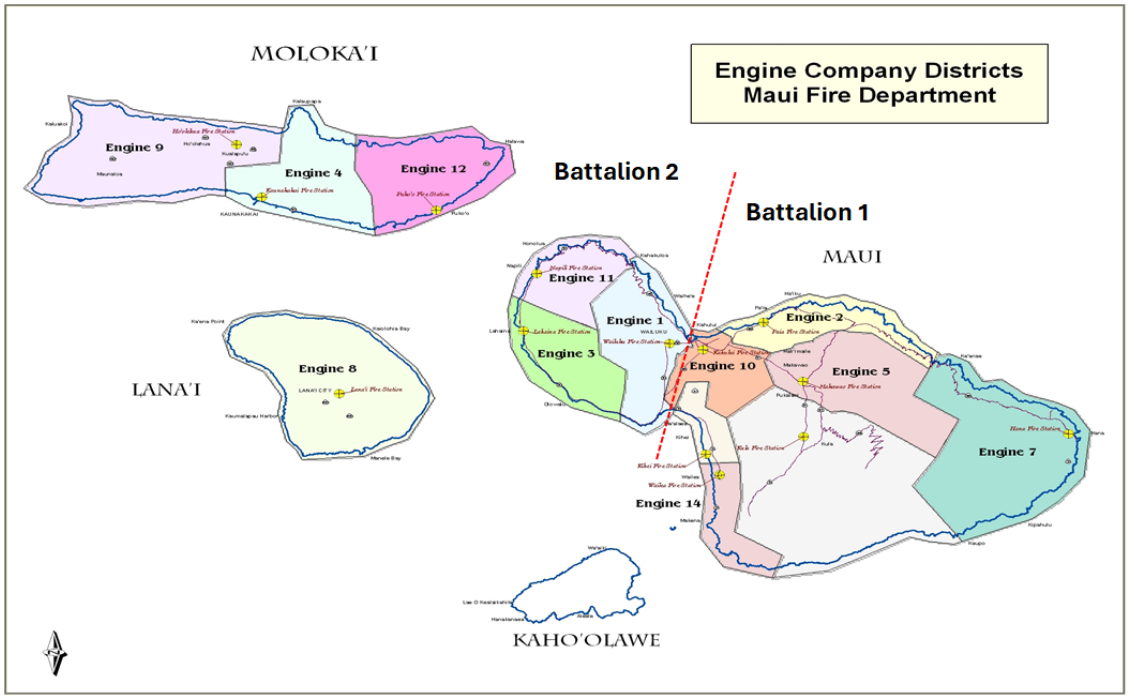
DEPARTMENT OF FIRE AND PUBLIC SAFETY

The MFD is under the authority of the County of Maui in Hawaii.[1] Maui County consists of four islands: Maui, Lana'i, Moloka'i, and Kaho'olawe. MFD is governed by the Mayor and nine members of the Fire & Public Safety Commission.[2] MFD consists of a Fire Chief, one Deputy Fire Chief, two Assistant Fire Chiefs, seven Battalion Chiefs, and 1 Fire Service Officer. The MFD has 282 personnel in Fire Operations, 63 in Ocean Safety, 11 in Fire Prevention, 3 in Health and Safety, 4 in Training, 5 in Mechanic Shop, and 20 in Administrative Support.

The department operates 14 fire stations, including one on Lana'i, three on Moloka'i, and 10 on Maui. All stations function as all-hazard, full-service fire organizations, providing collectively:

14 Engine Companies	**9 Mini Pumpers**
2 Ladder Companies	**1 Helicopter (exclusive use contract)**
1 Rescue Company	**3 Rescue Boats**
1 Hazmat Company	**11 Rescue Watercrafts (including Ocean Safety)**
6 Tankers	**10 Utility Vehicles**

The map below illustrates MFD's service area on Maui. A complete overview of MFD can be found in Appendix A.



www.qsl.net

Engine Company Districts. Source: MFD.

[1] County of Maui. *Fire & Public Safety.* https://www.mauicounty.gov/1460/Fire-Public-Safety. Accessed February 9, 2024.

[2] County of Maui. *Fire & Public Safety Commission.* https://www.mauicounty.gov/181/Fire-Public-Safety-Commission. Accessed February 9, 2024.

AAR METHODOLOGY & PROCESS

The AAR process started by establishing a baseline understanding of MFD, comprehending the unique characteristics of Maui, reviewing historical major events, and conducting interviews with both internal and external stakeholders. During December 2-17, 2023, facilitators conducted over 200 in-person interviews. The interviewees included representatives from the following organizations:

- County of Maui
    - Department of Fire and Public Safety (MFD)
    - Maui Emergency Management Agency (MEMA)
        - Maui County Emergency Operations Center (EOC)
    - Maui Police Department (MPD)
        - Maui Central Dispatch
- Windward Aviation
- Hawaii Department of Land and Natural Resources (DLNR)
- Private heavy equipment contractors
- Federal Emergency Management Agency (FEMA)
- California Department of Forestry and Fire Protection (CAL FIRE)
- Hawaii Wildfire Management Organization (HWMO)
- University of Hawaii
- American Medical Response (AMR)

Facilitators reviewed a considerable number of reference materials before drawing any conclusions. A complete set of reference citations and materials studied are contained in Appendix B and throughout the document. The data presented within was accurate as of the time of the report's construction. It is recognized that due to the complexity of the incidents, and revised post-fire data, some data may have slight differences.

Each important point discovered in the research and interview process was used to identify challenges, observations, and recommendations. The recommendations are intended to serve as a roadmap for administrators and policymakers, guiding them in establishing priorities for the future.

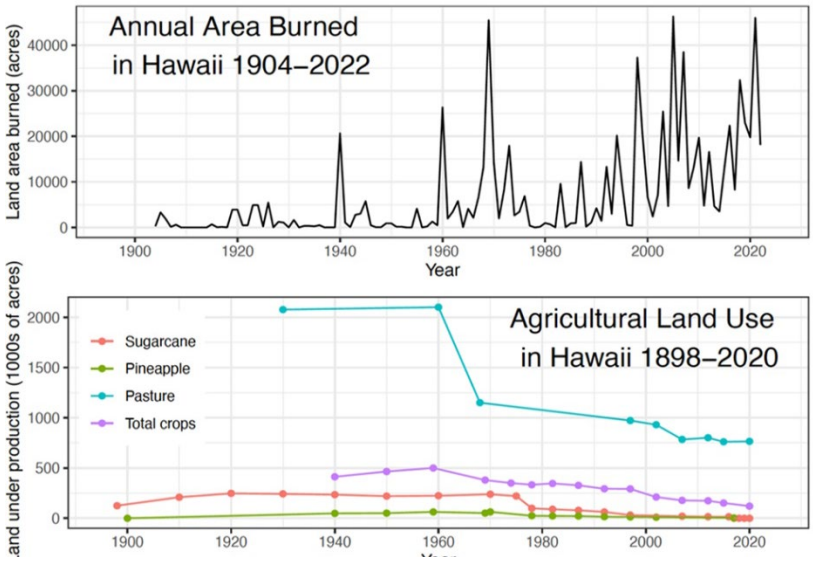
CONTRIBUTING FACTORS

The 2023 Maui wildfires were influenced by three main factors:

ISLAND LAND USE EVOLUTION

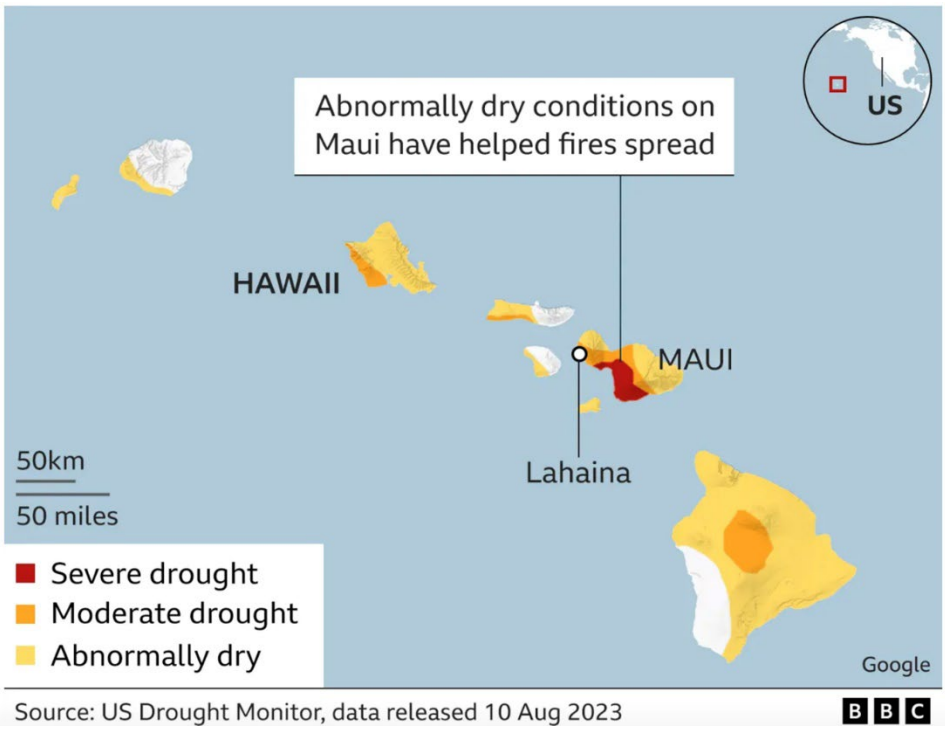
The island's land use evolution, dating back to the early 19th century, saw missionary settlements converting wetlands and fishponds into agricultural operations, leading to the emergence of sugarcane and pineapple as major crops.

However, the relocation of these operations in the 1970s to 1990s left fallow lands covered with buffelgrass and Guinea grass, creating a volatile fuel source for wildfires (Appendix C).



Hawaii Fire History and Agricultural Decline. Source: Trauernicht, Clay. University of Hawaii. Hawaii Wildfire Management Organization.

ENVIRONMENT



Hawaii fire: Maps and before and after images reveal Maui devastation. Source: BBC. August 13, 2023. Original Source: US Drought Monitor.

In examining the evolution of land use, it becomes evident that Maui's vegetation has undergone significant transformations. These alterations, coupled with prolonged periods of drought, have resulted in a volatile fuel bed across the island. Weather conditions, including the wind patterns unique to Maui's topography, create challenging conditions for monitoring and controlling wildfires (Appendix D). The distinctive ecosystem of Maui is less resilient to wildfires than the mainland, coupled with prolonged

periods of drought, further heightening the wildfire risk. The percentage of Hawaii wildfire acres burned is much higher than that typically observed on the mainland according to a report by University of Hawaii researcher Clay Trauernicht, PhD (Appendix E).[3]

RED FLAG WARNING

The National Weather Service (NWS) first issued a Red Flag Warning on August 5 for August 7 through August 9 due to lower relative humidity and high winds associated with Hurricane Dora, passing about 600 miles south of Maui.[4] With Hurricane Dora being 600 miles away and Maui being the windiest island in the state, there was not a heightened sense that this Red Flag Warning would be much different from past events (Appendix F).

[3] Hawaii Wildfire Management Organization. July 26, 2018. *Wildfire in Hawaii Factsheet*. https://www.hawaiiwildfire.org/fire-resource-library-blog/wildfire-in-hawaii-factsheet. Accessed February 9, 2024.

[4] Gutierrez, Ben. Hawaii News Now. August 6, 2023. *First Alert Weather Day: Red flag warning extended as Dora tracks west.* https://www.hawaiinewsnow.com/2023/08/06/first-alert-high-wind-fire-watches-issued-ahead-dry-gusty-weather/. Accessed February 9, 2024.

SEQUENCE OF EVENTS

The sequence of events provides a summary of the four major wildfires and actions taken by MFD. It intentionally does not include minute-by-minute details and individual actions, but instead focuses on specific key points. While this AAR is associated with the Lahaina conflagration, the overall MFD system deployment is the core of the discussion and focus.

AUGUST 5-6

On August 5, the NWS first issued alerts about high winds and Red Flag Warnings due to Hurricane Dora, located about 600 miles south of Maui, and the existing drought conditions on the island, including the leeward Lahaina side. This NWS news alert was widely covered by the media. The MFD did transmit this news to the organization via their Battalion Chiefs (BCs). There was no upstaffing or pre-positioning of additional resources at this time.

AUGUST 7

The day began as a normal call load day (Appendix G). As Maui has trade winds that blow 20-30 mph NE daily, there was no weather activity that was considered unusual until later. In the afternoon, there was a small brush fire in Fire Station 2's district with only 5-7 acres burned.

AUGUST 8

0020 HOURS

MFD responded to the Olinda Fire in the Upcountry area. The standard dispatch included two engines and one water tanker. Upon arrival in the area, firefighters could smell smoke, but had a difficult time finding the exact fire location. They subsequently found the main body of fire near the bird sanctuary, reporting two acres burning in heavy fuels.

Crews began an initial attack, only to regroup due to extremely strong winds (50+ mph). Whole trees snapped off, tree root balls came out of the ground, and power lines came down. As the winds continued their extreme speed, they became compressed and pushed the fire downhill following the gulches. Crews took defensive positions performing structure protection where access and water supplies allowed. MFD committed 40% of its available resources to battle this first wildfire.

0423 HOURS

BC-2 initiated a recall procedure to staff up relief engines, ordered evacuations via Maui Police Department, and continued to move resources to try and contain the fire and protect structures. Crews found several structures fully involved and maintained a structure protection posture. Perimeter control was not possible at this time due to strong wind conditions, heavy fuels, and the structure threat.

0635 HOURS

The first Lahaina Fire ignition occurred in the area at the top of Lahainaluna Road, near power pole #25. Engine 3's crew noticed the electrical power outage at the time of dispatch and discovered problems with the fire station's emergency power generator. Responding crews found extremely strong winds pushing a one-acre grass fire starting near the solar farm that was threatening structures. MFD requested an immediate evacuation order of the Hale Mahaolu and Lahaina Bypass area as well as additional resources.

0852 HOURS

Crews on-scene reported 100% containment of the first Lahaina wildfire even as weather conditions were deteriorating and high winds were knocking down utility poles and lines, toppling trees, and blowing debris throughout the Lahaina area.

An aggressive attack with a bulldozer and hose lines was able to contain this fire to about 1.5 acres even though aircraft were grounded. Due to the extreme winds, crews remained on scene for five hours using copious amounts of water and Class A foam to ensure the fire did not reignite.

As the Olinda Fire was active and BC-2 had initiated an earlier recall notice, BC-5 began to upstaff several pieces of equipment anticipating additional west side incidents. The Olinda Fire was increasing in size and complexity as it traversed the topography downhill. Crews continued to help evacuate residents and protect structures. They were challenged by poor access roads and water supplies. They became dependent on MFD's water tankers, private water tankers, and had private bulldozers assisting. Radio communications were operational with some spotty cell service areas. In the early hours, Windward Aviation dispatched a pilot to evaluate if aerial operations were a possibility. BC-5 was able to get one aerial observation flight before the helicopter returned to base due to extreme wind conditions.

1125 HOURS

The Kula Fire started off of Kualono burning down the gulch, east of the bridge on Haleakala Highway, and soon thereafter trees fell across the highway causing delays in response equipment. The fire's growth also prompted evacuations of the Kula Lani Drive/Circle area down into the Kulamanu subdivision. As the day evolved, strong downhill winds pushed the fire further west down the drainage features, where there were numerous homes without much defensible space. As the winds began to swirl, the fire began running back uphill destroying homes. Both the Olinda and Kula Fires reported losing public water supplies at times and MFD water tankers and private water tankers were in short supply. The terrain also prevented water tankers from going into limited access areas which made fire engines stop operations to find a water refill source.

Firefighters working both Upcountry fires were accustomed to green vegetation due to the elevation and lingering rain clouds offering regular precipitation. Firefighters were commenting that the grass fuels were “crunching” under their feet as they traversed the terrain. Firefighters also commented that while temperatures may not have risen sharply, they could sense that the normal 70-80% RH (relative humidity) had dropped, ultimately hitting 20-30% RH.

1418 HOURS

As the first Lahaina Fire overhaul operations were being completed, there was another wildfire reported near the Kahului Airport. Engine 11 was part of that dispatch and was canceled en route as the Kahului Airport Fire Department was able to quickly handle it. Engine 3 completed the Lahaina overhaul operation at 1418 hours and left the scene with no smoke or other signs of fire showing. Engine 11 also drove past the fire area a few minutes later and witnessed no smoke showing.

Engine 11 stopped near the Lahaina Cannery Mall area and was dispatched with Engine 3 back to the area of origin at about 1455 hours.

1500 HOURS

Engine 11 was first on scene and reported flames showing with a running wildfire toward Lahainaluna Road with 40-50 mph gusty winds. Additional resources were en route, but at 1522 hours, the ground fire spotted ¼ mile ahead, and established itself burning neighborhood structures and the urban conflagration/firestorm began.

1526 HOURS

MFD notified Central Dispatch to initiate evacuations.

1529 HOURS

The spot fire was now a direct threat to the Lahaina community. Crews began performing defensive actions to try and limit the spread of the fire, but the fire was spreading faster than the Incident Commanders (IC) knew due to heavy smoke conditions obscuring forward visibility. Crews thought that the fire would stop its northerly direction by the Kahoma Stream, a 100-foot wide concrete flood control swale that ran into the ocean, but to no avail. At this point, most of the available MFD resources were either committed to the Lahaina Fire or en route. At one point, only Engine 2, Engine 7, Rescue 10, and Ladder 14 were available for the rest of the island.

1610 HOURS

The second Lahaina Fire was now well established within the community. The density of structures, type of construction, limited access, and downed utility infrastructure greatly

contributed to the conflagration. MFD made many heroic attempts to combat the fire, but once the structures began to burn, the heat output and the extreme winds outmatched firefighting operations. Large 2 ½ inch fire nozzles were ineffective against such strong winds and then the worst-case scenario happened, the fire hydrants began to lose water supply. It is unknown if the sheer number of burning homes caused the water connections to fail or if the water supply tanks were not filled due to the early morning loss of electricity. MFD water tankers and private water tankers were sparse in numbers and the private water tankers were later ordered out of the area due to safety concerns. Furthermore, crews were dodging sheets of roofing material that had blown off and were hearing propane tanks popping off. There was complete gridlock as residents were fleeing through crowded streets with downed power lines, and it was unknown if the lines were energized or not. Residents who were leaving on foot, or after they could not stay in their cars, were barefoot and disoriented as the smoke obscured the sunlight into darkness. Firefighters witnessed fatalities and people walking into hazardous areas, and cautioned them, but had to focus on those actively being rescued. MFD was at its maximum deployment level with Ladder 14 (Wailea) being the only available resource for some time. Life preservation became the primary priority with fire suppression actions as conditions allowed.

1600-1630 HOURS

Engine 1 and Engine 6 with utility vehicles entered the Lahainaluna/Pauoa area. They were looking for a strategic area to stop the forward progress of the second Lahaina Fire, but they were directly in line with the fire's forward path. They were also assisting with numerous evacuations as many people were still fleeing. Mini 6 became ensnarled in downed power lines and Engine 6 was able to rescue the operator.

1645 HOURS

Engine 6 crew was trying to reassemble and found their Captain needed medical help and issued a "MAYDAY." With downed power lines and vehicles blocking egress, personnel from Engine 1 and Engine 6 were forced to shelter in place. A firefighter from Engine 6 took Mini 1 in search of help and called for MAYDAY. As Mini 1 incurred damage, the firefighter acquired a police SUV to help evacuate trapped crew members. Meanwhile, the remaining Engine 1 and Engine 6 crews who were sheltering in the cab needed to relocate to the lee side of the engine away from the fire due to extreme heat inside the engine. Once the firefighter in the police SUV arrived, the unresponsive captain and six other crew members were evacuated. A Personal Accountability Report (PAR) was conducted for all personnel assigned to the Lahaina incident.

1759 HOURS

The Pulehu Fire began with limited resources to attack it. Due to the other three fires actively burning, there was only Engine 2, Mini 2 & Rescue 10 available. The IC was

could with what resources were available. They were assisted by a private water tanker, limited aerial water drops by helicopter, and some sparse fuels. The limited resources on the Pulehu Fire took aggressive tactical steps on the southern flank of the fire that was heading toward Kihei.

At about 0300 hours on August 9, crews noticed the winds shifting, swirling, and going from the east to the west now. With very limited resources, these crews were able to stop the forward progress of the largest of the four major wildfires.

1800 HOURS

Back at Lahaina, water supplies were spotty, and access was greatly impacted due to fallen power poles and lines. Crews identified primary access routes that needed to be maintained for evacuations and rescues. Several engines were driven across downed power poles and lines so they could evacuate themselves and victims. One victim remained with the fire crew inside of the ladder truck for some time while crews found a lost infant being tended by strangers. Crews went into the hazard area in vehicles and on foot, found people in the water near the seawall and pulled them to safety. They had to carry some victims on their backs over downed power lines to a medical aid staging area that AMR Ambulance was assisting with near the Lahaina Cannery Mall. From there, victims were taken to the Civic Center near Fire Station #3. As evacuations were happening, the fire made a run above the Civic Center, which prompted the evacuation shelter to be evacuated and relocated to the Maui Prepatory Academy in Napil'i near Fire Station #11. The fire passed the Civic Center, but did not burn it. At the same time, fire was moving through Wahikuli toward the Hawaiian Homes area.

Firefighters continued with rescues, evacuations, and firefighting operations through the night until sunrise began to display the conflagration's devastation. Cell sites were down due to burnt fiber optic lines and loss of power. Radio communications were never lost due to the repeater on Lana'i, but the radio frequencies were overloaded for a variety of reasons.

AUGUST 9

The MFD Ocean Safety Bureau (OSB) began its activation with the U.S. Coast Guard to check for water rescue victims. At daybreak, coastal search operations were jointly conducted with MFD in near shore waters while the Coast Guard was in deeper waters. The Coast Guard and MFD OSB rescued 17 people from the water.

As the winds began to let up, the uncontrolled fire lines found surrounding vegetation that began burning northeast and southeast of Lahaina. Available MFD resources and private contractors were used to create control lines. Crews began to finally get some time to refresh and refuel as active fires were being extinguished.

AUGUST 10-11

As the days evolved, MFD's focus became trying to find survivors, regrouping, and assessing capabilities. They still needed to fully control the four major wildfires and answer new calls for service. The MFD dive team was utilized to do underwater search and rescue evaluations and the MFD Urban Search and Rescue (USAR) played a key role during the initial recovery, sharing knowledge of the local geography, culture, and history with outside USAR teams.

POST-INCIDENT OVERVIEW

MFD was committed before, during and post fire. Post fire operations included fire overhaul, search and rescue, investigations, and water & dive operations. Additional resources were arriving from the following:

HONOLULU FIRE DEPARTMENT • 9 members for search and rescue • 21 members for firefighting • 7 leadership positions for support and incident management	PRIVATE CONTRACTORS AND LAND MANAGERS • Bulldozers • Water Tankers • Excavators
CAL FIRE • EOC Incident Management Team Support	HAWAII NATIONAL GUARD • Provided Chinook support & check point security
DEPARTMENT OF FORESTRY AND WILDLIFE • 28 members for firefighting • Numerous apparatus and equipment including Type I, III, IV, VI Vehicles	STATE AIRPORT RESCUE FIRE FIGHTERS • 12 members for firefighting • Airport Crash Rescue Firefighting Apparatus • Type I Vehicle
NATIONAL USAR TEAMS • Search and rescue operations	U.S. ARMY • Aircraft for fire suppression

Emergency Service Dispatching is performed by a dedicated group of dispatchers within the Maui Police Department (MPD) at Wailuku. MPD has 39 dispatcher allocations, two dispatch supervisors and one coordinator. Not unlike other 911 dispatch centers, MPD dispatch center has high attrition, low recruitment results, and a challenging retention rate, so there are currently only 12 dispatchers. This staff shortage causes a high level of overtime and related issues.[5] During the four major wildfires, dispatch handled a peak call load on August 8 of 4,529 contacts. They usually average 1,600 calls a day (Appendix G).[6]

The Maui Emergency Operations Center (EOC) was mobilized soon after the NWS Red Flag Warning and ramped up very quickly as the first fire intensified. The EOC still remains in a partial activation role today. Additional details related to the EOC can be found in Appendix H.

Since the Maui wildfires made national news, there was a huge impact on data gathering and media requests. The EOC established a Joint Information Center and provided regular media briefings.

[5] Jedra, Christina. Honolulu Civil Beat. November 15, 2023. *Maui's Shorthanded and Underpaid 911 Dispatchers Improvised During Lahaina Fire*. https://www.civilbeat.org/2023/11/mauis-shorthanded-and-underpaid-911-dispatchers-improvised-during-lahaina-fire/. Accessed February 9, 2024.

[6] Johnson, et al. Associated Press. October 13, 2023. *AP Exclusive: 911 calls from deadly Lahaina wildfire reveal terror and panic in the rush to escape.* https://apnews.com/article/maui-lahaina-hawaii-wildfire-911-calls-ab4aadbe17c604619ce35b454546dd56. Accessed February 20, 2024.

Fire Chief Bradford Ventura instituted the MFD Incident Management Team (IMT) to establish the Department Operations Coordinator (DOC) function in coordination with the EOC. The IMT supported this mission for three weeks with:

- Apparatus
- Staffing
- Equipment requests
- Meals and rehabilitation
- Daily Documentation

The IMT issued its first Incident Action Plan on August 10, 2023.[7]

The recovery process also includes working with Federal Emergency Management Agency (FEMA) as the fires qualified for an initial Fire Management Assistance Grant (FMAG) declaration followed by the Presidential major disaster declaration (see items MFD is seeking FEMA reimbursements for in Appendix H). The true costs of these wildfires will be incurred for years and will require a myriad of public policy changes to address the housing, economic, cultural, infrastructure, response, and environmental challenges.[8]

The MFD has active employee wellness and mental health programs that have constantly been improving. These programs are currently assisting employees, especially the 15 MFD and 4 OSB staff members who lost homes in Lahaina and 2 MFD staff members whose homes survived but are uninhabitable at this time. The following reflects the current resources available for employees in need:

- Peer and Critical Incident Stress Management (CISM) Support
- Dr. Alicia Rodriguez, Mental Health Counselor
- NIOSH Exposure Reporting
- Cancer Cohort Study
- Numerous Charity efforts for firefighters
- Housing Assistance
- One on one meetings with FEMA

There is also great concern for the public and first responders who were exposed to the smoke in the environment. Further studies were announced January 3, 2024 by a team of researchers for University of Hawaii at Mānoa.[9]

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[7] Maui Incident Management Team. *Hurricane Dora Fires 2023.* https://wfca.com/wp-content/uploads/2024/01/Hurricane-Dora-Wildfires-2023-IAP.pdf. Accessed February 9, 2024.

[8] Headwaters Economics. May, 2018. *Full Community Costs of Wildfire.* https://headwaterseconomics.org/wildfire/homes-risk/full-community-costs-of-wildfire/. Accessed February 9, 2024.

[9] Maui Now. January 3, 2024. *UH Mānoa launches Maui wildfire health effects study, seeking 1,000 participants.* https://mauinow.com/2024/01/03/uh-manoa-launches-maui-wildfire-health-effects-study-seeking-1000-participants/. Accessed February 9, 2024.

CHALLENGES, OBSERVATIONS & RECOMMENDATIONS

This section of the After-Action Report outlines challenges encountered, observations made, and recommendations. These are organized into four categories: **Preparation**, **Mitigation**, **Response**, and **Recovery**.

OBSERVATION

RELIEF ENGINES

MFD's relief vehicles (engines, mini-pumpers, and utility vehicles) do not have a standardized equipment inventory due to the majority of equipment being dedicated to their primary first-run vehicles. Excess equipment is stored outside these relief vehicles, causing response delays and safety issues. Recalled off-duty crews reported up to an hour delay as warehouse staff equipped vehicles, and the inventory still fell short of first-run resources. Previous attempts to fully outfit relief resources were hindered by limited space in current MFD facilities, preventing adequate security protection.

RECOMMENDATIONS

- **1.1** Create, fund, and provide a standard inventory for all response vehicles.
- **1.2** Provide secure and enclosed facilities for all vehicles.
- **1.3** Conduct a regularly scheduled vehicle inventory for accountability purposes.

OBSERVATION

VEHICLE INVENTORY & TYPES

MFD's current fleet of vehicles meet a high standard of quality. The variety, including Type 1 engines, mini-pumpers, Type 4-6 engines, and utility vehicles, poses challenges in training and inventory management due to specific training requirements for each model.

During the peak of the August wildfires, off-duty staff were available, but insufficient vehicles hindered full deployment. In some instances, personal vehicles were utilized, occasionally in hazardous areas.

RECOMMENDATIONS

- **1.4** Assess the capabilities of MFD's current fleet to their service demands.
- **1.5** Standardize vehicle types in a way that streamlines training and fleet maintenance.

OBSERVATION

OFF & ON DUTY SITUATIONAL AWARENESS & CAPABILITY

Calls and text messages serve as the primary communication methods to staff up vehicles. Some staff members were not contacted and remained unaware of ongoing incident activities. Chief Officers and certain MFD staff utilize the "WhatsApp" application for situational awareness updates, but its usage is not universal across the department.

RECOMMENDATIONS

1.6 Create an automated system to notify all staff of a major deployment to take the burden off the on-duty BCs.

1.7 Explore the use of First Due or other software to provide timely situational updates.

1.8 Implement a take-home policy for BC command vehicles so off-duty BCs can readily respond from their residence; increasing MFD's command and control capability.

OBSERVATION

STATEWIDE MUTUAL AID

There are no formal County inter-island or State mutual aid agreements among fire departments, resulting in a cumbersome and slow process for relocating equipment. However, additional staffing during adverse times can really make a difference, especially for supporting firefighting operations. MFD attempts to adhere to National Wildfire Coordinating Group (NWCG) certifications and qualification standards, and/or the State can create their own. This certification facilitates collaboration among individuals who don't regularly work together, as they are trained to position and duty standards.

RECOMMENDATIONS

1.9 Create a statewide certification and qualifications system.

1.10 Create a statewide mutual aid agreement.

1.11 Establish an inter-island engine fleet program, where the State procures and maintains a specified number of Type 3, Type 4-6 engines for shared use on each island. Standardizing the model/type ensures consistency in training and operations across islands.

Example: CalOES Fleet Program

OBSERVATION

LOCAL & COUNTY MUTUAL AID

There appears to be limited mutual aid agreements within the County. Enhancing clarity through a comprehensive review of related agreements, coupled with reinforcement and training, would ensure that all parties have a clear understanding of their respective roles and responsibilities.

RECOMMENDATION

1.12 Review and provide training on agreements involving federal, state, county, private businesses, and NGOs to assess the necessity for reinforcement or clarification.

OBSERVATION

PRIVATE RESOURCES

In many cases, MFD may not have a demonstrated need to justify new resource or equipment allocations. In these cases, private contracts can serve as an effective tool for establishing surge capacity. For instance, the Windward Aviation contract exemplifies this approach, with defined performance standards and corresponding training. However, the same cannot be said for private heavy equipment. Water tankers, for example, may arrive on scene without fittings compatible for refilling fire engines. Operators often do not have direct communications with fire personnel, only their supervisors, raising safety concerns. Additionally, there is an absence of an upfront contract outlining performance expectations and reimbursement schedules.

During dynamic incidents using aerial assets, it is challenging for aircraft to identify ground resources quickly for safety concerns.

RECOMMENDATIONS

1.13 Create guidelines and procedures for hiring private resources, outlining dispatch procedures, performance expectations, and reimbursement schedules.

1.14 Conduct annual training with all equipment operators and supervisors to enhance operating relationships, performance, and safety.

1.15 Install Automatic Vehicle Locators (AVL) on all private resources.

1.16 Add a resource ID on top of private vehicles and equipment for aerial identification.

OBSERVATION

PRE-POSITIONING

Following the issuance of the Red Flag Warning by the National Weather Service, there was minimal upstaffing and pre-positioning of resources. Battalion Chiefs initiated upstaffing for some resources on the morning of August 8.

RECOMMENDATIONS

1.17	Create an intelligence center within the EOC or MFD to continually monitor current and predicted emergency events and facilitate the sharing of relevant data.
1.18	Utilize new technology to visually display potential trouble spots in electrical service, identifying areas of concern before the onset of a fire.
1.19	Upstaff and preposition appropriate resources based upon intelligence briefings.
1.20	As part of the surge capacity, assign drivers to accompany the two on-duty BCs to augment their capacity, improve incident organizational management, and enhance safety.
1.21	Create an emergency fund dedicated to surge capacity and leverage the provisions outlined in the new FEMA 2022 FIRE Act for effective utilization.

OBSERVATION

STAFFING

MFD staffing allocations are higher compared to the other islands which greatly assisted response during the wildfires. Supported by a 2016 study and a 2018 study (Appendix I), there is a recognized need to establish a Standards of Cover (SOC) criteria. Discrepancies exist in the number of calls and the staffing ratio, creating challenges in meeting service delivery expectations (Appendix A). Staffing and resource allocations raise specific concerns for the west side of Maui due to its vulnerability to road closures and delays.

Currently, MFD does not have any fire handcrews that could perform fuels mitigation work. The introduction of such crews could not only address this specific task but also contribute to various year-round support functions. Additionally, this initiative could pave the way for establishing a firefighter entry-level orientation program.

RECOMMENDATIONS

1.22 Review and reaffirm the SOC criteria. Adjust as needed and subsequently implement appropriation and management actions to fulfill staffing expectations.

1.23 Explore the possibility of creating dedicated fire handcrews via an at-risk youth development program.

Example: The C.R.E.W.

OBSERVATION

FIRE STATIONS

The current number and capacity of existing fire stations pose limitations on adequately housing expensive vehicles, ensuring inventory security, providing mixed-gender facilities, and offering emergency community shelters. During emergency incidents and anticipated Public Safety Power Shutoffs (PSPS), fire stations serve as the de facto community site to assist those who need medical aid, shelter by leveraging their emergency power generators.

RECOMMENDATIONS

1.24 In association with the SOC review mentioned above, develop a master facility plan to align fire stations with the public's expectations of serving as safe refuge areas and then pursue appropriations.

1.25 Install diesel exhaust systems at each work site to enhance workplace safety.

OBSERVATION

"BATTLE STATION" ASSIGNMENTS

Every member of MFD is well-versed in their primary responsibilities that are included in their hiring classification. As members of an emergency agency and County employees, each individual should be assigned and trained for an ancillary function to augment capacity during major events. This doesn't imply assigning an administrative clerk to a firefighter, but rather considering roles such as a note-taker in the EOC.

RECOMMENDATIONS

1.26 Identify the skill sets required during major events.

1.27 Provide training for staff to acquire the necessary skill sets ahead of major events.

1.28 Explore the reserve capacity of OSB personnel for expanded roles during major events.

OBSERVATION

COMMUNITY EMERGENCY RESPONSE TEAM (CERT) & RETIRED EMPLOYEES

During major incidents, there are tasks that could be efficiently handled with additional staffing. Relief engines were not outfitted with equipment, and the time it took to outfit engines during the four major wildfires depended on the number of staff members available.

If the public requires emergency power for a medical device and the fire station is vacant, alternative options must be sought. The CERT program trains civilians to provide assistance, and there may be retired MFD members willing to contribute during major incidents. It is crucial to establish this capacity beforehand rather than during an incident.

RECOMMENDATIONS

1.29 Establish a process where retirees can be utilized.

1.30 Utilize CERT members to provide assistance under the direction of MFD staff before and during incidents.

Reference: FEMA CERT

OBSERVATION

PUBLIC POLICY FUNDING

The Fire Chief and policymakers are faced with a conundrum in determining the appropriate level of funding for MFD. The dilemma lies in whether to allocate funds based on the average of service demands, performance expectations, and/or at the maximum level required for major incidents in the future.

RECOMMENDATIONS

1.31	Review studies conducted since 2016 to formulate a base funding plan. Align this plan with the MFD strategic plan, incorporating the identified surge capacity options.
1.32	Revise the MFD strategic plan to incorporate the recommendations outlined in this AAR.
1.33	Establish a revenue stream by implementing taxes, levees, bonding increases, or similar measures.

OBSERVATION

PUBLIC INVOLVEMENT

Like on the mainland, staff, policymakers, and the public may not see the escalating wildfire issues until an emergency incident unfolds, as observed in August. A myriad of studies since 2010 have delved into topics such as climate change, fuel conditions, and the growing workload demands for firefighters. Policymakers face the challenge of deciding whether public education alone will suffice or if there's a necessity for policy and enforcement changes to better address the wildfire problem.

RECOMMENDATIONS

2.1 Engage social scientists to assess and evaluate the most effective ways to communicate with the public about preparedness, mitigation, response, and recovery, taking into account Maui's unique cultural context.

2.2 Utilize the findings from the social scientists to develop methods and options to effectively convey information to the population on how to live with the challenges posed by wildfires.

2.3 Enhance the partnership with the Hawaii Wildfire Management Organization.

2.4 Adopt a centralized wildfire education program, such as Ready, Set, GO!, and customize it to be accessible in multiple languages.

OBSERVATION

TOURIST EVACUATION

Effectively communicating evacuation information to a transient tourist population that speaks multiple languages poses a significant challenge.

RECOMMENDATION

2.5 Collaborate with MEMA to explore software options that facilitate multiple language evacuation notifications.

OBSERVATION

TRAINING

MFD opted to implement the Blue Card system some years ago, but due to attrition and the impact of COVID-19, training and certifications experienced a decline. The high attrition rate within MFD has resulted in BC ranks with an average of 2.5 years of experience. As MFD is the Agency Having Jurisdiction (AHJ), they are empowered to design their training curriculum, but MFD needs to adhere to its own training standards in subject, frequency, and performance.

RECOMMENDATIONS

3.1	Recommit to and initiate Blue Card system training.
3.2	Provide Command and General Staff ICS training to all Captains and Chief Officers in a common environment.
3.3	Conduct complex incident command and control training exercises with Captains and Chief Officers.

OBSERVATION

TECHNOLOGY

Numerous activities, including recalls, daily staffing, incident accountability, and management, demand significant time from Chief Officers and other personnel. While MFD has invested in First Due software, its underutilization is attributed to non-direct IT connections. Many resources were unaccounted for during the wildfire siege, raising operational and safety concerns. Investments are needed to provide better incident intelligence capabilities before, during, and after incidents.

RECOMMENDATIONS

3.4	Explore the utilization of a software program as a public-facing platform to provide alerts and enhance situational awareness among the public with PD and MEMA.
3.5	Explore the utilization of a software program for daily staffing and recall purposes.
3.6	Review the First Due software to identify areas where it can be better utilized for organizational management during incidents.
3.7	Clearly identify critical infrastructure and priority target hazards, particularly in situations where PSPS are anticipated.
3.8	Collaborate with DLNR to enhance RAWS sites and consider implementing an automated camera/early detection system.

OBSERVATION

EVACUATIONS

On August 8, evacuation routes across the island were obstructed by downed power poles, trees, and wires, exacerbating pre-existing challenges with accessing and leaving areas. MFD requested law enforcement to facilitate evacuations over the radio. Although law enforcement was part of the ICS structure, lack of co-location at Incident Command Posts (ICP) was partly attributed to the dynamic nature of the incidents and available staffing.

RECOMMENDATIONS

4.1 Collaborate with law enforcement and MEMA to identify key access routes and develop contingency plans.

4.2 Upon identifying key access routes, collaborate with the Hawaiian Electric Company to relocate adjacent infrastructure, potentially underground, to enhance the safety of evacuation routes.

4.3 Before deploying PSPS, thoroughly examine consequence management options.

4.4 Collaboratively, MFD, law enforcement, and MEMA should explore new evacuation software options.

OBSERVATION

PARTNER RELATIONSHIPS

Response entities may encounter challenges when facing major incidents that outmatch their capabilities. Success is contingent on establishing relationships with key entities before an incident occurs. In this case, assistance from the Navy, Army, National Guard, and U.S. Coast Guard arrived after the first operational period. These relationships and agreements are infrequently used, but can be instrumental in providing surge capacity. Success in these partnerships is achieved by establishing and maintaining them before an incident and understanding that personnel on all sides may change. All involved parties must understand their roles within ICS and designate a liaison representative to be present at the ICP or EOC.

It is crucial for fire and law enforcement to collaborate closely during incidents. On one incident, fire can support law enforcement, while on another, law enforcement can support fire, depending incident's nature and complexity. If law enforcement is conducting evacuations during a wildfire, they can either participate in operations and/or join a unified command structure. In Lahaina-type incidents, a unified command structure is likely the most effective organizational approach, given the significant roles of both fire and law enforcement. Either structure requires a shared/co-located ICP so that communications become a priority.

RECOMMENDATIONS

5.1	Initiate proactive outreach to non-traditional partners and develop agreements, engage in joint training exercises, and maintain relationships.
5.2	Ensure that each partnering entity maintains a full-time presence at the ICP or EOC once they are activated.
5.3	Collaborate with law enforcement to enhance on-scene command and control operations.
5.4	Share and instruct law enforcement on the Ready, Set, GO! program.
5.5	Fire and law to cross train on ICS structures and ICP best practices.

CHALLENGE #6:

HOW TO IMPROVE THE EMERGENCY OPERATIONS CENTER (EOC) AND DEPARTMENT OPERATIONS COORDINATION (DOC) FUNCTIONS?

PREPARATION

OBSERVATION

FACILITY & TECHNOLOGY INVESTMENTS

The current EOC worksite is too small to provide adequate workspace for each agency. Given the infrequent use of EOCs, regular training is crucial to build lasting relationships and enhance skillsets. The recent implementation of the WebEOC software, although not fully operational during these incidents, holds the potential to be beneficial once fully deployed.

RECOMMENDATIONS

6.1 Convene an EOC AAR, with a specific focus on the August 2023 wildfire activation, to promptly identify lessons learned and generate specific recommendations for improvement.

6.2 Clearly identify and delineate the roles and responsibilities of the EOC, DOC, and incident command.

6.3 Conduct EOC drills involving the actual representatives who will be present during incidents.

OBSERVATION

PREPARATION

MFD needs to ensure that fire stations and personnel can be self-sufficient for at least 48 hours during incidents. Fire Station #3 faced challenges with its emergency generator, which failed to provide power to essential functions, necessitating emergency electrical work. Before the DOC becomes operational for logistical needs, each crew/facility must be self-sufficient.

RECOMMENDATIONS

7.1	Conduct a review of every facility to ensure the availability of emergency power backup for a period of 48-96 hours.
7.2	Provide water and food for each response unit to ensure logistical support for a minimum of 48 hours.

OBSERVATION

NEW & EXISTING ACTIONS

Effectively addressing wildfire issues requires a comprehensive set of activities. Each activity may have a different priority depending upon the location, fuels, values at risk, etc. Many of the recommendations presented are already in place, but may need enhancements to be fully effective. These items also require public education and voluntary or mandatory compliance.

RECOMMENDATIONS

8.1 Establish and enforce a defensible space program of at least 100 feet, incorporating fuel reduction zones, to ensure structures can be defended and have a higher likelihood of surviving a wildfire.

8.2 Implement a 0-5 foot clear zone between structures and any vegetation or combustible materials.

8.3 Establish joint approval authority involving County Planning and MFD when approving new construction.

8.4 Develop water supply standards that encompass established fire water flow requirements and includes emergency backup power supply.

8.5 Enforce a mandate requiring all cell tower facilities to establish defensible space similar to structures and to implement backup power supplies.

8.6 On new developments over a certain size, require a secondary access road that does not require any special action to access.

RECOMMENDATIONS CONTINUED ON NEXT PAGE

RECOMMENDATIONS *CONTINUED*

8.7	Revise existing hazard maps to create true risk parcel-level maps to fully recognize actions that can lower risks.
8.8	Review and adopt modern building codes that have a Wildland Urban Interface (WUI) component.
8.9	Streamline the enforcement procedures to achieve higher levels of compliance.
8.10	Implement a Ready, Set, GO! public education program to enhance situational awareness and emphasize the importance of early evacuations.
8.11	Promote and support the adoption of Firewise USA ® or equivalent community programs.
8.12	Establish a countywide home hardening and maintenance program to reduce ember environment hazards.
8.13	Collaborate with County and property owners to reduce the fuel load in Upcountry gulches without causing excessive erosion.

OBSERVATION

LAND MANAGEMENT

Fallow farmlands, generating annual grasses prone to rapid and wind-driven wildfires, necessitate annual mitigation efforts. Various approaches such as mechanical methods, grazing, chemical treatments, prescribed burning, or reconversion to farming can be employed. There is no one-size-fits-all solution, the choice depends on the geography and requires evaluation of consequences. Mechanical mowing, while effective on certain terrain, is labor-intensive. Grazing is another viable solution if there's enough contiguous land for economical herd movement. Chemical treatments are effective but may have downstream consequences. Performing prescribed burning is the most cost effective, but raises concerns about erosion and escape. The best option overall is returning fallow land to farming, but will require copious amounts of water.

RECOMMENDATIONS

9.1 Continue collaboration with HWMO to ensure every community in the county has an updated CWPP.

9.2 Harness software tools to conduct fuel and community risk evaluations, generating data-driven recommendations.

OBSERVATION

TRAINING & EQUIPMENT

Wildland firefighting mandates the implementation of numerous safety measures. MFD equips assigned positions on first-run engines with fire shelters and portable handheld radios. Fire shelters are stored in an upper fire engine compartment and are not readily accessible. Crews were not aware that fire shelters can be used inside of vehicles for safe refuge. Communication and radio discipline is crucial during dynamic situations for command-and-control awareness and safety. The current portable handheld radios cannot monitor two frequencies simultaneously. A cross band repeater is required at incidents due to multiple agency frequencies.

Congress enabled the FirstNet system to ensure cellular capability and broadband coverage during major incidents. While MFD reviewed this system, the FirstNet infrastructure coverage was not adequate at that time. As the power grid failed, certain field software was not functional as it was relying on broadband coverage to be operational.

The water tankers are normally staffed with only one operator and often used on uneven terrain for long hours on wildfires. Safe operations can be compromised during extended/long duration incidents and while backing up.

RECOMMENDATIONS

10.1 Equip each line personnel with Personal Protective Equipment (PPE), including issued fire shelters and portable radios.

10.2 Train all line personnel on the proper use of fire shelters and ensure they are well-versed in their correct application.

10.3 Train all line personnel about portable radio features and the value of radio discipline during dynamic incidents.

10.4 Contact the Hawaii FirstNet representative and request an island-specific system analysis.

10.5 If AT&T FirstNet can provide a viable infrastructure, MFD should consider converting to this dedicated communications system.

10.6 Ensure that all new technology implemented is equipped with dedicated broadband coverage.

RECOMMENDATIONS CONTINUED ON NEXT PAGE

RECOMMENDATIONS *CONTINUED*

10.7	Evaluate the current communications technology to determine if there are options to address the "Orange" cross band repeater implementation process delays.
10.8	Explore technology solutions that integrate into operational tools, ensuring their functionality remains intact even during power outages – e.g., maps.
10.9	Implement the provision of a second driver/operator on water tankers during deployments for safety and relief purposes.

OBSERVATION

DISPATCH LIAISON

During the initial chaotic phase of evolving incidents, Battalion 1 and Battalion 2 Chiefs may be consumed in directing operations, limiting their capacity to handle recalls or contact private contractors. Until additional command staff becomes available, there is a risk of losing the macro view of MFD. This situation tends to resolve itself as the days progress, the DOC becomes operational, and more staff becomes available. However, field units must then place additional requests to BC or dispatch, creating additional burdens on dispatch operations.

RECOMMENDATION

11.1 Establish a Call When Needed (CWN) process where a Chief Officer would temporarily go into dispatch to assist in covering macro-level MFD decisions until enough command staff are available.

OBSERVATION

CLASS A FOAM

MFD has been a longstanding user of Class A foam. While they have utilized Compressed Air Foams System (CAFS), they found that simple foam proportioning systems are more trouble-free. These systems have built in eductors and in-line eductors are available if needed. The use of Class A foam is effective in lowering water surface tension and allows water to penetrate into fuel sources more easily, especially during overall operations.

RECOMMENDATION

12.1	Review and provide consistent use of Class A foam throughout MFD.

OBSERVATION

IMPROVISE

During the Upcountry and Lahaina fires, water supplies were compromised, with some underperforming or not functioning at all. While the exact reasons may remain unknown, factors such as the extensive number of burnt structures with broken water lines and water supply tanks running empty due to power loss could have contributed. Anticipating potential failures is integral to contingency planning, and the ability to improvise is crucial to the success in managing such situations.

RECOMMENDATIONS

13.1	Establish dedicated drafting locations in strategic locations, situated near bodies of water, and utilizing alternative sources such as piped water from swimming pools and dedicated weirs.
13.2	Ensure that all pumpers are equipped with hard suction drafting hose.
13.3	Review and propose the addition of more MFD water tankers or explore private resource options.
13.4	Explore the possibility of obtaining fire boat services directly or indirectly, with fire pump capability.

OBSERVATION

LIMITED AIRCRAFT

Firefighting aircraft may not be a panacea for wildfires, especially in extreme wind conditions. However, when conditions allow, aircraft can be instrumental in containing wildfires, especially with the use of foams and retardants. Windward Aviation holds an exclusive use contract for Air 1 and a Call When Needed (CWN) contract for additional helicopters, assisting with rescues and firefighting regularly. The primary challenge lies in aviation costs and the infrequency of their use, but the need is real, especially during wildfires.

RECOMMENDATIONS

14.1 Review the existing exclusive use contract and explore the possibility of expanding it to enhance aerial operation capabilities.

14.2 Contact aviation vendors to explore options for different types of aircraft, including the possibility of unstaffed aircraft.

14.3 Initiate a dialogue with the National Guard to explore the possibility of reassigning a Modular Airborne Firefighting (MAFFs) C-130 unit from the mainland to Hawaii to provide wildfire suppression duties across the entire state.

14.4 Introduce and implement a dedicated air-to-ground radio frequency to improve aerial firefighting operations and enhance safety measures.

CHALLENGE #15:

HOW DOES MFD ENSURE THE SAFETY AND PRODUCTIVITY OF ITS WORKFORCE DURING AND AFTER MAJOR INCIDENTS?

OBSERVATION

EMPLOYEE ASSISTANCE PROGRAMS

MFD has demonstrated its commitment to its Employee Assistance Program (EAP), Critical Incident Stress Management (CISM), and Mental Health programs. Following the tragic Line of Duty Death (LODD) and the 2023 wildfires, the workforce has been tested both physically and emotionally. As the workforce is crucial to effective service delivery, it is paramount that employee assistance programs remain a high priority. One aspect that could use reinforcement is exposure reporting, where options like the NFORS program exist. Additionally, MFD does not have a plan in place to conduct wellness checks on both on-duty and off-duty staff during and after incidents. Implementing a wellness check program can ease tensions for on-duty staff, allowing them to better focus on operations.

RECOMMENDATIONS

15.1 Maintain MFD's commitment to these programs and constantly strive to enhance them.

15.2 Establish and institutionalize a program for reporting exposures.

15.3 Collaborate with Hawaii State organizations to develop presumptive coverage for cancer, hernia, pneumonia, and mental health.

15.4 Contact the University of Hawaii or another public health entity to conduct a 20-year exposure study on firefighters and the public, considering the substantial amount of unknown smoke particulates from the wildfires.

15.5 Improve and implement pre-entry/hire psychological screenings.

15.6 Establish a wellness check program where MFD staff can voluntarily register at the fire station near their residence. On-duty staff at the fire station can then conduct checks on family members.

OBSERVATION

AFTER-ACTION REPORT

AARs can be conducted through a straightforward engine company review, assessing successes and areas for improvement. They can also be utilized on major incidents. AARs are not meant for fault-finding, as this impedes self-improvement and creates barriers to improvement.

RECOMMENDATION

15.7 Incorporate AARs into MFD's institutional practices to enhance daily operations, safety, and overall improvement.

OBSERVATION

SERIOUS ACCIDENT REVIEW TEAM (SART)

Following any LODD or serious accident, initiate a SART process immediately to understand causal factors, prevent future incidents, and ensure compliance with OSHA standards. Injuries occurred during the August wildfires, resulting in staff taking time off, have not yet been reviewed.

RECOMMENDATION

15.8 Establish a policy to institutionalize a SART-type process to perform timely reviews of significant injuries that result in time loss.

Example: 2015 Fresno Fire Department SART Investigation Report

OBSERVATION

TEAMWORK

In any major incident, the process of bringing order to chaos requires time and strategic coordination. Chief Ventura requested MFD's IMT to establish itself as the DOC. As the days unfolded, the IMT then assisted with the EOC function, both of which are founded on the ICS and the NIIMS platform. MFD's capabilities extend well beyond fire service responses, they excel at bringing calm to chaotic and adverse situations through exceptional organizational management.

RECOMMENDATIONS

16.1	Build relationships within the County that can rely on utilizing MFD's IMT for emergencies and major events.
16.2	Continuously send MFD staff off-island to participate in other major incidents as part of a mentoring process for key ICS positions.
16.3	Expand MFD's relationships with local, state, and federal cooperators to enhance the depth and breadth of their IMT.
16.4	Maintain active participation in weekly FEMA recovery community meetings to demonstrate involvement and leadership from MFD.
16.5	Take on the role as public advocate, leading mitigation efforts before Hawaii faces an insurance crisis.
16.6	Position MFD as the lead advocate for emergency infrastructure needs on the West side of Maui, i.e., disaster EMS location and capability.

CHALLENGE #17:

HOW CAN REPORTS, FIRE CAUSE INVESTIGATIONS, AND COST RECOVERY BE ENHANCED?

RECOVERY

OBSERVATION

TRAINING & DEDICATED STAFF

To better understand wildfire issues, incident reports need to include specifics detailing fire cause and acreage size. Wildfires caused by neglect should be able to recover response costs and offenders should be prosecuted. This begins with the allocation of dedicated staff, such as Arson/Fire Cause Investigators, who have undergone specialized training in evidence preservation, cause investigation, and expert witness testimony. Proper evidence preservation, crucial for criminal and civil court cases, can be achieved through various methods. Currently, fire prevention staff is handling these responsibilities as collateral duties.

RECOMMENDATIONS

17.1 Establish a team of trained staff dedicated to fire cause investigations, evidence preservation, and expert witness testimony.

17.2 Establish a cost recovery unit to pursue reimbursement for wildfires caused by neglect.

17.3 Generate more comprehensive fire reports that thoroughly identify fire causes and acreage size, facilitating better problem identification.

NOTE

We commend MFD for their swift actions to address the issues identified in this AAR, rather than waiting for AAR recommendations. These enhancements demonstrate their commitment to excellence and continuous improvement. Some of the notable improvements already being implemented are:

01 Upstaffing for Red Flag Warnings.

02 Working with law enforcement to review new evacuation software.

03 Committing to enhancing the Blue Card system and organizational command and control training.

04 Working to enhance and clarify the MFD's IMT function.

05 Building a professional development program for all personnel.

06 Committing to the fleet replacement program.

CONCLUSIONS

After-Action Reviews take place with historical evidence in a controlled environment, unlike the actual incident where first responders are faced with a chaotic scene and must use their training and experience to make the best decisions possible with the facts at hand. Generally speaking, firefighters view themselves as change agents who can intercede in adverse fire situations and potentially alter the outcome. Conversely, with other natural emergency incidents such as hurricanes, earthquakes, and tornadoes, firefighters and other first responders must wait for the situation to stabilize, then take action. To alter the outcome, those first responders often place their own lives in hazardous situations that can manifest physical outcomes immediately and many with delayed physical and mental effects.

Since 2010, the region has addressed wildfires through a series of significant studies and policy initiatives (Appendix I). We can clearly demonstrate that Maui and the State knows about the inherent dangers of wildfires (Appendix J). Like the mainland, wildfires have increased in scale and damage since 2015 and that trend will continue in the future.[10] The fire was really an urban conflagration/firestorm started by a wildfire, not a pure wildfire. The core problem remains getting the public to raise their situational awareness and become part of the solution.[11] Maui has the fuel, wind, temperatures and relative humidity, plus the urban interface to create a public policy conundrum. These factors, coupled with climate change, indicate the need to change past wildfire practices and policies.[12]

The series of wildfires that occurred on August 8, 2023, stressed the MFD and the entire emergency response system, but the system did not break. This AAR has identified the challenges and makes recommendations for the future. While the AAR focuses on wildfires, it really addresses the MFD's capability to address any major incident.

During the AAR process, we asked interviewees if the overall situation would have resulted in a different outcome if the Lahaina Fire started first. It was generally agreed that the wind condition that affected Lahaina far outpaced the response capability of the MFD. Valiant efforts by firefighters to alter the Lahaina Fire outcome were marginalized due to the speed of the wind driving the fire. It was also agreed that if the Lahaina Fire had occurred first, the Olinda, Kula and Pulehu fires would have increased in both scale and loss with the possibility of the Pulehu Fire inflicting tremendous damage to the Kihei community.

After the fact, firefighters, law enforcement, and EOC staff would probably tell you that they might take different actions now as they look back on known facts. That revelation is the basis for conducting an AAR, as lessons learned create recommendations for the future. The challenge for policy makers is how to determine what level of emergency preparedness they want to maintain and how to fund that level. This is where surge capacity enhancements should become priorities in conjunction with baseline operations.

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[10] Lee, et al. NBC News. February 3, 2024. *'This is not a Lahaina problem': Once unthinkable, frequent fires are Hawaii's new normal.* https://www-nbcnews-com.cdn.ampproject.org/c/s/www.nbcnews.com/specials/hawaii-fire-scientists-warn-escalating-wildfire-threat/amp-index.html. Accessed February 21, 2024.

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[12] Ramirez, Rachel. CNN. August 9, 2023. *Why did the Maui fires spread so fast? Drought, nonnative species and climate change among possible reasons.* https://www.cnn.com/2023/08/09/us/climate-change-reason-maui-fire/index.html. Accessed February 9, 2024.

The After-Action Report honors those lost, their families, and individuals stripped of homes/businesses, cherished memories, and livelihoods. It pays tribute to the heroic efforts of firefighters, law enforcement, and neighbors who rallied together. May this report drive recovery, inspire action, and shape public policy to better address future major incidents.

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STATE AIRPORT RESCUE FIRE DEPARTMENT *Colby Hanley, Fire Chief*	UNIVERSITY OF HAWAII *Clay Trauernicht, PhD*
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APPENDIX A

OVERVIEW OF THE COUNTY OF MAUI DEPARTMENT OF FIRE AND PUBLIC SAFETY (MFD)

Below are the Mission, Vision, and Values of MFD, as listed on their website.[13]

MISSION STATEMENT

To protect and preserve life, environment, and property.

VISION

Building on this mission the department has identified vision statements to establish targets for excellence in the future. These are to:

- Have personnel recognized as community leaders both on and off duty
- Maintain a high level of professional development for our members
- Maintain a management/labor partnership where decisions are made collaboratively
- Manage resources that reflect the diverse needs of the community
- Be recognized as a leading resource for community relations and public safety education
- Be a progressive organization that embraces change
- Be an organization that promotes the wellness and fitness of its members
- Be a department that is altogether prepared for any emergency
- Become an accredited agency

VALUES

Recognizing that its collective personality and the values of its members enhance the organization, the Department of Fire and Public Safety has declared a set of values that included such statements as:

- PROFESSIONAL EXCELLENCE
  We believe the pursuit of excellence and demonstrating high professional standards are critical to our work. We will ensure the best possible service for our community. The fire and rescue department supports continuous training and encourages professional development. We will respect the diversity of our community by providing compassionate and quality service to all.

- COMMUNITY SERVICE AND INVOLVEMENT
  We believe we have a duty to be involved in the community where we work. We are committed to fulfilling our responsibility by expanding our involvement in the community we serve.

- INTEGRITY
  We understand the trust placed in us by the public and our colleagues is integral to the performance of our duties. We are committed to honest and ethical behavior and will hold ourselves accountable to these values.

- Effective Communication
  We believe effective communication is essential to the cohesiveness and performance of our organization. We are committed to providing effective and responsive means of communication throughout the organization and the community.

[13] County of Maui. *About Us*. https://www.mauicounty.gov/1462/About-Us. Accessed February 9, 2024.

- HEALTH AND SAFETY
  We believe our health and safety are essential to fulfilling the fire and rescue department's mission. We are committed to providing the best health and safety programs for our members well-being and operational readiness.

- TEAMWORK AND SHARED LEADERSHIP
  We know well-functioning teams of people are more effective than individuals who are working separately; our lives depend on it! We believe individuals have the capacity to lead, and our organization values leadership at all levels. Teamwork and shared leadership are integral to our organization, and we will seek out and value the opinions of our members.

- INNOVATION
  We recognize and understand that the constant change in our community and industry impacts our daily business. We are committed to seeking out and implementing innovative and progressive thinking to address change effectively, benefiting those we serve.

MFD DIVISIONS:

- Administration and Maintenance[14]
  - Administration
    - Provides general oversight, including budgeting, human resource functions, procurement, and enforcing regulations
  - Maintenance
    - Has a full-service fleet repair and maintenance facility
- Fire and Rescue Operations[15]
  - Responsible for emergency response in Maui County
- Fire Prevention Bureau[16]
  - Responsible for abating fire and life safety hazards before they can cause injury and property damage via:
    - Code Enforcement
    - Fire Investigation
    - Plans Review
    - Fire Education
    - Maui County Wildland Urban Interface (WUI) Program[17]

      In this program, the MFD works with community leaders to reduce the impacts of wildfires within their community
- Training, Health and Safety[18]
  - Training Bureau
    - Provides training and tracking of personnel certifications
  - Health and Safety Bureau
    - Provides the department with health, safety and wellness support
- Ocean Safety Bureau[19]
  - Consists of Ocean Safety Officers
    - Highly skilled water rescue officers used in island-wide emergency response
    - Staffs lifeguard towers and provides water safety tips to the public

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[14] County of Maui. *Administration and Maintenance*. https://www.mauicounty.gov/1463/Administration-and-Maintenance. Accessed February 9, 2024.
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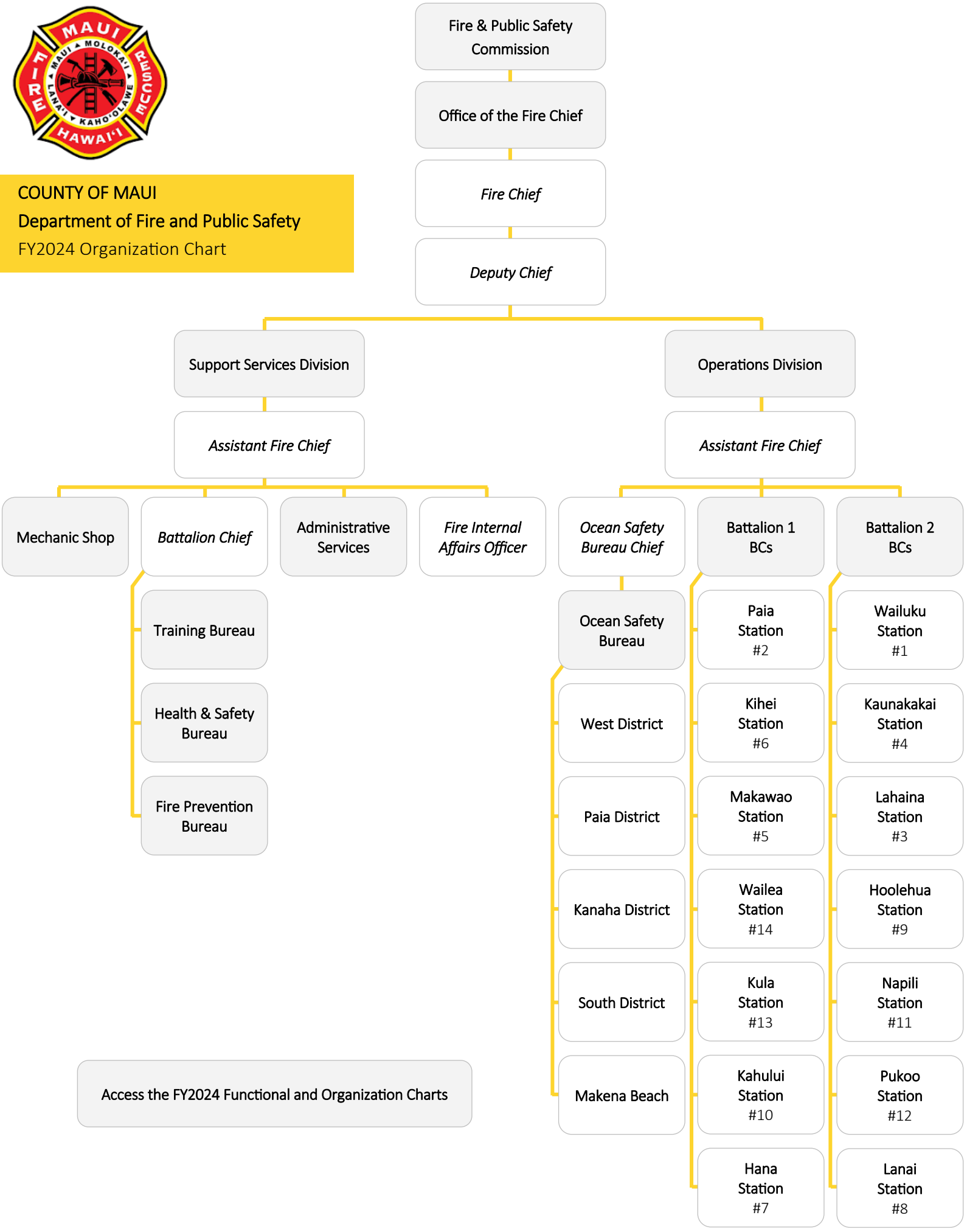
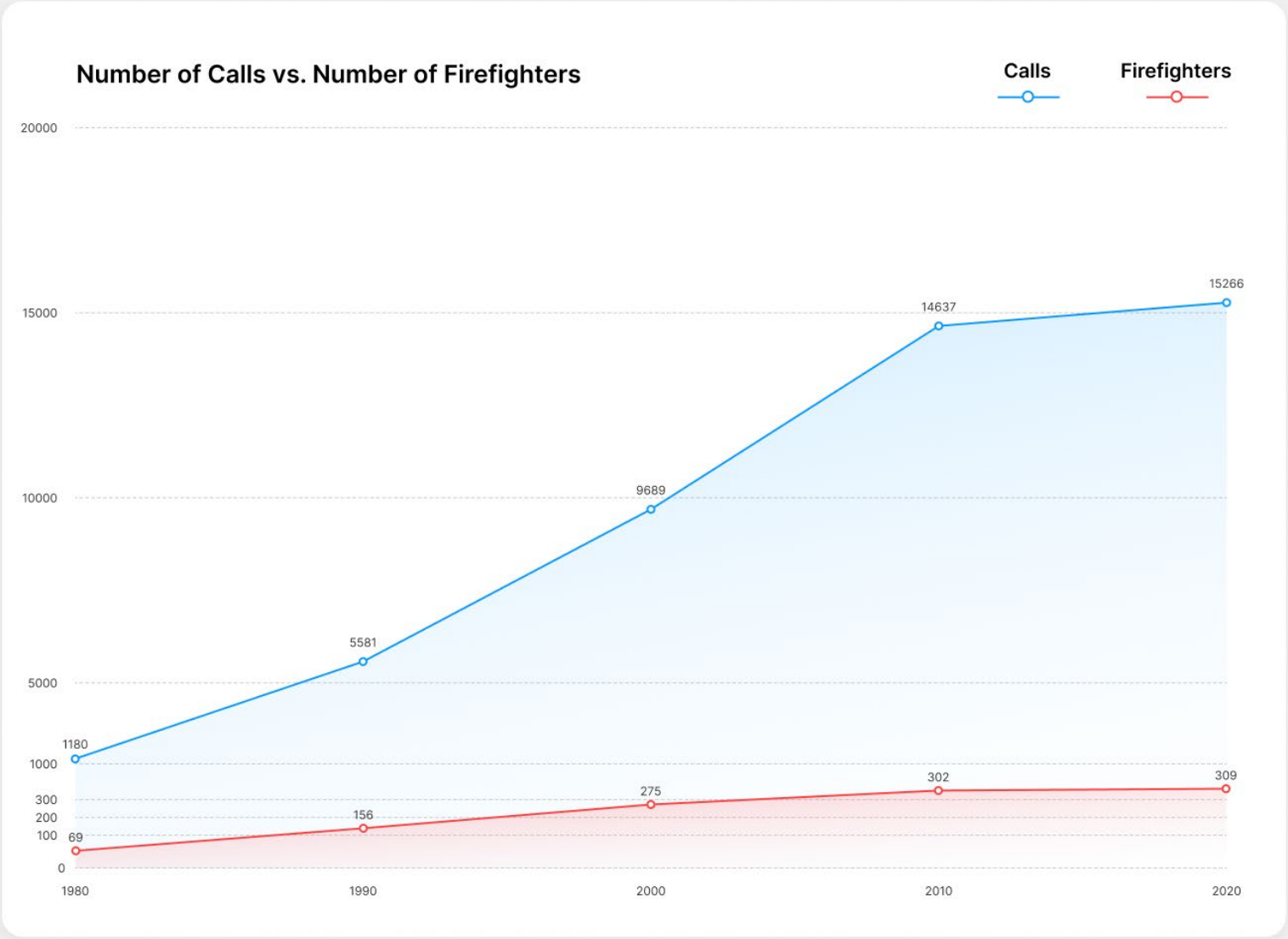
COUNTY OF MAUI
Department of Fire and Public Safety
FY2024 Organization Chart



Access the FY2024 Functional and Organization Charts

NUMBER OF CALLS VS. NUMBER OF FIREFIGHTERS

The chart below illustrates the historical overall call load ratio of MFD in comparison to the number of firefighters.



This chart was built using the data on the next page (MFD Service Delivery Statistics).

MFD SERVICE DELIVERY STATISTICS

	1970	1980		1990		2000		2010		2020		2023	
POPULATION	38,691	62,823	↑ 61.4 %	91,361	↑ 45.4 %	117,644	↑ 28.5 %	155,025	↑ 32.4 %	164,754	↑ 5.8 %	167,730	↑ 1.8 %
TOURISTS	151,185	540,659	↑ 258 %	2,284,862	↑ 323 %	2,304,396	↑ .87 %	2,122,635	↓ -8.6 %	792,602	↓ -168 %	--	-- %
TOTAL	189,976	603,482	↑ 219 %	2,376,223	↑ 294 %	2,422,340	↑ 1.9 %	2,277,650	↓ -6.3 %	957,356	↓ -138 %	--	-- %
MFD BUDGET	608,561	1,325,545	↑ 118 %	6,344,087	↑ 379 %	11,400,163	↑ 79.7 %	30,785,046	↑ 170 %	42,495,955	↑ 38 %	48,556,871	↑ 14.2 %
CALLS	--	1,180	-- %	--	-- %	5,581	↑ 372.9 %	9,689	↑ 73.6 %	14,637	↑ 51 %	15,266	↑ 4.3 %
FIRE STATIONS	4	8	↑ 100 %	9	↑ 12.5 %	13	↑ 44.4 %	14	↑ 7.6 %	14	↑ 0 %	14	↑ 0 %
FIREFIGHTERS	--	69	-- %	156	↑ 126 %	275	↑ 76.3 %	302	↑ 9.8 %	309	↑ 2.3 %	309	↑ 0 %
TOTAL POP/FF	--	8,746	-- %	15,232	↑ 74.1 %	8,808	↓ -72.9%	7,541	↓ -16.8 %	3,098	↓ -143 %	--	-- %
TOTAL POP/CALLS	--	511	-- %	--	-- %	434	↓ -17.7%	235	↓ -84.6 %	65	↓ -261 %	--	-- %
$/CALLS	--	1,123	-- %	--	-- %	2,042	↑ 81.8%	3,177	↑ 55.5 %	2,903	↓ -9.4 %	3,180	↑ 9.5 %
CALLS/FF	--	17	-- %	--	-- %	20	↑ 17.6%	32	↑ 60 %	47	↑ 46.8 %	49	↑ 4.2 %

MFD FIRE STATION LOCATIONS

STATION 1	Wailuku Fire Station 21 Kinipopo Street Wailuku, Maui, HI 96793 (808) 270-7569	STATION 2	Paia Fire Station 179 Hana Hwy Paia, Maui, HI 96779 (808) 876-4545
STATION 3	Lahaina Fire Station 1860 Honoapiilani Hwy Lahaina, Maui, HI 96761 (808) 661-4065	STATION 4	Kaunakakai Fire Station 230 Kakalahale Street Kaunakakai, Molokai, HI 96748 (808) 553-5601
STATION 5	Makawao Fire Station 134 Makawao Avenue Makawao, Maui, HI 96768 (808) 876-4570	STATION 6	Kihei Fire Station 11 Waimahaihai Street Kihei, Maui, HI 96753 (808) 879-2741
STATION 7	Hana Fire Station 4655 Hana Hwy Hana, Maui, HI 96713 (808) 876-4595	STATION 8	Lanai Fire Station 1345 Fraser Avenue Lanai City, Lanai, HI 96763 (808) 565-8390
STATION 9	Hoolehua Fire Station 2190 Farrington Avenue Hoolehua, Molokai, HI 96729 (808) 567-6525	STATION 10	Kahului Fire Station 200 Dairy Road Kahului, Maui, HI 96732 (808) 270-7911
STATION 11	Napili Fire Station 4950 Hanawai Street Lahaina, Maui, HI 96761 (808) 669-4300	STATION 12	Pukoo Fire Station 8735 E. Kamehameha V Hwy Kaunakakai, Molokai, HI 96748 (808) 558-8580
STATION 13	Kula Fire Station 50 Calasa Road Kula, Maui, HI 96790 (808) 876-4575	STATION 14	Wailea Fire Station 300 Kilohana Drive Kihei, Maui, HI 96753 (808) 874-8520

APPENDIX B

MATERIALS STUDIED

Below is a collection of pertinent web links not already listed in the AAR body:

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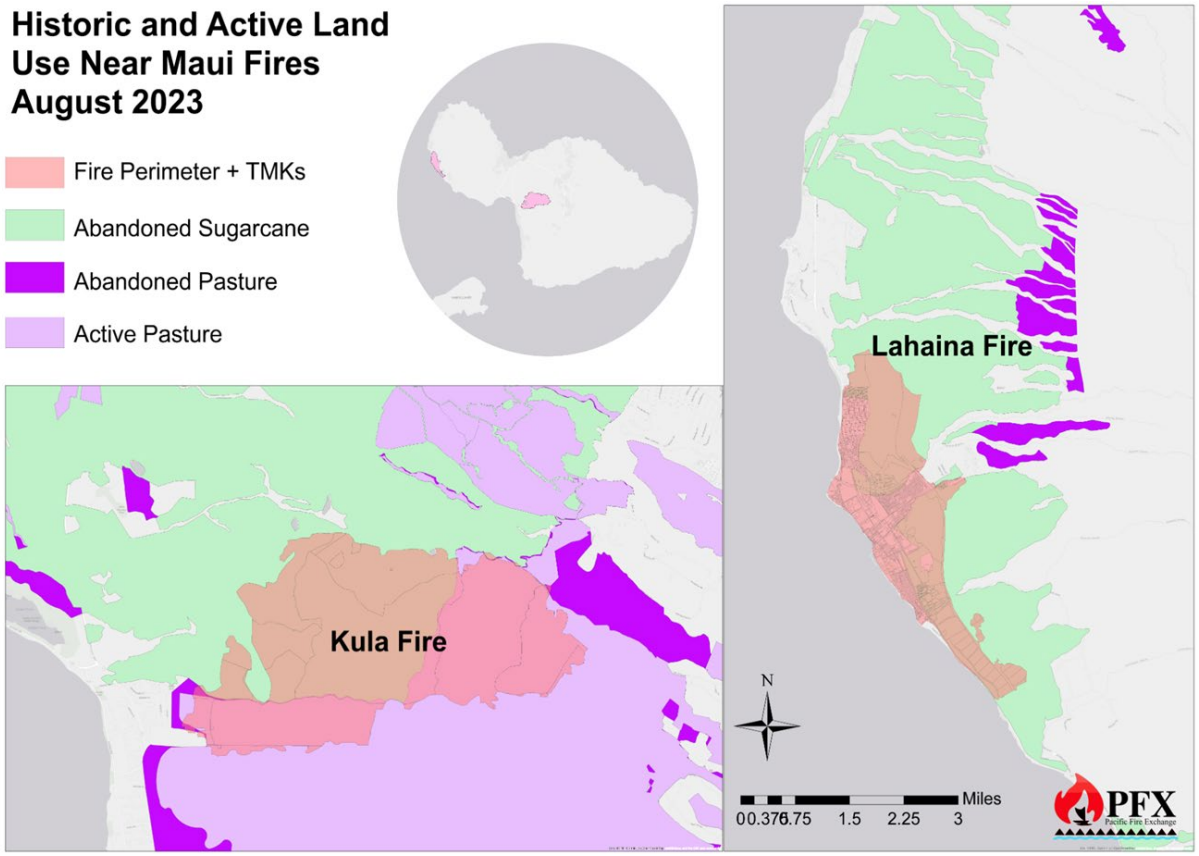
APPENDIX C

ISLAND LAND USE EVOLUTION

A historical review of Maui reveals that in the early 19th century, missionary settlements initiated the conversion of wetlands and fishponds into agricultural operations. Sugarcane and pineapple emerged as a major crop and prominent markets developed, particularly as the demand for whale oil diminished. These agriculture endeavors generated employment opportunities and contributed to the region's flourishing economy. During this period, wildfires were infrequent and were often handled by the land use manager's heavy equipment.

During the 1970s to 1990s, the cost of farming soared, leading to the relocation of sugarcane and pineapple operations to other global locations. Consequently, the once lush forests, wetlands, and native shrubland failed to regenerate, and the land soon became fallow. The subsequent vegetation consisted of a mix of buffelgrass and Guinea grass, primarily used for grazing feedstock, along with remnants of old agriculture crops. This combination of vegetation, coupled with the Kona and Trade winds, create a volatile fuel source for wildfires. The fallow lands now have less access, labor, and private heavy equipment, making them more susceptible to larger and more destructive wildfires, a situation exacerbated by changes in climate.

This graphic illustrates how these conditions contributed to the Kula and Lahaina fires:



Hawaii and Active Land Use Near Maui Fires August 2023. Source: Trauernicht, Clay. University of Hawaii. Hawaii Wildfire Management Organization.

APPENDIX D

WEATHER

Areas that were once lush at elevations that held moisture are now vulnerable to wildfires. Even in the Upcountry region, where Haleakala's 10,000-foot elevation historically retained moisture between 3,000 and 6,000 feet, Maui now faces the risk of wildfires due to a multi-year drought. During late summer/early fall, historical average temperatures ranging from 70-89 degrees, coupled with relative humidity at 70-80%, have now shifted to weather conditions more conducive for the spread of wildfires.

Maui has the reputation of being the windiest island in the state with seasonal trade winds that average 15-30 mph (N-NE direction) and Kona winds that average 10-20 mph (S-SE direction).[20]
The best way to articulate Maui's weather and winds is via this citation:[21]

> *"The local situations that produce occasional violent winds are not well understood, even though the general causes of these winds can be surmised. These are local winds, of very limited extent. They have been observed only in a few areas. They must sometimes reach speeds of 60 to 100 MPH, for they have been known to blow down well-rooted trees as well as power lines designed to withstand very high wind loads. It is likely that these winds occur infrequently in many sparsely settled areas on the slopes of the mountains of Hawaii and Maui, or near the mouths of canyons along the base of these mountains. They are, however, known best in the settled areas of Kula and Lahaina on Maui.*
>
> *The Kula winds are strong down slope winds. They occur in the Kula District along a section of the lower slopes on the west side of Mt. Haleakala. According to observations by inhabitants of the area, the winds tend to be strongest in the zone that lies between 2,000 and 4,000 feet above mean sea level. In this zone there may be episodes of down slope winds with speeds of over 40 MPH as often as twice a year. However, winds with speeds in excess of 60 MPH probably occur only once every four or five years, on the average.*
>
> *The Lahaina winds seem also to be down slope winds, but of somewhat different character from those of Kula. In the Lahaina area they have been given the name of "lehua winds" after the lehua tree which grows in that locality and with whose red blossoms the air is filled when these strong winds blow. They issue from the canyons at the base of the main mountain mass of western Maui, where the steeper canyon slopes meet the gentler piedmont slope below. These winds have been reported from both the western and southern side of the western Maui mountains. They are evidently quite infrequent, occurring every eight to 12 years on the average. When they do occur, however, they are extremely violent, with wind speeds whose effects suggest they may reach 80 to 100 MPH or even more. They have been known to demolish buildings, uproot trees and cause severe lodging throughout whole fields of sugarcane. That they are partly down slope winds is evident from their being hot and dry. The mountains of western Maui are less than 6,000 feet high as contrasted with the 10,000-foot height of Haleakala, and it seems likely that these local Lahaina winds are caused, at least in part, by the funneling of strong trade winds through certain of the mountain gorges."*

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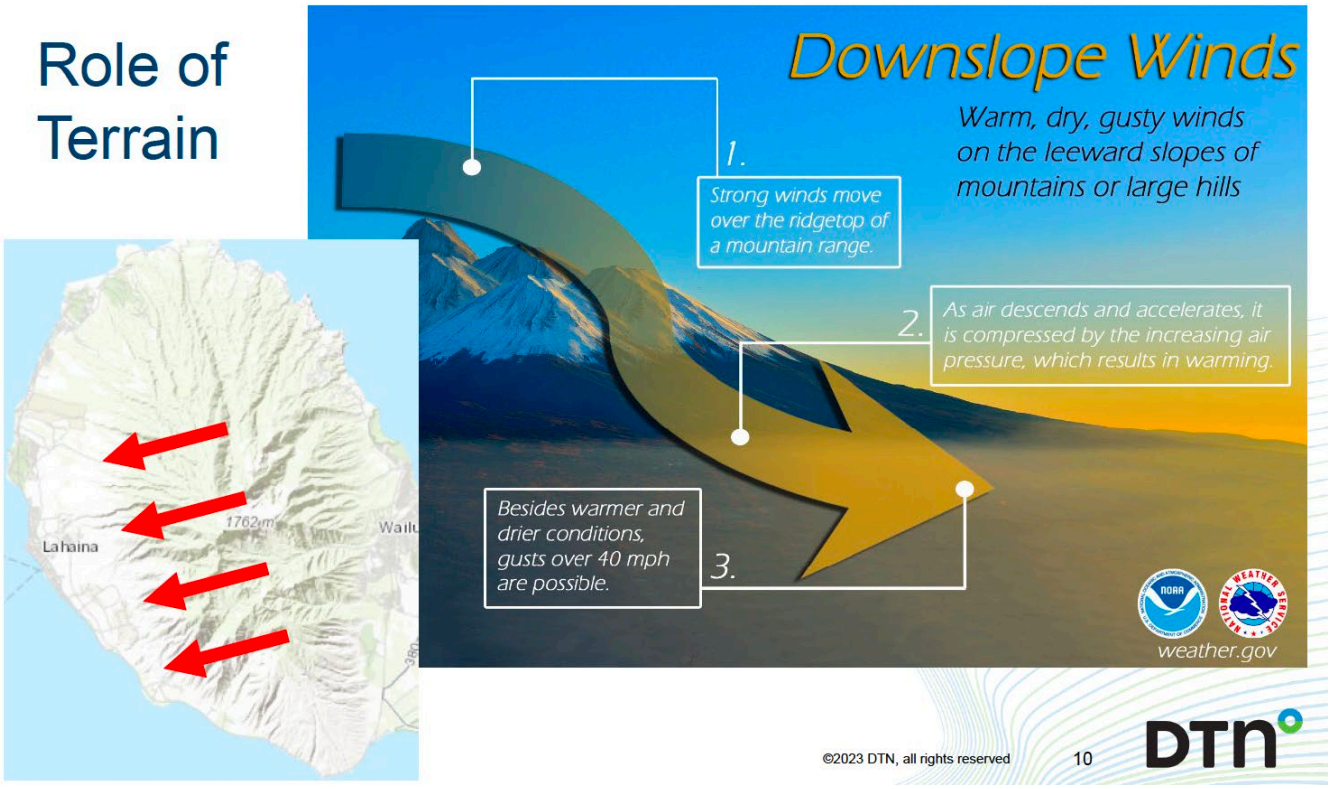
[20] Hawaii Ocean Project. March 8, 2018. *A Guide to Understanding Maui's Weather*. https://hawaiioceanproject.com/a-guide-to-understanding-mauis-weather/. Accessed February 9, 2024.

[21] Western Regional Climate Center. *Climate of Hawaii*. https://wrcc.dri.edu/Climate/narrative_hi.php. Accessed February 9, 2024.



Role of Terrain and Downslope Winds. Source: DTN. National Weather Service. National Oceanic and Atmospheric Administration.

Weather and wind monitoring is difficult on Maui because the topographic features create many microclimates. Hawaii Department of Land and Natural Resources has recognized this by recently installing two new Remote Automated Weather Station (RAWS) units near Lahaina with several others planned.

During the wildfires, reports from firefighters stated that it was hard for firefighters to open vehicle doors and stand up in certain locations. A Windward Aviation pilot was able to measure wind gusts around 80 mph at times as one of the most accurate citations available.

APPENDIX E

WILDFIRE HISTORY

Maui and the rest of Hawaii have a distinctive ecosystem, setting them apart from the continental United States. Many of Hawaii's plant species struggle to recover from wildfires, and downhill runoff exacerbates issues by causing soil erosion, negatively impacting ocean plant life and coral.

Notable large wildfires seasons in Maui include:

- 2003: 3,001 acres
- 2005: 1,352 acres
- 2006: 7,390 acres
- 2007: 4,218 acres
    - Upper Waiohuli Fire (1,800 acres) destroyed 75% of the Forest Reserve
- 2010: 5,535 acres
- 2016: 10,908 acres
- 2018: 4,601 acres
    - Hurricane Lane Fire (2,215 acres)
    - Kaanapali Fire (294 acres)
    - Both Hurricane Lane and Kaanapali fires were fueled by 70 mph winds. Before the 4 major wildfires in August of 2023, these wildfires were the most complex incidents in MFD history. 21 residences, 27 vehicles, and 150 acres of farmland were lost.
- 2019: 19,316 acres
    - Waiko Fire (7,908 acres)
- 2023: 6,721 acres
    - Pulehu Fire (3,268 acres)
    - Lahaina Fire (2,170 acres)
    - Olinda Fire (1,081 acres)
    - Kula Fire (202 acres)

Although the annual acreage listed above may not equal the megafire sizes on the mainland, it's essential to note that Maui's ecosystems are far more sensitive and less resilient to wildfires.

APPENDIX F

HURRICANE DORA & RED FLAG WARNINGS

A Red Flag Warning generally means warmer temperatures, lower humidity, and stronger winds are expected to combine to produce an increased risk of fire danger. These factors vary depending upon geographical area. The relative humidity (RH) may not go as low in Hawaii, but the RH percentage decrease forms basically the same conditions. For example: Red Flag Warnings in California are typically, temp @ 80-100+ degrees, ***RH below 15%*** and wind speeds above 50 mph with gusts. In Hawaii, temp @ 80-100 degrees, ***RH @ 30-60%*** and wind speeds above 50 mph with gusts.

The National Weather Service (NWS) issued a Red Flag Warning on August 5 for August 7-9 due to lower relative humidity and high winds associated with Hurricane Dora, passing about 600 miles south of Maui.[22] Many of the people, mostly firefighters, interviewed for the AAR are also fishermen and surfers who study the weather daily. With Hurricane Dora being 600 miles away and Maui being the windiest island in the state, there was not a heightened sense that this Red Flag Warning would be much different from past events.

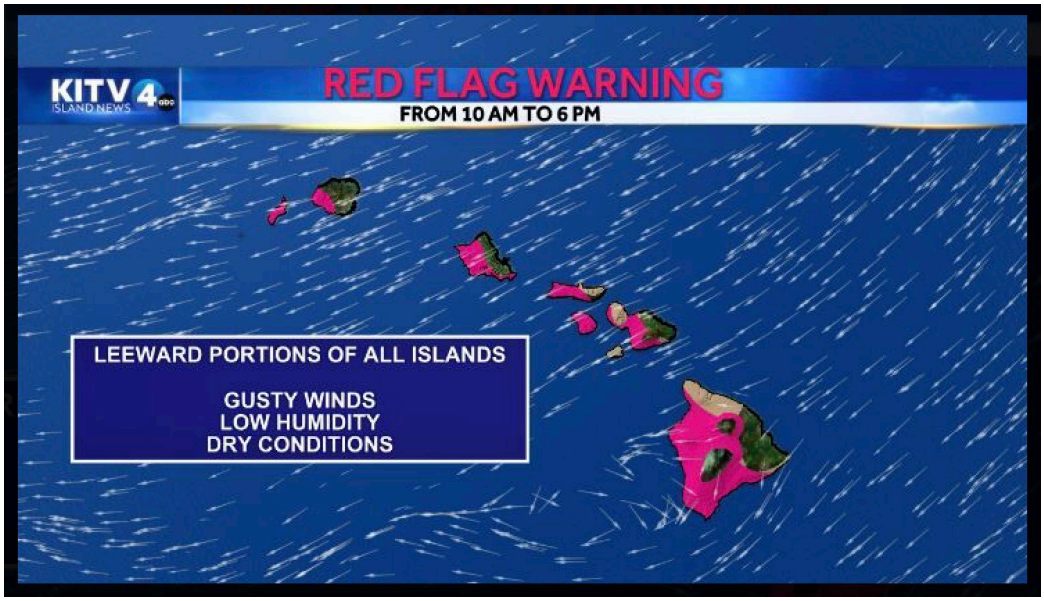
A review of past Red Flag events since 2020 indicate 14 Red Flag Warnings with 74 wildfire incidents. A total of 27 wildfires occurred between August 7-11, 2023. Impressively, 85% of those wildfires were contained at 50 acres or less, with the Olinda, Kula, Pulehu and Lahaina fires being larger.

Date Red Flag Warnings Issued	# Wildfires	# Wildfires Over 50 Acres
2020/08/30 – 09/01	7	
2020/09/05 – 09/07	3	
2020/09/10 – 09/11	6	
2021/08/25 – 08/27	2	
2021/09/03 – 09/05	2	
2021/09/17 – 09/19	3	
2021/09/20 – 09/22	3	
2021/10/06 – 10/10	3	
2022/07/31 – 08/02	8	
2022/08/10 – 08/12	6	
2022/08/27 – 08/28	3	
2022/11/21	1	
2023/08/07 – 08/10	27	4
2023/08/31	1	

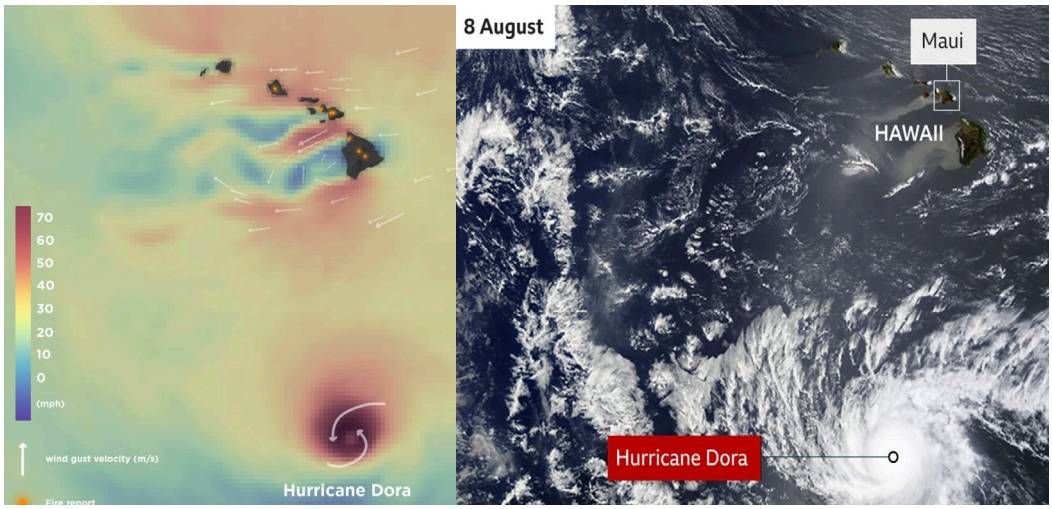
[22] Gutierrez, Ben. Hawaii News Now. August 6, 2023. *First Alert Weather Day: Red flag warning extended as Dora tracks west.* https://www.hawaiinewsnow.com/2023/08/06/first-alert-high-wind-fire-watches-issued-ahead-dry-gusty-weather/. Accessed February 9, 2024.

Prediction of actual Red Flag criteria and responsible messaging is paramount to ensure the validity and credibility of the warnings. The National Oceanic and Atmospheric Administration (NOAA) continues to study the Red Flag process to ensure public acceptance and avoid complacency.[23]

The exact influence and impact of Hurricane Dora remains unclear today. Most people believed that Hurricane Dora being 600 miles away would have little effect. The National Weather Service is actively researching Hurricane Dora's influence to better understand the future. Further review seems to indicate that an inversion was in place that strengthened and accelerated the wind due to terrain features of Maui. This was also supported by Windward Aviation's pilots.



Red Flag Warning. Source: KITV ABC 4 Honolulu.



Hawaii fire: Maps and before and after images reveal Maui devastation. Source: BBC. August 13, 2023. Original Source: NASA.

[23] National Weather Service, National Oceanic and Atmospheric Administration. *CSTAR Projects*. https://vlab.noaa.gov/web/nws-osti/cstar. Accessed February 9, 2024.

APPENDIX G

CALL LOAD CHART

	8/6/23	8/7/23	8/8/23	8/9/23	8/10/23	8/11/23
Total # of Incidents	41	65	71	27	53	57
Wildfires	1	6	11	4	8	5
EMS	14	30	10	3	14	16
Other Fires	11	16	27	14	11	16
Misc. Calls	15	13	23	6	20	20
# Calls Received by Dispatchers	983	1,329	4,523	3,388	2,376	2,477

Note the high 911 call volume (text and telephone) on August 8. Many of these calls were duplicate calls reporting the same incidents. Dedicated dispatchers must still answer each call in case there is a new distinct incident.

APPENDIX H

ADDITIONAL EOC DETAILS

- MFD personnel were on standby from August 7 onward, prepared for activation if needed
- MFD provided between 2 and 6 personnel at the EOC after the Olinda Fire called for evacuations
- MFD provided a presence at the EOC for several weeks
- MFD continued to assist the EOC with the re-entry phase of the recovery

MFD HAS BEEN SEEKING FEMA REIMBURSEMENTS FOR ITEMS SUCH AS:

- Damaged apparatus and equipment
- Overtime
- Helicopter time
- Heavy equipment rental
- Materials they had to purchase, or were taken for use out of the warehouse (i.e., respirators, water, snacks, decontamination supplies, etc.)
- "Force Account Equipment" = standard FEMA rates by vehicle type to cover use, wear and tear, fuel, etc., for various vehicles that responded
- Time and costs incurred in managing the FMAG (i.e., accounting for all the above, meetings to clarify the process, document production and uploading, etc.)

APPENDIX I

PREVIOUS STUDIES

The following list categorizes the most pertinent documents and prior studies centered on the Island of Maui by year, incorporating comments and observations:

2014

WESTERN MAUI COMMUNITY WILDFIRE PROTECTION PLAN

- https://dlnr.hawaii.gov/forestry/files/2023/08/Western-Maui-CWPP14.pdf
- Very comprehensive, but only addresses West Maui
- Consider updating the plan to be inclusive of the whole county since wildfire conditions have changed

2016

STANDARDS OF COVER REPORT

- http://mauicounty.us/wp-content/uploads/2017/06/MAUI-SOC-4-6-17.pdf
- The Standard of Cover report is very complete but should consider a tiered response depending upon Red Flag Warning
- There are many recommendations that still need implementation

2017

COMMISSION ON FIRE ACCREDITATION INTERNATIONAL ACCREDITATION REPORT

- http://mauicounty.us/wp-content/uploads/2017/06/Maui-Fire-Dept-Accreditation-Report-February-2017-Final.pdf
- There is little reference to wildfires in the report
- There are many recommendations that still need implementation

2018

PERFORMANCE AND FISCAL AUDIT OF THE DEPARTMENT OF FIRE AND PUBLIC SAFETY

- https://wfca.com/wp-content/uploads/2024/01/Performance-and-Fiscal-Audit-Final-Report-03-20-2018.pdf
- Supports the creation of Maui-centric Standards of Cover and a fire station location study

TROPICAL CYCLONE LANE AFTER ACTION REPORT

- https://wfca.com/wp-content/uploads/2024/01/AAR-DRAFT-4-Combined.pdf
- There are many recommendations that still need implementation

2020

HAZARD MITIGATION PLAN UPDATE

- https://www.mauicounty.gov/DocumentCenter/View/125977/2020-Maui-County-Hazard-Mitigation-Plan-Final
- The County's 2020 Hazard Mitigation plan is excellent and reflects current deficiencies that should be addressed when updating the Community Wildfire Protection Plan and the MFD Strategic Plan

2021

MAUI FIRE & PUBLIC SAFETY STRATEGIC PLAN, 2021-2025

- https://www.mauicounty.gov/DocumentCenter/View/101890/MFD-Master-Strategic-Plan-2021---2025?bidId=
- Support “Initiative 4 - Operations Goals 1-5” and the other initiatives
- Consider revisiting Strategic Plan following 2023 wildfires that stressed the overall system to suggest specific wildfire enhancements

MFD COMMUNITY RISK REDUCTION PROGRAM

- https://www.mauicounty.gov/DocumentCenter/View/142946/-Maui-County-Wildland-Urban-Interface-WUI-Program
- Support this program, and consider providing adequate staffing for goal achievement

COUNTY OF MAUI, “COST OF GOVERNMENT COMMISSION”

- https://www.mauicounty.gov/DocumentCenter/View/129493/Report-on-Wildfire-Prevention--Cost-Recovery-on-Maui---Part-1-Report--Exhibits-A-B-33-MB
- This document ranked wildfire risk as "low" despite increasing fire acreage and dangers from drought and non-native grasses
- The report criticized inadequate funding and lack of fire prevention strategies
- Previous wildfires served as a warning, but risks were not adequately addressed
- Hawaii's fire management budgets have not kept pace with growing threats, according to the Hawaii Wildfire Management Organization

THREAT AND HAZARD IDENTIFICATION AND RISK ASSESSMENT

- https://dod.hawaii.gov/hiema/files/2023/01/21-1227-Threat-and-Hazard-Identification-and-Risk-Assessment-1.pdf
- Maui’s geography contains towns hugging the coast between the ocean that sit in the funnel of compressed terrain driven winds. Populations tend to be clustered and dependent on single highways, often located on the island edge. This is a double edge sword where climate change is increasing tide heights against coastal communities and these dense communities are then prone to inland wildfires catching them in the middle on Maui.
- Despite these growing dangers, state budgets for fire management have not kept pace with worsening conditions, according to the Hawaii Wildfire Management Organization
- Within this report, on pages 46-48, two Capability Targets were cited and now should be acted upon with appropriate steps. Both of these Capability Targets should be revisited with the Standards of Cover report
  - *“Within 12 hour(s) of an incident, conduct fire fighting operations to suppress and extinguish 50 structure fires”*.
  - *“The capability target is based on a real world incident, Hurricane Lane in 2018, and input from DLNR. During the 2018 incident, a wildland fire was fueled and caused damage to 50 structures. Response time took more than 12 hours in this event, but due to feedback from DLNR and chiefs within the county fire departments, this response time is reachable when additional equipment and personnel are on hand.*
  - *“Within 72 hours of an incident, conduct firefighting operations to contain 3 wildland fires covering 2300 acres*.

- Seventy-two hours to contain major wildland fires is a realistic capability target given the weather conditions described in the hurricane scenario

2022

STATE OF HAWAII COMPREHENSIVE MANAGEMENT PLAN

- https://dod.hawaii.gov/hiema/files/2022/03/Hawaii-State-CEMP-FEB-2022.pdf
- The report's wildfire rating should be reconsidered by Maui policy makers as the island recovers and makes long-term policy decisions, i.e., planning, building codes, evacuation routes and MFD preparedness.
- The vulnerability of the islands to deadly wildfires was gravely underestimated in long term assessments. A year prior, the State of Hawaii Comprehensive Emergency Management Plan Report had detailed wildfire risks as one of the lowest threats for the state.

STATE EMERGENCY MANAGEMENT AGENCY'S - PUBLIC RESOURCE WEBPAGE

- https://dod.hawaii.gov/hiema/public-resources/types-of-disaster/
- Lays out clear, bullet-point recommendations of what residents should do in the event of a hurricane, tsunami, flash flood or earthquake. At the bottom of the page, the agency includes two short paragraphs about wildfires – with no similar advice on ways to stay safe.

2023

2023 HAWAII POST FIRE TECHNICAL REPORT

- https://wfca.com/wp-content/uploads/2024/01/2023HawaiiPostFireTechnicalReport_20230912.pdf
- Burn area technical review to assist with rehabilitation efforts

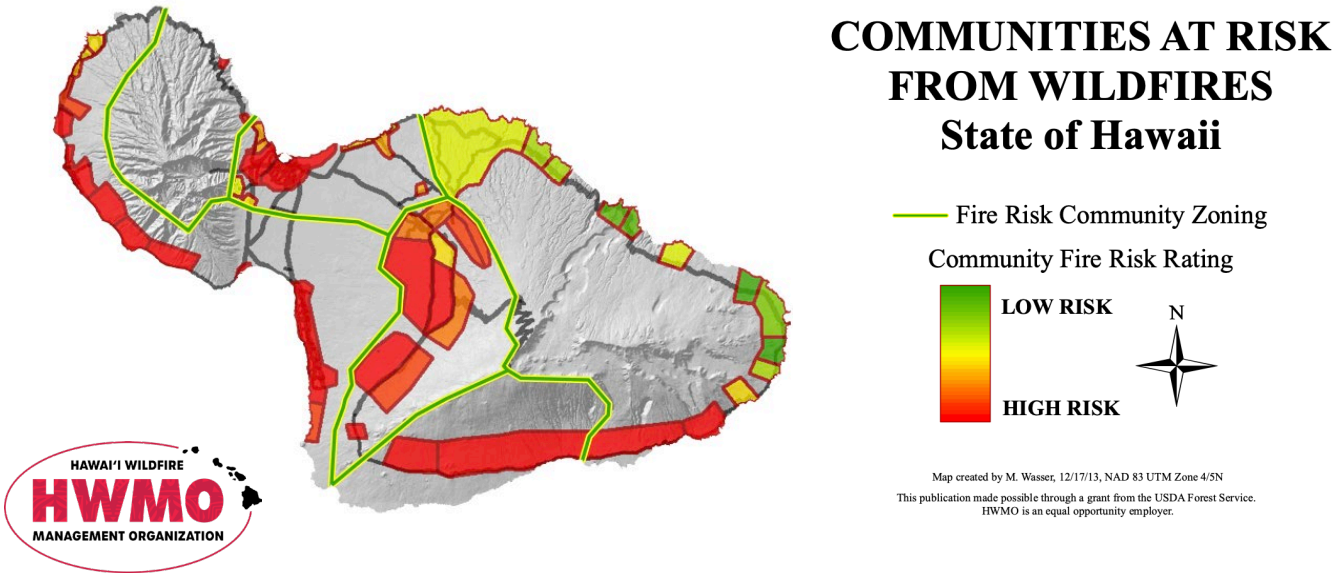
LATEST CWPP RESOURCES

HWMO WEBPAGE

- https://www.hawaiiwildfire.org/cwpp-resources
- HWMO has helped develop Community Wildfire Protection Plans (CWPP) for most of the priority fire-prone regions of Hawaii. The plans assesses values at risk such as safety, natural resource protection, recreation, scenic values, and economic assets. Through a collaborative process involving input from community members, resource management and firefighting agencies, and a variety of other interested parties, CWPPs help bring wildfire hazard information and planning and action opportunities to all parties.

APPENDIX J

MAUI WILDFIRE RISKS



Communities at Risk from Wildfires – State of Hawaii Map. Source: Hawaii Wildfire Management Organization. June 30, 2015.

In June 2014, the Hawaii Wildfire Management Organization prepared a Western Maui Community Wildfire Protection Plan (CWPP) that warned that most of the Lahaina area was at extremely high risk for burning. The County's 2020 Hazard Mitigation Plan also identified Lahaina as a high-risk wildfire zone. The County has adopted a modern building code that references NFPA 1, Chapter 17 provision, but these codes only apply to new development. There are provisions to address defensible space with enforcement procedures.

Generally, wildfire risks are greatly undervalued by the public and policy makers (see 2020 Hazard Mitigation Plan in Appendix I). Additionally, wildfires are nationally under-publicized.[24] A challenge exists in the willingness of the public and policymakers to proactively address and finance wildfire actions upfront in preparation, mitigation and response, as opposed to dealing with the recovery costs and impacts of wildfires later on.

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[24] Hawaii Wildfire Management Organization. July 25, 2018. *Hawaii Wildfire Impacts Flyer*. https://www.hawaiiwildfire.org/fire-resource-library-blog/hi-wildfire-impacts-flyer. Accessed February 9, 2024.

APPENDIX K

Recommendations Summary

Preparation Challenge #1 - How to maximize MFD reserve and surge capacity?		
Observations	Recommendations	Page
Relief Engines	1.1 Create, fund, and provide a standard inventory for all response vehicles. 1.2 Provide secure and enclosed facilities for all vehicles. 1.3 Conduct a regularly scheduled vehicle inventory for accountability purposes.	19
Vehicle Inventory & Types	1.4 Assess the capabilities of MFD's current fleet to their service demands. 1.5 Standardize vehicle types in a way that streamlines training and fleet maintenance.	19
Off & On Duty Situational Awareness & Capability	1.6 Create an automated system to notify all staff of a major deployment to take the burden off the on-duty BCs. 1.7 Explore the use of First Due or other software to provide timely situational updates. 1.8 Implement a take-home policy for BC command vehicles so off-duty BCs can readily respond from their residence; increasing MFD's command and control capability.	20
Statewide Mutual Aid	1.9 Create a statewide certification and qualifications system. 1.10 Create a statewide mutual aid agreement. 1.11 Establish an inter-island engine fleet program, where the State procures and maintains a specified number of Type 3, Type 4-6 engines for shared use on each island. Standardizing the model/type ensures consistency in training and operations across islands. Example: CalOES Fleet Program	20
Local & County Mutual Aid	1.12 Review and provide training on agreements involving federal, state, county, private businesses, and NGOs to assess the necessity for reinforcement or clarification.	21
Private Resources	1.13 Create guidelines and procedures for hiring private resources, outlining dispatch procedures, performance expectations, and reimbursement schedules. 1.14 Conduct annual training with all equipment operators and supervisors to enhance operating relationships, performance, and safety. 1.15 Install Automatic Vehicle Locators (AVL) on all private resources. 1.16 Add a resource ID on top of private vehicles and equipment for aerial identification.	21

Pre-Positioning	1.17 Create an intelligence center within the EOC or MFD to continually monitor current and predicted emergency events and facilitate the sharing of relevant data. 1.18 Utilize new technology to visually display potential trouble spots in electrical service, identifying areas of concern before the onset of a fire. 1.19 Upstaff and preposition appropriate resources based upon intelligence briefings. 1.20 As part of the surge capacity, assign drivers to accompany the two on-duty BCs to augment their capacity, improve incident organizational management, and enhance safety. 1.21 Create an emergency fund dedicated to surge capacity and leverage the provisions outlined in the new FEMA 2022 FIRE Act for effective utilization.	22
Staffing	1.22 Review and reaffirm the SOC criteria. Adjust as needed and subsequently implement appropriation and management actions to fulfill staffing expectations. 1.23 Explore the possibility of creating dedicated fire handcrews via an at-risk youth development program. Example: The C.R.E.W	23
Fire Stations	1.24 In association with the SOC review mentioned above, develop a master facility plan to align fire stations with the public's expectations of serving as safe refuge areas and then pursue appropriations. 1.25 Install diesel exhaust systems at each work site to enhance workplace safety.	23
"Battle Station" Assignments	1.26 Identify the skill sets required during major events. 1.27 Provide training for staff to acquire the necessary skill sets ahead of major events. 1.28 Explore the reserve capacity of OSB personnel for expanded roles during major events.	24
Community Emergency Response Team (CERT) & Retired Employees	1.29 Establish a process where retirees can be utilized. 1.30 Utilize CERT members to provide assistance under the direction of MFD staff before and during incidents. Reference: FEMA CERT	24
Public Policy Funding	1.31 Review studies conducted since 2016 to formulate a base funding plan. Align this plan with the MFD strategic plan, incorporating the identified surge capacity options. 1.32 Revise the MFD strategic plan to incorporate the recommendations outlined in this AAR. 1.33 Establish a revenue stream by implementing taxes, levees, bonding increases, or similar measures.	25

Preparation Challenge #2 - How to raise situation awareness of the wildfire problem?		
Observations	Recommendations	Page
Public Involvement	2.1 Engage social scientists to assess and evaluate the most effective ways to communicate with the public about preparedness, mitigation, response, and recovery, taking into account Maui's unique cultural context. 2.2 Utilize the findings from the social scientists to develop methods and options to effectively convey information to the population on how to live with the challenges posed by wildfires. 2.3 Enhance the partnership with the Hawaii Wildfire Management Organization. 2.4 Adopt a centralized wildfire education program, such as Ready, Set, GO!, and customize it to be accessible in multiple languages.	26
Tourist Evacuation	2.5 Collaborate with MEMA to explore software options that facilitate multiple language evacuation notifications.	26
Preparation Challenge #3 – What type of training and technology is essential for effective leadership and operational management?		
Observations	Recommendations	Page
Training	3.1 Recommit to and initiate Blue Card system training. 3.2 Provide Command and General Staff ICS training to all Captains and Chief Officers in a common environment. 3.3 Conduct complex incident command and control training exercises with Captains and Chief Officers	27
Technology	3.4 Explore the utilization of a software program as a public-facing platform to provide alerts and enhance situational awareness among the public with PD and MEMA. 3.5 Explore the utilization of a software program for daily staffing and recall purposes. 3.6 Review the First Due software to identify areas where it can be better utilized for organizational management during incidents. 3.7 Clearly identify critical infrastructure and priority target hazards, particularly in situations where PSPS are anticipated.	28

	3.8 Collaborate with DLNR to enhance RAWS sites and consider implementing an automated camera/early detection system.	
Preparation **Challenge #4 - How to provide better evacuation routes?**		
Observations	Recommendations	Page
Evacuations	**4.1** Collaborate with law enforcement and MEMA to identify key access routes and develop contingency plans. **4.2** Upon identifying key access routes, collaborate with the Hawaiian Electric Company to relocate adjacent infrastructure, potentially underground, to enhance the safety of evacuation routes. **4.3** Before deploying PSPS, thoroughly examine consequence management options. **4.4** Collaboratively, MFD, law enforcement, and MEMA should explore new evacuation software options.	29
Preparation **Challenge #5 – How to develop better relationships and operational effectiveness with non-traditional and traditional partners?**		
Observations	Recommendations	Page
Partner Relationships	5.1 Initiate proactive outreach to non-traditional partners and develop agreements, engage in joint training exercises, and maintain relationships. 5.2 Ensure that each partnering entity maintains a full-time presence at the ICP or EOC once they are activated. 5.3 Collaborate with law enforcement to enhance on-scene command and control operations. 5.4 Share and instruct law enforcement on the Ready, Set, Go! program. 5.5 Fire and Law enforcement to cross train on ICS structures and ICP best practices.	30
Preparation **Challenge #6 – How to improve the Emergency Operations Center (EOC) and Department Operations Coordination (DOC) functions?**		
Observations	Recommendations	Page
Facility & Technology Investments	6.1 Convene an EOC AAR, with a specific focus on the August 2023 wildfire activation, to promptly identify lessons learned and generate specific recommendations for improvement. 6.2 Clearly identify and delineate the roles and responsibilities of the EOC, DOC, and incident command.	31

	6.3 Conduct EOC drills involving the actual representatives who will be present during incidents.	
Preparation **Challenge #7 - How to enhance business and incident continuity?**		
Observations	Recommendations	Page
Preparation	7.1 Conduct a review of every facility to ensure the availability of emergency power backup for a period of 48-96 hours. 7.2 Provide water and food for each response unit to ensure logistical support for a minimum of 48 hours	32
Mitigation **Challenge #8 – What public policies and actions are needed to address future wildfires?**		
Observations	Recommendations	Page
New & Existing Actions	8.1 Establish and enforce a defensible space program of at least 100 feet, incorporating fuel reduction zones, to ensure structures can be defended and have a higher likelihood of surviving a wildfire. 8.2 Implement a 0-5 foot clear zone between structures and any vegetation or combustible materials. 8.3 Establish joint approval authority involving County Planning and MFD when approving new construction. 8.4 Develop water supply standards that encompass established fire water flow requirements and includes emergency backup power supply. 8.5 Enforce a mandate requiring all cell tower facilities to establish defensible space similar to structures and to implement backup power supplies. 8.6 On new developments over a certain size, require a secondary access road that does not require any special action to access. 8.7 Revise existing hazard maps to create true risk parcel-level maps to fully recognize actions that can lower risks. 8.8 Review and adopt modern building codes that have a Wildland Urban Interface (WUI) component. 8.9 Streamline the enforcement procedures to achieve higher levels of compliance. 8.10 Implement a Ready, Set, GO! public education program to enhance situational awareness and emphasize the importance of early evacuations. 8.11 Promote and support the adoption of Firewise USA® or equivalent community programs. 8.12 Establish a countywide home hardening and maintenance program to reduce ember environment hazards.	33

	8.13 Collaborate with County and property owners to reduce the fuel load in Upcountry gulches without causing excessive erosion.	
Mitigation **Challenge #9 - How to address the annual light, flashy fuels?**		
Observations	Recommendations	Page
Land Management	9.1 Continue collaboration with HWMO to ensure every community in the county has an updated CWPP. 9.2 Harness software tools to conduct fuel and community risk evaluations, generating data-driven recommendations.	35
Response **Challenge #10 - How to improve operations and firefighter safety on wildfires?**		
Observations	Recommendations	Page
Training & Equipment	10.1 Equip each line personnel with Personal Protective Equipment (PPE), including issued fire shelters and portable radios. 10.2 Train all line personnel on the proper use of fire shelters and ensure they are well-versed in their correct application. 10.3 Train all line personnel about portable radio features and the value of radio discipline during dynamic incidents. 10.4 Contact the Hawaii FirstNet representative and request an island-specific system analysis. 10.5 If AT&T FirstNet can provide a viable infrastructure, MFD should consider converting to this dedicated communications system. 10.6 Ensure that all new technology implemented is equipped with dedicated broadband coverage. 10.7 Evaluate the current communications technology to determine if there are options to address the "Orange" cross band repeater implementation process delays. 10.8 Explore technology solutions that integrate into operational tools, ensuring their functionality remains intact even during power outages – i.e., maps. 10.9 Implement the provision of a second driver/operator on water tankers during deployments for safety and relief purposes.	36
Response **Challenge #11 - How to prioritize resources during dynamic moving incidents?**		
Observations	Recommendations	Page
Dispatch Liaison	11.1 Establish a Call When Needed (CWN) process where a Chief Officer would temporarily go into dispatch to assist in	38

	covering macro-level MFD decisions until enough command staff are available.	
Response **Challenge #12 - How to enhance effectiveness in suppression and overhaul during droughts with limited water supplies?**		
Observations	Recommendations	Page
Class A Foam	12.1 Review and provide consistent the use of Class A foam throughout MFD.	39
Response **Challenge #13 – How to create alternative water sources?**		
Observations	Recommendations	Page
Improvise	13.1 Establish dedicated drafting locations in strategic locations, situated near bodies of water, and utilizing alternative sources such as piped water from swimming pools and dedicated weirs. 13.2 Ensure that all pumpers are equipped with hard suction drafting hose. 13.3 Review and propose the addition of more MFD water tankers or explore private resource options. 13.4 Explore the possibility of obtaining fire boat services directly or indirectly, with fire pump capability.	40
Response **Challenge #14 – How to increase aerial firefighting capabilities?**		
Observations	Recommendations	Page
Limited Aircraft	14.1 Review the existing exclusive use contract and explore the possibility of expanding it to enhance aerial operation capabilities. 14.2 Contact aviation vendors to explore options for different types of aircraft, including the possibility of unstaffed aircraft. 14.3 Initiate a dialogue with the National Guard to explore the possibility of reassigning a Modular Airborne Firefighting (MAFFs) C-130 unit from the mainland to Hawaii to provide wildfire suppression duties across the entire state. 14.4 Introduce and implement a dedicated air-to-ground radio frequency to improve aerial firefighting operations and enhance safety measures.	41

Recovery Challenge #15 – How does MFD ensure the safety and productivity of its workforce during and after major incidents?		
Observations	Recommendations	Page
Employee Assistance Programs	15.1 Maintain MFD's commitment to these programs and constantly strive to enhance them. 15.2 Establish and institutionalize a program for reporting exposures. 15.3 Collaborate with Hawaii State organizations to develop presumptive coverage for cancer, hernia, pneumonia, and mental health. 15.4 Contact the University of Hawaii or another public health entity to conduct a 20-year exposure study on firefighters and the public, considering the substantial amount of unknown smoke particulates from the wildfires. 15.5 Improve and implement pre-entry/hire psychological screenings. 15.6 Establish a wellness check program where MFD staff can voluntarily register at the fire station near their residence. On-duty staff at the fire station can then conduct checks on family members.	42
After-Action Report	15.7 Incorporate AARs into MFD's institutional practices to enhance daily operations, safety, and overall improvement.	43
Serious Accident Review Team (SART)	15.8 Establish a policy to institutionalize a SART-type process to perform timely reviews of significant injuries that result in time loss. Example: 2015 Fresno Fire Department SART Investigation Report	43

Recovery Challenge #16 – How can MFD assist in the recovery process?		
Observations	Recommendations	Page
Teamwork	16.1 Build relationships within the County that can rely on utilizing MFD's IMT for emergencies and major events. 16.2 Continuously send MFD staff off-island to participate in other major incidents as part of a mentoring process for key ICS positions. 16.3 Expand MFD's relationships with local, state, and federal cooperators to enhance the depth and breadth of their IMT. 16.4 Maintain active participation in weekly FEMA recovery community meetings to demonstrate involvement and leadership from MFD. 16.5 Take on the role as public advocate, leading mitigation efforts before Hawaii faces an insurance crisis. 16.6 Position MFD as the lead advocate for emergency infrastructure needs on the West side of Maui, i.e., disaster EMS location and capability.	44
Recovery Challenge #17 – How can reports, fire cause investigations, and cost recovery be enhanced?		
Observations	Recommendations	Page
Training & Dedicated Staff	17.1 Establish a team of trained staff dedicated to fire cause investigations, evidence preservation, and expert witness testimony. 17.2 Establish a cost recovery unit to pursue reimbursement for wildfires caused by neglect. 17.3 Generate more comprehensive fire reports that thoroughly identify fire causes and acreage size, facilitating better problem identification.	45

DEFINITIONS

Blue Card	Training program provided to fire departments with a training and certification system that defines the best standard command practices for common, local, everyday strategic and tactical emergency operations conducted on NIIMS Type 4 & Type 5 events
Buffelgrass	A perennial bunch grass introduced from the African savannah
Call load	Volume or frequency of emergency calls or incidents within a given period, measuring the demand on fire department resources
Class A foam	Specially formulated to make water more effective for firefighting
Conflagration	A large destructive fire
Defensible space	The area between a structure and the nearest fuel source, providing firefighters enough space to safely defend the structure
Drainage fire	A fire in a depressed geographical feature that transmits water downhill
Eductor	A piece of equipment that introduces foam concentrate into a water stream
Egress	The means of exit or escape from a building, structure, or confined space during a fire
Fuel	Organic materials that can ignite and carry fire
Fully involved	Term used to describe the on-scene conditions as to the degree a structure is involved, 0-100%
Guinea grass	A fast-growing perennial grass that is native to Africa and Yemen
Gulch	A geographic feature that acts as a drain or unimproved channel for water
Kona winds	Opposing winds from the south-southeast, 10-20mph usually in summer
Lee side	The sheltered side, the wide away from the wind
Leeward	Situated on or toward the side sheltered from the wind
MAYDAY	A fire service term to notify all parties on an incident that personnel are in dire need of assistance
Megafires	The classification of wildfires that are not easily controlled, often burning over 100,000 acres
Microclimate	Specific weather features in unique geographical areas that produce unique weather conditions
Overhaul	Action taken after a fire is controlled to fully eliminate any reignition
Perimeter control	Control lines around a wildfire to "box" in the fire
Recall notice	An alert to off duty personnel to return to work
Red Flag Warning	Term used to display when high winds, low humidity, and higher temperatures occur
Relative Humidity (RH)	A unit measure by % to determine the amount of water vapor in the air relative to the temperature
Spot fire	Small incident wildfire started by embers ahead of the main body of fire, usually caused by wind
Trade winds	Prevailing winds from the north-northeast, 5-15mph
Upstaff	Action taken to increase staffing based upon a specific need

ACRONYMS

Acronym	Explanation
AAR	After-Action Report
AVL	Automatic Vehicle Locator
BC	Battalion Chief
CAFS	Compressed Air Foam Systems
CERT	Community Emergency Response Team
CISM	Critical Incident Stress Management
CWN	Call When Needed
DLNR	Department of Land and Natural Resources
DOC	Department Operations Coordinator
EAP	Employee Assistance Program
ECO	Emergency Operations Center
EMS	Emergency Medical Services
FEMA	Federal Emergency Management Agency
FMAG	Fire Management Assistance Grant
HWMO	Hawaii Wildfire Management Organization
IC	Incident Commanders
ICP	Incident Command Posts
ICS	Incident Command System
IMT	Incident Management Team
LODD	Line of Duty Death
MAFFS	Modular Airborne Firefighting Systems
MEMA	Maui Emergency Management Agency
MFD	Maui Fire and Public Safety Department
MPD	Maui Police Department
NGO	Non-governmental Organization
NIIMS	National Interagency Incident Management System
NOAA	National Oceanic and Atmospheric Administration
NWCG	National Wildfire Coordination Group
NWS	National Weather System
OSHA	Occupational Safety and Health Administration
OSB	Ocean Safety Bureau
PSPS	Public Safety Power Shutoffs
RH	Relative Humidity
RAWS	Remote Automated Weather Stations
SART	Serious Accident Review Team
USAR	Urban Search and Rescue
WUI	Wildland Urban Interface