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KA ʻOIHANA KUMUWAIWAI ʻĀINA

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HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

September 13, 2025

Ms. Mary Alice Evans
State of Hawai'i
Office of Planning and Sustainable Development
Environmental Review Program
235 South Beretania Street, Suite 702
Honolulu, Hawai'i 96813

Subject: DRAFT Environmental Assessment and Anticipated Finding of No Significant Impact for the Proposed Kamehamenui Forest Reserve Management Plan, in Kula, Makawao, Maui, Hawaii TMKs (2) 2-3-005:002 and 014

Dear Ms. Evans,

The Department of Land and Natural Resources, Division of Forestry and Wildlife hereby transmits the Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA-AFNSI) for the Draft Kamehamenui Forest Reserve Management Plan for publication in the next available edition of The Environmental Notice. In addition to this letter, we have also submitted the electronic version of the Environmental Review Program Publication Form and a searchable PDF-formatted copy of the DEA-AFNSI through the online submission platform.

The Draft Management Plan is included in the DEA document as Appendix I. If you have any questions, please contact Scott Fretz, at (808) 984-8100 or via email at reserveplanning@harveyecology.com.

Sincerely,

DGS

Dawn N.S. Chang, Chairperson
Department of Land and Natural Resources

Signature:

Email: david.g.smith@hawaii.gov

From: dbedt.opsd.erp@hawaii.gov
To: DBEDT OPSD Environmental Review Program
Subject: New online submission for The Environmental Notice
Date: Tuesday, September 16, 2025 10:57:26 AM

Action Name

Kamehamenui Forest Reserve Management Plan

Type of Document/Determination

Draft environmental assessment and anticipated finding of no significant impact (DEA-AFNSI)

HRS §343-5(a) Trigger(s)

- (1) Propose the use of state or county lands or the use of state or county funds
- (2) Propose any use within any land classified as a conservation district

Judicial district

Makawao, Maui

Tax Map Key(s) (TMK(s))

(2) 2-3-005:002; (2) 2-3-005:014

Action type

Agency

Other required permits and approvals

Board of Natural Resources approval, HRS Chapter 6E-8 review

Proposing/determining agency

Department of Land and Natural Resources

Agency jurisdiction

State of Hawai‘i

Agency contact name

Scott Fretz

Agency contact email (for info about the action)

scott.fretz@hawaii.gov

Email address for receiving comments

reserveplanning@harveyecology.com

Agency contact phone

(808) 984-8100

Agency address

685 Haleakala Hwy
Kahului, HI 96732
United States
Map It

Is there a consultant for this action?

Yes

Consultant

H. T. Harvey & Associates Ecological Consultants

Consultant contact name

Shahin Ansari

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Consultant contact phone

(808) 441-2082

Consultant address

P.O. Box 2143
91-760 Papipi Road
Ewa Beach, HI 96706-9998
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Map It

Action summary

The Proposed Action is implementation of the Kamehamenui Forest Reserve (the Reserve) Management Plan. To enhance watershed functions and protect natural and cultural resources Department of Land and Natural Resources Division of Forestry and Wildlife (DOFAW) proposes to take a balanced and phased approach to systematically remove ungulates and minimize soil erosion and compaction. Revegetation efforts will restore the native forest and provide suitable habitat for a suite of native plant and animal species. Unique subalpine habitats will be preserved through the mitigation of ongoing threats from invading non-native plants, predators, and feral ungulates. Proposed public use and limited recreational activities of hiking, biking, horseback riding, archery, and permit-based camping will be consistent with the natural and cultural resource values and remote backcountry character of the Reserve. Access to the Reserve is proposed at multiple locations. The Reserve will be closed at night and DOFAW staff will enforce compliance. Public safety measures to protect the community involve managing fire risk by managing fuel loads and strategically installing fuel breaks/firebreaks.

Reasons supporting determination

See Section 5 of the Draft EA.

Attached documents (signed agency letter & EA/EIS)

- DRAFT-EA_Kamehamenui-Forest-Reserve_9.16.20252.pdf
- DLNR-Agency-Letter2.pdf

ADA Compliance certification (HRS §368-1.5):

The authorized individual listed below acknowledges that they retain the responsibility for ADA compliance and are knowingly submitting documents that are unlocked, searchable, and may not be in an ADA compliant format for publication. Audio files do not include transcripts, captions, or alternative descriptions. The project files will be published without further ADA compliance changes from ERP, with the following statement included below the project summary in The Environmental Notice: "If you are experiencing any ADA compliance issues with the above project, please contact (authorized individual submitting the project at email)."

Action location map
• Kamehamenui-Forest-Reserve3.zip
Authorized individual
Shahin Ansari
Authorized individual email
sansari@harveyecology.com
Authorized individual phone
(808) 441-2082
Authorization
• The above named authorized individual hereby certifies that he/she has the authority to make this submission.

KAMEHAMENUI

State Forest Reserve



DRAFT Environmental Assessment
Anticipated Finding of No Significant Impact
September 2025

State of Hawai‘i
Department of Land and Natural Resources
Division of Forestry and Wildlife
Forest Management Section

Executive Summary

Project Name:
Kamehamenui Forest Reserve Proposed Management Plan

Type of Document:
Draft Environmental Assessment

Legal Authority:
Chapter 343, Hawai'i Revised Statutes

Anticipated Determination:
Anticipated Finding of No Significant Impact (AFONSI)

Applicable Environmental Assessment review "Trigger":
Use of State Funds
Use of State Lands
Use of Conservation District Lands

Location:
Maui Island
Kula, Makawao
TMK Nos. (2) 2-3-005:002 and (2) 2-3-005:014

Landowner:
State of Hawai'i Department of Land and Natural Resources
1151 Punchbowl Street
Honolulu, Hawai'i 96813
Phone: (808) 587-0400

Proposing and Determining Agency:
State of Hawai'i Department of Land and Natural Resources
Division of Forestry and Wildlife
1151 Punchbowl Street
Honolulu, Hawai'i 96813
Phone: (808) 587-0400

Consultant:
H. T. Harvey & Associates Ecological Consultants
91-1020 Kai Loli Street
Ewa Beach, HI 96706

Project Summary

The Department of Land and Natural Resources Division of Forestry and Wildlife (DOFAW) is proposing a Management Plan for the Kamehamenui Forest Reserve (the Reserve). In the draft Management Plan, DOFAW would take a balanced approach to protect the natural and cultural resources at Kamehamenui while simultaneously managing public use in a responsible way to allow for sustainable and appropriate recreational activities. DOFAW will continue to systematically fence the Reserve to remove ungulates and minimize soil erosion and compaction and improve watershed functions.

Implementation of the Management Plan involves habitat protection and restoration. Revegetation efforts will systematically restore native forests, providing suitable habitat for a suite of native plant and animal species. Unique subalpine habitats will be improved and preserved through the mitigation of ongoing threats from invading non-native plants, predators, and feral ungulates. Rare, T&E species populations are anticipated to increase with the release of grazing pressure from ungulates and protection from predators. The Management Plan also involves public safety actions by DOFAW to manage fire risk by managing the fuel loads and strategically installing fuel breaks/firebreaks.

Based on comments received during extensive public scoping meetings, the Management Plan proposes recreational activities consistent with the natural and cultural resource values and remote backcountry character of the Reserve. Recreational activities proposed in the Management Plan include hiking, biking, horseback riding, an archery range, and camping. Recreational activities will be limited to certain parts of the Reserve and will not be allowed in the uppermost portion of the Reserve that contains sensitive habitat. Limited improvements such as parking and access to support public use activities are also proposed for the Reserve. The Reserve would be closed at night, and compliance would be enforced by DOFAW staff.

Lands underlying the Reserve are classified as “Agricultural” and “Conservation” by the State Land Use District and zoned “Agricultural” by the County of Maui. The proposed action involves the use of State lands and State funds, and work will occur within the Conservation District, which are triggers for the preparation of an Environmental Assessment (EA) pursuant to Chapter 343, Hawai‘i Revised Statutes. As such, this EA is being prepared to evaluate the technical characteristics, alternatives, and environmental impacts, as well as to advance findings relative to the proposed project. The Department of Land and Natural Resources is serving as the Approving Agency for the EA.

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Appendices

Appendix I. Kamehamenui Forest Reserve Management Plan I-1
Appendix II. Traffic Study for Kamehamenui II-1

The Draft Management Plan can be found in Appendix I at the end of this document (pg. I-1)

Acronyms and Abbreviations

AIS	Archaeological Impact Assessment
BMPs	Best Management Practices
CIA	Cultural Impact Assessment
DLNR	Department of Land and Natural Resources
DOFAW	Division of Forestry and Wildlife
EA	Environmental Assessment
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FONSI	Finding of No Significant Impact
FR	Forest Reserve
FR System	State Forest Reserve System
ft	feet
HAR	Hawai‘i Administrative Rules
HRS	Hawai‘i Revised Statures
HSP	Hawai‘i State Plan
LOS	Level of Service
m	meters
the Management Plan or the Plan	Kamehamenui Forest Reserve Management Plan
mgd	million gallons per day
mm	millimeters
M.P.	milepost
RAWS	Remote Automated Weather Stations
the Reserve or Kamehamenui FR	Kamehamenui Forest Reserve
ROD	Rapid ‘Ōhi‘a Death
SHPD	State Historic Preservation Division
State	State of Hawai‘i
SWAP	State Wildlife Action Plan
T&E	Threatened and Endangered
TMK	Tax Map Keys
TNC	The Nature Conservancy
USFWS	U. S. Fish and Wildlife Service

Section 1.0 INTRODUCTION

1.1 Environmental Assessment Process and Purpose of this Document

On March 12, 2025, through Executive Order 4732, Governor Josh Green designated about 4734 acres of public lands in Kamehamenui, Kula, Makawao, Maui, Hawai'i Tax Map Keys (TMKs) (2) 2-3-005:002 and 014 to the Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW, or the Division) as the Kamehamenui Forest Reserve ('the Reserve' or 'Kamehamenui FR'). DOFAW is preparing the Kamehamenui FR Management Plan ('the Management Plan' or 'the Plan'). The Kamehamenui FR Management Plan is available in Appendix I of this document. Implementation of the Management Plan (i.e., the Project) by DOFAW requires an environmental review in accordance with Hawai'i Revised Statutes (HRS) Chapter 343 because it would use State of Hawai'i (State) lands and use State funds. The present Environmental Assessment (EA) document was prepared by DOFAW in accordance with HRS Chapter 343 and DLNR is the proposing and approving agency. An EA is prepared to determine impacts associated with an action, to develop mitigation measures for adverse impacts, and to determine whether any of the impacts are significant according to thirteen specific criteria per Hawai'i Administrative Rules (HAR) 11-200.1-13. DLNR anticipates that the project would not have a "significant" effect in accordance with HRS Chapter 343 and HAR 11-200.1-13 therefore, an EA process was selected for the environmental review. If the approving agency, after considering comments to the Draft EA, concurs that no significant impacts are expected to occur, then it issues a Finding of No Significant Impact (FONSI), and the action will be permitted. If the agency concludes that significant impacts are expected to occur as a result of the proposed action, then the agency will require an Environmental Impact Statement (EIS) for the action to proceed.

Implementation of the Plan will require approval by the Board of Land and Natural Resources, Chapter 6e, HRS; approvals related to historic sites; review by the Office of Conservation and Coastal Lands; and appropriate approvals for any cooperative actions implemented on adjacent private lands. A final Plan will be published in the Final EA, which will include the final goals and objectives of the Plan. The management actions proposed in the Plan are meant to be updated through the dynamic process of incorporating community input and research results into resource protection and enhancement (i.e., adaptive management). Ongoing refinement of the Plan will include findings from ecosystem management and traditional ecological knowledge to improve management outcomes.

The Plan contains in-depth information that is summarized in this EA document to the extent required to evaluate impacts and provide background for proposed mitigation.

1.2 Project Location and Background

Kamehamenui FR is in the central portion of the island of Maui, in the district of Kula (Figure 1). The property is recorded with the County of Maui Real Property Tax Assessment Office as TMKs:

(2) 2-3-005: Parcels 002 and 014. The County Property Tax Class is “Rural” and the State Land Use designation is listed as “Agricultural” and “Conservation.” The total area of the Reserve is about 3,434 acres (about 1,390 hectares), with parcel 002 encompassing 3,433.72 acres and parcel 014 comprising 0.0275 acres (about 0.01 hectares) (Figure 2). There are two privately owned residential properties (TMK Nos.: [2] 2-3-005: Parcels 007 and 008) that were not acquired by the State and are not part of the FR (Figure 2).

Kamehamenui FR ranges in elevation from approximately 3,650 ft (about 1,113 meters [m]) above mean sea level on the west side to approximately 9,700 ft (about 2,957 m) above mean sea level on the east side, just below the summit of Haleakalā (U.S. Geological Survey 2013). Situated on the western slopes of Haleakalā Mountain, the FR lies within the ahupuaʻa of Kamehamenui. Haleakalā Ranch Company lies to the north with a few residential properties along the northwestern border. The Kula State FR lies to the south and there are a few private properties along the southwestern border. Haleakalā National Park borders the upper eastern side of the Reserve and Kekaulike Avenue borders the western limit of the Reserve, with Maui Electric Company substation adjoining the center of the western boundary (Figures 1 and 2).

Kamehamenui has a rich history of land use. In the pre-contact period, Kamehamenui was one of the 17 ahupuaʻa in Kula that had a sizeable population of native Hawaiians. Land use then was limited to subsistence farming in cleared forests.

The post-contact period (1778 to 1888 C.E.) brought drastic transformations to the land use, culture, and economy of the Islands. Trade for the prized ʻiliahi (Hawaiian sandalwood), demand for fuelwood by the whaling industry on Maui, and expansion and intensification of westernized agriculture contributed to the loss of vast areas of forestland, including those at Kamehamenui.

Since the great land division in 1848, the lands of Kamehamenui FR passed through several owners, including Louis who purchased it in 1888 and established the Erehwon Cattle Company. Under the von Tempsky family’s ownership, Kamehamenui FR was largely a dairy and cattle ranch. Even after the family sold it in 2002, the land continued to be leased for ranching without any major development. Kamehamenui was acquired by DLNR DOFAW in September of 2020 for integration into the State FR System (FR System) and will be held in public trust for the people of Hawaiʻi in perpetuity.

1.3 Purpose and Need

The FR System was created in 1903 by the Territorial Government of Hawaiʻi and is managed today under the guidance of the Hawaiʻi State Constitution, HRS Chapter 183, and associated HAR Chapter 104. Through this legal framework, DOFAW is mandated to protect, manage, restore, and monitor the natural resources within the FR System.

- The overarching purpose of the Kamehamenui FR Management Plan is to conform with Hawaiʻi State Constitution, HRS Chapter 183, and associated HAR Chapter 104 to protect, manage, restore, and monitor resources within Kamehamenui FR.

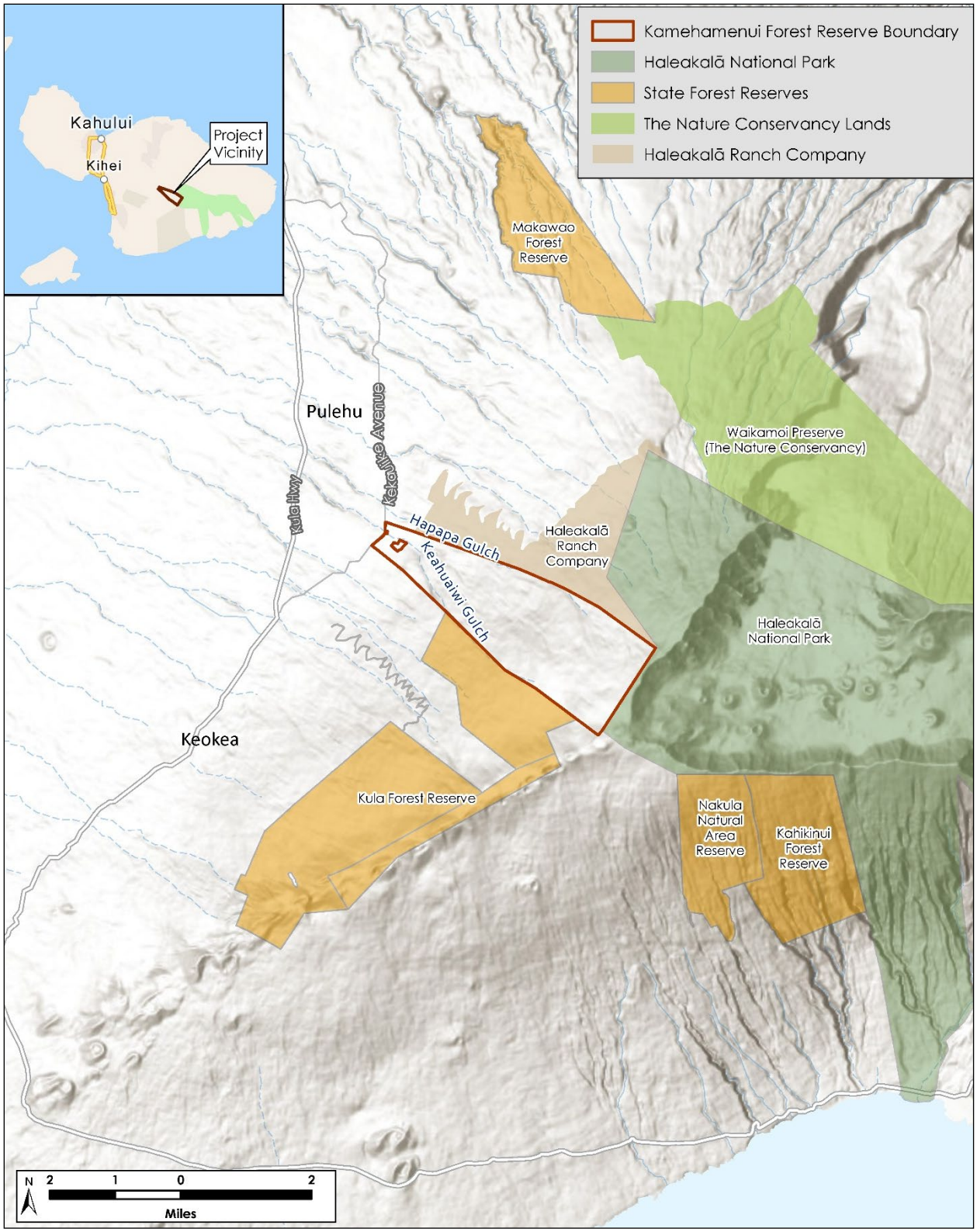


Figure 1. Kamehamenui Vicinity Map

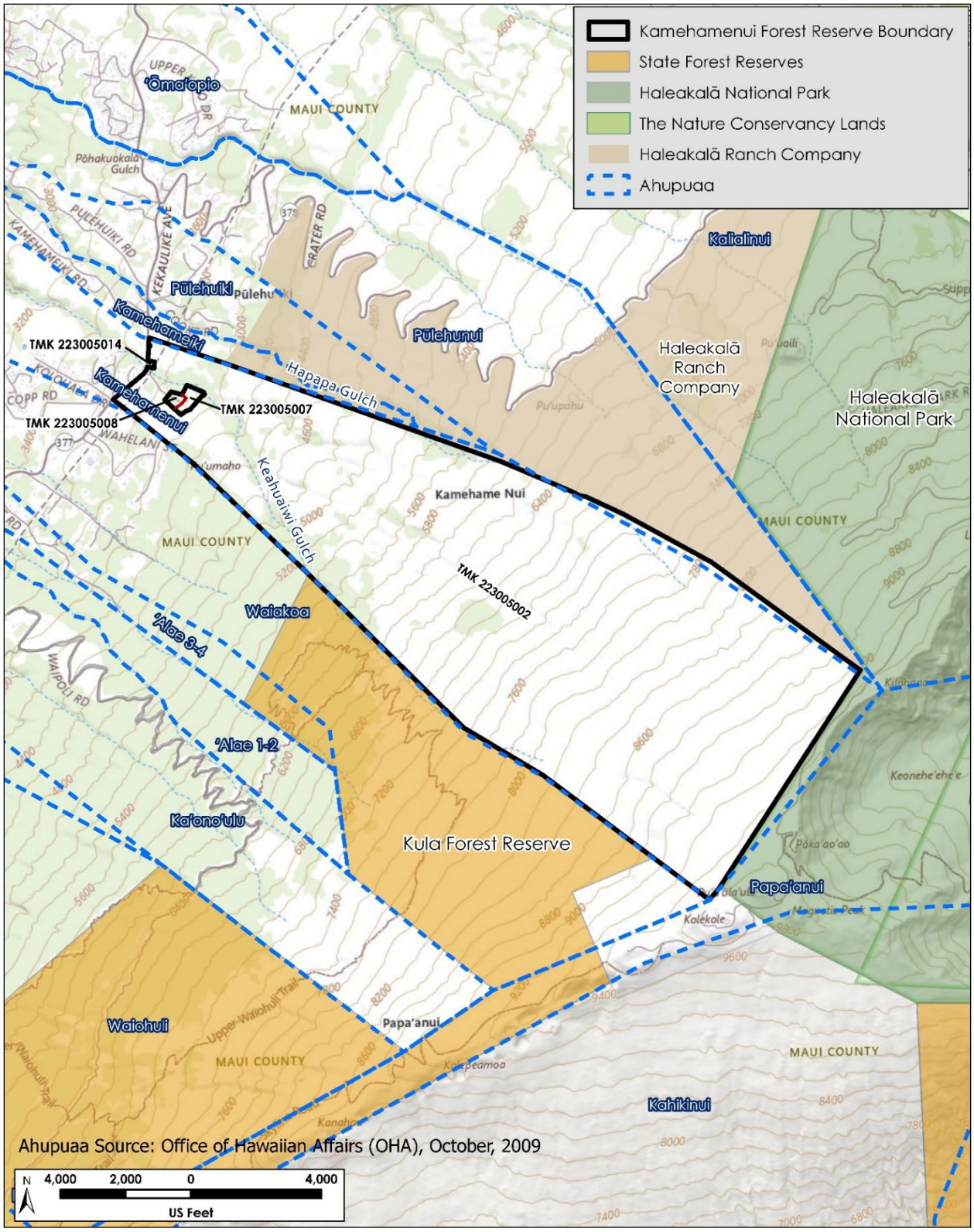


Figure 2. Kamehamenui Forest Reserve

To fulfil this overarching purpose, specific rationales for Kamehamenui FR Management Plan are to:

- Implement site-specific management actions such as fencing, predator control, invasive species monitoring and removal, native plant restoration, and fire suppression and mitigation to improve watershed functions and protect and restore natural and cultural resources.
- Provide sustainable public use and recreational opportunities at Kamehamenui FR through the development and maintenance of public access roads, and other infrastructure (parking, trails, campgrounds, etc.).

DOFAW has identified the following specific needs for Kamehamenui FR:

- *Need to Enhance Watershed Functions*—Currently Kamehamenui is estimated to contribute about 3.37 million gallons per day (mgd) of water to the Makawao Aquifer which provides drinking water to the communities in Kula and Makawao regions in east Maui, and supports agriculture and other businesses. About two-thirds of the lower western portion of Kamehamenui FR is pastureland with little to no forest cover. It is estimated that habitat restoration efforts could increase the Reserve's water contribution to 4.19 mgd which translates to an additional 296 million gallons of water per year for the aquifer.
- *Need to Preserve Unique Habitats to Support Rare, Threatened, and Endangered Plants and Animals*—The elevations of Kamehamenui FR are important for preserving Hawai'i's unique subalpine and alpine ecosystems and the native species they support. Several native species that occupy these habitats include plants such as 'a'ali'i (*Dodonaea viscosa*), pūkiawe (*Leptecophylla tameiameiae*), 'ōhelo (*Vaccinium reticulatum*), scattered with remnants of some rare tree species such as the Haleakalā sandalwood (*Santalum haleakalae* var. *haleakalae*). These high elevation habitats are also home to several native insect species such as wolf spider (*Lycosa hawaiiensis*), Hawaiian long-jawed spider (*Tetragnatha acuta*), Haleakalā flightless moth (*Thyrocopa apatela*), and yellow-faced bee species (*Hylaeus nivicola* and *H. volatilis*); and the native endangered seabird, Hawaiian petrel or 'ua'u (*Pterodroma sandwichensis*). Furthermore, the uppermost 1,171 acres of alpine and subalpine habitats in Kamehamenui overlaps federally designated critical habitat for eight endangered plants: Haleakalā silversword (*Argyroxiphium sandwicense* ssp. *macrocephalum*), *Asplenium peruvianum* var. *insulare*, Ko'oko'lau (*Bidens micrantha* ssp. *kalealaha*), Hawaiian red-flowered geranium (*Geranium arboreum*), nohoanu (*Geranium multiflorum*), *Phyllostegia bracteat*, *Schiedea haleakalensis*, and a'e (*Zanthoxylum hawaiiense*); and two endangered bird species: 'ākohekohe or crested honeycreeper (*Palmeria dolei*) and kiwikiu or Maui parrotbill (*Pseudonestor xanthophrys*). Survival and recovery of these rare native plants and animals depend upon preservation of habitat by reducing impacts from threats such as ungulates and other non-native predators, invasive plants, disease-bearing mosquitoes and other introduced insects, diseases, and forest pathogens.

- *Need to Restore the "Mauna Lei" of Haleakalā Mountain*—Kamehamenui is surrounded by lands protected by federal, state, and private entities, e.g., the Haleakalā National Park to the east, Kula FR to the south, and private conservation areas managed by The Nature Conservancy (TNC) and Haleakalā Ranch to the north. The lower portions of Kamehamenui are currently composed of pasturelands. However, prior to being converted to pasture, these lands supported healthy native mesic forests that were part of the "mauna lei" or band of native forest trees that once encompassed the mid-elevations of Haleakalā. Native forest trees such as ʻōhiʻa (*Metrosideros polymorpha* var. *glaberrima*) and koa (*Acacia koa*) are currently limited to steep gulch habitats in the pasturelands that are harder for browsing and grazing ungulates to reach. These pasturelands upon removal of ungulates are well suited for reforestation with native plant species and will contribute to extending the surrounding forest cover, thereby restoring the "mauna lei" of Haleakalā. Reforestation of Kamehamenui will also help create suitable habitat for a variety of other native plant and animal species to thrive such as the ʻōpeʻapeʻa, or Hawaiian hoary bat (*Lasiurus cinereus semotus*), and forest birds such as the ʻamakihi (*Chlorodrepanis virens* var. *wilsoni*) and ʻapapane (*Himatione sanguinea*).
- *Need to Preserve Scenic Value*—Kamehamenui is an iconic property in Kula situated on the western slopes of Haleakalā. It provides for spectacular views upslope all the way to the summit of Haleakalā for the residents of Kula and those passing through along Kekaulike Avenue. Preserving these majestic views of Haleakalā for the people of Hawaiʻi will depend on protecting the lands at Kamehamenui in perpetuity for future generations.
- *Need to Provide Public Use Opportunities on Maui*—Kamehamenui is strategically located with Kekaulike Avenue bordering the lower western portion of the Reserve and the Kula FR, one of the most popular forest recreational areas on Maui, bordering the southern portion of the Reserve. The Reserve has the potential to provide for a variety of sustainable recreational activities, educational activities, and opportunities to gather forest resources for personal and cultural use. Managing Kamehamenui as a forest reserve will fulfil the need to provide additional sustainable public use opportunities as it is easily accessible from Kekaulike Avenue and will extend the recreational opportunities available in the Kula FR through the development of new trails.

1.4 Project Description

The Management Plan will be implemented over a period of ten years. The Plan is one in a series of site-specific natural resource management plans prepared by DLNR DOFAW for individual forest reserves in the State. The Plan presents a brief history of the Kamehamenui area, a complete record of land transactions and boundary changes over time, a description of natural and cultural resources, as well as an account of infrastructure and intended use(s) of the area. The Plan concludes with a series of management goals and objectives with implementation tasks that respond to the purpose and needs described in Section 1.3. The management goals and objectives comprise the "action" elements of the Plan. These actions stem from DOFAW's nine

priorities for the management of lands in the FR System, which are: watershed values; natural resource protection; cultural resource protection; game animal management; threatened and endangered (T&E) species management; native ecosystems; invasive species control; access, trails, and other public uses; and commercial activity. The actions listed below are summarized and adapted from Section 5.5 of Kamehamenui FR Management Plan (Appendix I of this document).

1. Watershed Values
    - Re-establish appropriate forest cover on at least 75% (~1300 acres through passive restoration and ~1250 acres through seeding and outplanting) of Kamehamenui FR.
    - In the lower portion of Kamehamenui, withdraw FR lands from the grazing lease in phases, transition out cattle and sheep, and install 8 feet (ft) tall ungulate-proof fences to restore ranchland to forest and improve watershed functions.
    - In the upper portions of Kamehamenui, maintain the installed ungulate-proof fence and remove feral ungulates to facilitate watershed restoration.
    - Set up plots to monitor reforestation efforts.
    - Improve communication and coordination with state, county, federal, private, and community partners regarding watershed protection.
    - Issue and then annually renew Kamehamenui FR Special Use Permits (for various management actions otherwise prohibited by HAR).
    - Participate in climate change seminars, meetings, and workshops and implement strategies to adapt to changing climate.

2. Natural Resource Protection
    - Develop fire management plans to protect natural resources at Kamehamenui.
    - Scope and install water storage and dip tanks for use during fire suppression activities.
    - Install fuel breaks and firebreaks and explore fuel treatment methods such as managed grazing and planting of native species in place of fire prone invasive species.
    - Conduct outreach activities such as posting Smokey the Bear fire prevention signs.
    - Following a fire, employ appropriate mitigation strategies such as scattering seeds and planting native species to build more fire-resilient vegetation communities.
    - Install Remote Automated Weather Stations (RAWS) to monitor environmental conditions and use the data to determine and implement appropriate fire preparedness activities.
    - Implement biosecurity measures such as bi-annual ground and aerial surveys for early detection, and to monitor and respond to the spread of forest diseases.

- Collaborate and work with partner agencies to share technical information and adopt appropriate sanitation protocols to prevent the introduction and spread of forest pests and diseases, including rapid ʻōhiʻa death.
- Revise planning documents based on climate change data.

3. Cultural Resource Protection
    - Collect data from the community and consultants to better protect cultural resources.
    - Articulate the value of culturally significant habitats (especially for cultural resource improvement).
    - Restore culturally significant habitats from mauka to makai where practicable and compatible.
    - Identify or create designated spaces in Kamehamenui FR for cultural practices.
    - Maintain and update cultural application process.
    - Review applications and issue applicable forest reserve permit(s) if approved.
4. Game Animal Management
    - Scope development of opportunities for game bird hunting in the Reserve, consistent with conservation goals and objectives.
    - Use hunters to initially control and remove ungulates in the fenced areas of the FR when safe, feasible, and effective.
    - Communicate with hunters about the importance of feral ungulate control to achieve ecosystem restoration.
5. T&E Species Management
    - Conduct biological surveys for baseline inventory and status of T&E species in the FR.
    - Before permanent fencing is complete, construct temporary enclosures and control predators and ungulates where needed to protect T&E species, and outplant T&E plants.
    - Continue ongoing monitoring and surveys to document the presence, location, and population estimates of rare T&E species. Use baseline data to determine specific areas to protect species of interest.
    - Identify, protect, and prioritize reintroduction of species at risk to contribute to island-wide and statewide recovery efforts for those species. Incorporate climate change scenarios into the decision-making process.
6. Native Ecosystems
    - Use ground and aerial methods to monitor and document the abundance and richness of native plants and animals.

- Improve seed storage capacity, seed propagation methods, and silvicultural planting methods (i.e., seed collection, composition, spacing).
- Collect seeds of native plant species and broadcast seeds in suitable areas to enhance natural regeneration and planned restoration activities.
- Protect and enhance native plant populations in areas identified for habitat protection.
- Restore native species through outplanting and reintroduction to reestablish plant and animal communities in natural patterns of species diversity.
- Control and remove ungulates from fenced areas of the Reserve (Also see Game Management and Watershed Management categories).
- Conduct periodic aerial and ground surveys for ungulate presence, and to check for damages and possible breaches to ungulate-proof fences.
- Conduct a cost-benefit analysis for a range of management alternatives based on climate change vulnerability assessments and prioritization processes.
- Implement various climate adaptation strategies, including experiments to identify species applicability under changing climatic conditions, timing and seasonality for outplanting natives to create habitat and facilitate biome shifts, and monitor and map transitional areas between different habitat types.

7. Invasive Species Control
    - Improve data sharing with partner agencies and work cooperatively on early detection and control of invasive species in the FR.
    - Support applied research for potential biocontrol agents, including labor and helicopter time.
    - Adopt biosecurity measures to prevent the introduction and spread of invasive species such as Division-specific biosecurity policies and protocols, implementing intra-island quarantines, conducting surveys to detect new invasive species early before their spread, and researching and implementing improved methods for early response and eradication.
    - Write a comprehensive weed control plan.
    - Research and develop new/improved and cost-effective control methods for invasive species and small predators.
    - Adopt appropriate manual, chemical (ground or aerial), biological (ground or aerial), and mechanical methods to control established invasive species, prioritizing areas with a high diversity of native species.
    - Conduct periodic surveys to monitor and map invasive species populations within the FR. Use surveys to validate the effectiveness of each control method.

8. Access, Trails, and Other Public Uses
    - Meet with neighboring landowners and lease holders to scope, identify, and establish access to the FR where appropriate.

- Build and maintain public vehicle access road and parking area at the lower western end of the FR and public access trails to connect with the Kula FR in the upper part of the Kamehamenui FR.
- Determine location of trails for hiking, mountain biking, and horseback riding, and connect remote trails to public access paths.
- Build, maintain, and repair trails as needed and in accordance with Nā Ala Hele standards and plans (if they are Nā Ala Hele trails).
- Identify locations to build campsites and cabins, and complete necessary environmental compliance for construction.
- Provide the public with parking and covered rest areas or weather shelters for day and extended overnight trips.
- Establish a reservation, permit, and fee system for camping and parking. Any income generated from fee services (e.g., parking and camping) would go towards funding natural resource management activities as well as infrastructure maintenance and upgrades.
- Construct and maintain an archery range in the FR.
- Build and maintain the public vehicle access road to parking areas.
- Evaluate and if needed provide porta-potties in areas where they can be serviced easily.
- Assess and manage recreational opportunities at appropriate levels compatible with Reserve management goals.
- Per applicable HAR, increase enforcement measures for additional nighttime survey and patrols to protect DOFAW infrastructure and periodically evaluate parking situation to enforce rules to prevent disruption to the neighboring community.
- Adjust the timing of actions (e.g., open/close dates, road or trail closures, special use permits) to accommodate changing climate conditions (e.g., drought, increased fire risk).

9. Commercial Activity
    - Identify future small-scale outplanting sites and initiate outplanting of sandalwood and koa seedlings as potential forestry revenue streams.
    - Explore certification (Carbon sequestration: Certified carbon offset market) of Kamehamenui FR reforestation projects under a Voluntary Carbon Standard and establish inventory plots for future certifications.
    - Generate income from donation programs and social media platforms.

1.5 Proposed Action—Implement the Kamehamenui FR Management Plan to Allow for Habitat Protection and Restoration and Provide Responsible Managed Public Access for Outdoor Recreation Consistent with Rural and Wilderness Qualities

The Proposed Action is the implementation of the Kamehamenui FR Management Plan—see Appendix I of this document for the Management Plan. Figure 3 illustrates some of the activities covered under the Proposed Action. In the Management Plan, DOFAW would take a balanced approach to enhance watershed functions and protect the natural and cultural resources at Kamehamenui while simultaneously managing public access in a responsible way to allow for sustainable and appropriate recreational activities. The upper portion of the Reserve that has already been withdrawn from the grazing lease and enclosed in an ungulate-proof fence represents Phase I in the planning process, with all feral ungulates now removed from this area. In addition, DOFAW will continue to fence the remainder of the Reserve in a phased manner as described in the Management Plan. For each phase, DOFAW will systematically remove ungulates to minimize soil erosion and compaction and improve watershed functions at Kamehamenui.

Implementation of the Management Plan will allow for habitat protection and restoration. Revegetation efforts will systematically restore the "mauna lei," or band of native forest, around Haleakalā that will provide suitable habitat for a suite of native plant and animal species. Revegetation efforts under this alternative will further facilitate improving the watershed functions of Kamehamenui. Unique subalpine habitats, including those in the federally designated critical habitat, will be preserved through the mitigation of ongoing threats from invading non-native plants, predators, and feral ungulates, leading to the continued improvement of these habitats. Rare, T&E species populations are anticipated to increase with the release of grazing pressure from ungulates and protection from predators.

In the Management Plan, DOFAW will continue to implement actions necessary for public safety. DOFAW will conduct all measures necessary to manage the fire risk at Kamehamenui. This includes actions such as monitoring environmental conditions, managing the fuel loads, and strategically installing fuel breaks/firebreaks to minimize fire and protect the community. Furthermore, DOFAW will also revegetate using native fire-resilient species where appropriate to further minimize fire risk in the Reserve.

Implementation of the Management Plan would allow for public use and recreational activities to be offered at Kamehamenui FR, consistent with the natural and cultural resource values and remote backcountry character of the Reserve. Recreational activities will be limited by type and site. Only hiking, biking, horseback riding, and archery will be allowed, and these activities will be limited to certain areas of the Reserve. No recreational activities will be allowed in the uppermost areas of the Reserve that contain sensitive areas and federally designated critical habitats. Biking and horseback riding will be limited to designated trails. To minimize impacts on natural and cultural resources in the Reserve and enhance public use experience, there will be separate trails for biking and horseback riding. Permit-based camping will be limited to a few

remote locations, accessible to backcountry hiking only, and with minimum amenities such as comfort stations. Under the Proposed Action, there will be limited improvements for amenities to support public use activities at the Reserve. Main access will be provided from two locations on Kekaulike Avenue and each access point will lead to a parking area that is planned based on expected user level. Access will also be available along the southern border of the Reserve from #5 Forest Access Road in the Kula FR that would connect directly to the middle and upper elevation trails in Kamehamenui. The Reserve will be closed at night to avoid noise and other impacts on the neighboring community. DOFAW staff and law enforcement will be present in the park to enforce compliance.

Cultural, historical, and archaeological resources in the Reserve would be protected when implementing the Management Plan. DOFAW will coordinate with the State Historic Preservation Division (SHPD) and produce a preservation plan for protecting historical archaeological resources. These resources would be properly signed and roped off for protection and public education. DOFAW staff and law enforcement will also monitor to enforce protection of these resources at the Reserve.

The scenic value of Kamehamenui and Haleakalā from below the FR are likely to continue to improve in the long term when implementing the Management Plan. Control of tall invasive trees such as eucalyptus and black wattle will prevent them from blocking the views of Haleakalā summit from Kekaulike Avenue. Revegetation with native plant species is expected to improve the scenic value of the Reserve as well.

Overall, the Proposed Action of implementing the Management Plan is consistent with the purpose of the FR system and provides community benefits through native habitat protection and restoration while also providing sustainable public use and recreational activities at Kamehamenui FR. Implementation of the Management Plan will allow DOFAW to be in compliance with the deed and acquisition obligations and meet the project's purpose and need, it was selected by DOFAW as the Proposed Action and is evaluated further in this EA.

1.6 Other Alternatives Considered

1.6.1 No Action—No Resource Management Actions Except Those for Public Safety

Under the No Action Alternative, the Kamehamenui FR Management Plan will not be implemented. Under this alternative the upper portion of the Reserve that has already been withdrawn from the grazing lease and enclosed in an ungulate-proof fence will remain as it is (fence will not be removed). However, there will be no management actions to control feral ungulates or to maintain the fence. Soil erosion and compaction caused by feral ungulates is likely to continue to have a negative impact on watershed functions such as recharging the aquifer and availability of water.

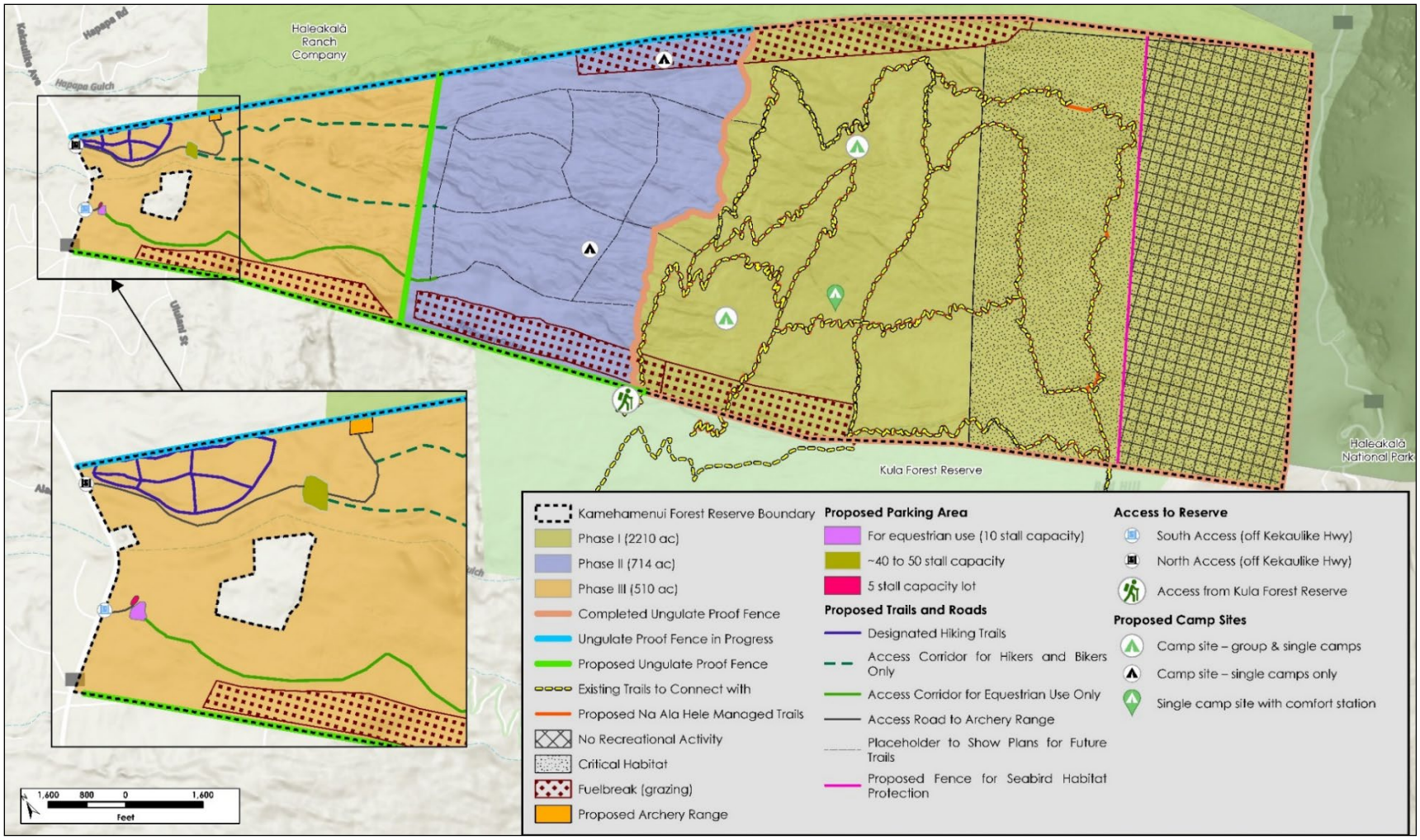


Figure 3. Proposed Phased Management Actions at Kamehamenui Forest Reserve

Under this alternative, efforts will not be made to systematically restore the Reserve with native forest. The "mauna lei" or band of native forest around Haleakalā will not be restored and suitable habitat for native plant and animal species will not be established. The FR will not be revegetated to restore forest cover, which means that watershed functions are likely to continue to further deteriorate. Unique subalpine habitats, including those in federally designated critical habitats will not be protected from ongoing threats from invading non-native plants, predators, and feral ungulates, consequently leading to the continued deterioration of these habitats. T&E species supported by these habitats are likely to continue to be adversely impacted by ongoing pressures such as grazing from feral ungulates and predation from introduced small mammals like mongooses and feral cats.

Despite no resource management actions, DOFAW would continue to implement actions necessary for public safety under this No Action alternative. DOFAW will conduct all measures necessary to manage the fire risk at Kamehamenui. This includes actions such as monitoring environmental conditions and managing the fuel loads and strategically installing fuel breaks/ firebreaks to minimize fire risk and protect the community.

Under the No Action alternative, there will be minimal public use benefits available at Kamehamenui. Public lands of the FR will be open to public access unless closed for emergencies. Beyond the enjoyment of open space, no improvements for recreational opportunities will be available at the Reserve. DOFAW will not provide and manage access, parking, or other infrastructure associated with public use under this alternative. DOFAW staff and law enforcement presence would be reduced to enforce compliance. Measures to manage use at appropriate locations and levels would not be implemented, including nighttime closures to reduce noise and impacts.

Under the No Action alternative, cultural, historical, and archaeological resources in the Reserve would be left as they are. There will be no protective infrastructure such as signposts or roped-off areas for protection and public education. Also, DOFAW staff and law enforcement monitoring to enforce protection of these resources at the Reserve would be reduced.

The scenic value of Kamehamenui and views of Haleakalā from below the FR are likely to continue to remain the same in the short term. However, without any planned management actions there is no guarantee that this scenic value will be preserved in the long term. For example, when the mid to lower elevations are no longer under a grazing lease, non-native trees such as black wattle and eucalyptus are more likely to become established in the area and block the scenic view from Kekaulike Avenue. The invasion and spread of non-native trees may also drastically increase fire hazards in the area.

This alternative also does not meet the Project's purpose to acquire lands threatened with sale and development for their public benefits, including site-specific management actions for habitat protection and restoration, while simultaneously providing sustainable public use and recreational activities at Kamehamenui FR. Furthermore, because habitat protection and habitat restoration will not occur under the No Action alternative, DOFAW would be in default of its deed and acquisition obligations. Therefore, this alternative is not considered further in this EA.

1.6.2 Restoration Emphasis—Management Limited to Natural Resources, Habitat Protection, and Public Safety Measures

Under the "Restoration" alternative, DOFAW's management actions in the Reserve will include implementing public safety measures and habitat protection and restoration activities. Under this alternative the upper portion of the Reserve that has already been withdrawn from the grazing lease and enclosed in an ungulate-proof fence will remain in place (the fence will not be removed). In addition, DOFAW will continue to fence the remainder of the Reserve in a phased manner as described in the Management Plan. For each phase, DOFAW will systematically remove ungulates to minimize soil erosion and compaction and improve watershed functions at Kamehamenui.

Under the "Restoration" alternative, DOFAW will implement actions from the Management Plan regarding habitat protection and restoration. Revegetation efforts will systematically restore the "mauna lei," or band of native forest, around Haleakalā that will provide suitable habitat for a suite of native plant and animal species. Revegetation efforts under this alternative will further facilitate improving the watershed functions at Kamehamenui. Unique subalpine habitats, including those in the federally designated critical habitat will be preserved because ongoing threats from invading non-native plants, predators, and feral ungulates will be mitigated, consequently leading to the continued improvement of these habitats. With the release of pressure from grazing ungulates and protection from predators, rare, T&E species population are anticipated to increase.

In addition to resource management actions, under this alternative DOFAW would continue to implement actions necessary for public safety. DOFAW will conduct all measures necessary to manage the fire risk at Kamehamenui. This includes actions such as monitoring environmental conditions and managing the fuel loads and strategically installing fuel breaks/firebreaks to minimize fire and protect the community. Furthermore, DOFAW will also revegetate with native fire-resilient species where appropriate to further minimize fire risk in the Reserve.

Similar to the No Action alternative, under this "Restoration" alternative, there will be minimal public use benefits available at Kamehamenui. Public lands of the FR will be open to public access unless closed for emergencies. Beyond enjoyment of open space, no improvements for recreational opportunities will be available at the Reserve. Under this alternative, DOFAW will not provide and manage access, parking, visitor levels, or other infrastructure associated with public use. DOFAW staff and law enforcement monitoring of the Reserve to enforce compliance would be reduced. Other measures to manage visitor use levels would not be employed, including nighttime closures to reduce noise and impacts.

Similar to the No Action alternative, cultural, historical, and archaeological resources in the Reserve would be left as they are under this "Restoration" alternative. There would be no protective infrastructure such as signposts or roped-off areas for protection and public education. Also, DOFAW staff and law enforcement monitoring to enforce protection of these resources at the Reserve would be reduced.

The scenic values of Kamehamenui and views of Haleakalā from below the FR are likely to continue to improve in the long term. Control of tall invasive trees such as eucalyptus and black wattle will prevent the trees from blocking the views of Haleakalā ‘s summit from Kekaulike Avenue. Planned revegetation with native plant species, from the perspective of many residents and visitors is expected to improve the scenic value of the Reserve as well.

Because habitat protection and habitat restoration actions will be managed under the “Restoration” alternative, DOFAW would not be in default of its deed and acquisition obligations. However, this alternative still would not meet the Project’s purpose and need as it does not include providing sustainable public use and recreational activities at Kamehamenui FR managed in a responsible manner for compatibility with natural resources and consistent with community values. Therefore, this alternative is not considered further in this EA.

1.6.3 Recreation Emphasis—Reforestation Along with Actions to Maximize Public Access for Outdoor Recreation

Under the “Recreation” alternative, in addition to habitat protection and restoration actions that will occur under the “Restoration” alternative (see Section 1.6.2), DOFAW would maximize public use and recreational activities at the Reserve. There would be an extensive network of trails in the Reserve for a variety of recreational activities such as hiking, biking, and horseback riding. Camping would be allowed in the Reserve at multiple locations. There would be limited planning, leading to spatial and temporal overlap of compatible users. For example, hikers and bikers would use the same trails during at the same time. There would be no limit to the number of users recreating in the Reserve. To support maximum recreational use of the Reserve, extensive infrastructure would be installed. For example, there would need to be multiple access points and large parking areas. Amenities such as comfort stations would also be installed at multiple locations.

Similar to the No Action and the “Restoration” alternatives, under this “Recreation” alternative, DOFAW would continue to implement actions necessary for public safety. DOFAW would conduct all measures necessary to manage the fire risk at Kamehamenui. This includes actions such as monitoring environmental conditions and managing the fuel loads and strategically installing fuel breaks/firebreaks to minimize fire risk and protect the community. Furthermore, DOFAW would also revegetate using native fire-resilient species as appropriate to further minimize fire risk in the Reserve.

Maximizing recreational activities in the Reserve under this alternative is expected to undermine co-occurring habitat protection and restoration activities. For example, a large network of trails would divide up the Reserve into smaller units, increasing edge effects and making it challenging to enhance habitat for restoration efforts to be successful. Maximizing recreational activities on a large scale would also exasperate soil erosion in the Reserve beyond the benefits offered through simultaneous restoration activities. Under these contradicting outcomes of natural resource management and extensive recreational activities with no limit on users, the Project’s purpose to improve watershed functions and protect and restore natural and cultural resource will only partially be met. The purpose of providing responsible public use and recreational

opportunities consistent with community values would not be met. Overall, this alternative does not meet the Project's purpose and need and therefore, it is not considered further in this EA.

1.7 Summary of Alternatives Considered

Table 1 below compares the management alternatives that DOFAW considered to the proposed action for the Kamehamenui FR in this EA.

Compared to the Proposed Action, the other alternatives of No Action, Restoration and Recreation do not meet the purpose and need of the Project to protect, manage, restore natural and cultural resources in Kamehamenui FR while also sustainably managing public use activities. Therefore, these alternatives are not considered further in this EA.

Table 1. Management Alternatives Summary for Kamehamenui Forest Reserve

Evaluation Criterion	"No Action"	"Restoration"	"Recreational"	"Proposed Action"
Division of Forestry and Wildlife (DOFAW) is in compliance of deed and acquisition obligations				
Feral ungulates will be controlled and ungulate-proof fence maintained.				
Maintain or increase quantity and/or quality of aquifer recharge and soils erosion control.				
Restore ecological function, ecosystem services, evolutionary processes and adapt to the impacts of climate change.				
Rare species and federally and state listed threatened and endangered species will be protected.				
Public safety measure of managing fuel loads to manage fire risk.				
Access to the Reserve, parking, infrastructure, and public use amenities will be controlled and managed by DOFAW as appropriate.				
Recreational activities will be appropriately managed based on user types and levels, consistent with desired limits.				
Nighttime closure to reduce noise and impacts.				
Staff and law enforcement presence to ensure compliance.				
Preserves scenic value				

Evaluation Criterion	"No Action"	"Restoration"	"Recreational"	"Proposed Action"
Overall meets Project purpose and need.				

Legend

	Fully satisfies the criterion to meet Project's purpose and need.
	Partially satisfies the criterion to meet Project's purpose and need.
	Does not satisfy the criterion to meet Project's purpose and need.

Section 2.0 Affected Environment, Potential Impacts, and Proposed Mitigation

This section describes the existing environmental conditions of the Project site (i.e., the Reserve), potential long-term impacts of the Project, impacts due to construction, and the proposed mitigation measures to avoid, minimize, or mitigate those potential effects. The relative impact(s) that would likely remain after mitigation is also described. Each subsection within this section is dedicated to analyzing specific environmental or social disciplines. Short-term potential construction phase impacts are also discussed within each respective section.

Existing conditions, potential impacts, and proposed mitigation measures presented in this section have been developed through a review of existing information related to the Project Area (see References Section); studies conducted specifically for the Project; coordination with regulatory agencies; and consultation with the general public.

2.1 Physical Factors—Geography, Soil, and Water

2.1.1 Existing Conditions

Two volcanoes make up the island of Maui—the older West Maui volcano that formed about 1.6 million years ago and the eastern younger volcano also called Haleakalā Volcano that formed about 1.1 million years ago (Sherrod et al. 2007). Similar to those forming the other Hawaiian Islands, these volcanoes are also basaltic shield volcanoes. While the West Maui volcano is considered extinct, the younger but larger Haleakalā Volcano is considered active with eruptions occurring every few hundred years (Sherrod et al. 2007). It is one of the largest shield volcanoes in Hawai'i. Thousands of thin shield-stage lava flows form the base of the Haleakalā Volcano that constitute most of its volume and are known as Honomanū Basalt. The shield-stage rocks are almost completely covered by younger lava rocks and are divided into two formations—the older Kula Volcanics and the younger Hāna Volcanics. Surface geology of Kamehamenui FR consists of lava flows from the Kula Volcanic Series that span the period from 150,000 to 950,000 years ago during the Pleistocene (Sherrod et al. 2007, U.S. Geological Survey 2023).

The U.S. Department of Agriculture's Natural Resource Conservation Service has mapped eight soil types. This agency provides online soil maps and data at https://websoilsurvey.sc.egov.usda.gov. The lower half of Reserve that overlaps existing pastureland is composed of: Kaopoioi loam, 7–40% slopes; Kula loam 12–20% slopes; and Kula loam 4–12% slopes. The central portion of the Reserve is composed of the Laumaia series—Laumaia extremely stony loam, 40–70%; Laumaia loam, 7–40% slopes; and Laumaia loam, 40–70% slopes. The uppermost elevations are largely composed of Lava flows-Cinder land complex, 2–40% with little (4%) composed of Rock land.

Climatic conditions at Kamehamenui FR vary with elevation. Mean annual rainfall increases with elevation with the driest months being from April to October and the wettest months from November to March. The lower elevations below 5,000 ft receive about 28 inches (711 millimeters [mm]) of average annual rainfall (Giambelluca et al. 2013). Rainfall in the upper elevations of Kamehamenui FR is influenced by cloud inversion layer that traps moisture below. Therefore, moisture availability in the uppermost elevations of the Reserve, above the inversion layer is very dry compared to the moderate dry and seasonal mesic conditions below this inversion layer. The rockier, less developed soils in the uppermost portion of the Reserve also contribute to the arid conditions here (Figure 4).

There are no major streams in Kamehamenui FR. The topography of Haleakalā is striking; while the eastern slopes are deeply carved by four large stream valleys (Keʻanae, Waihoʻi, Kīpahulu, and Kaupō Gap), most of the leeward surface of Haleakalā is incised only by shallow narrow gulches. There are two main geological features in the Kamehamenui FR—Hāpapa Gulch borders and extends into the northern side of the Reserve and the Keāhuaiwi Gulch borders the western side of the Reserve, then cuts through the center of the western portion of the Reserve (U.S. Geological Survey 2013). Surface flows in these gulches are limited to short-duration flash rain events. Compared to most other rock types, Kula Volcanics are considered to have higher permeability but has lower permeability than Hāna Volcanics and Honomanū Basalt. Regarding ground water, the Reserve contributes to the recharge of the Makawao Aquifer of the central sector of Maui. According to the U.S. Geological Survey, groundwater recharge modeling dataset, Kamehamenui currently contributes approximately 3.37 mgd per day (Izuka et al. 2018).

The age and type of volcanic material influences the development of soils, stream channels, aquifers, and forest types which together determine the watershed function. The Hawaiian proverb "Hāhāi no ka ula i ka ulu laʻau" (the rain follows after the forests) captures the important and complex relationship among forests, soil, and water in the Hawaiian watersheds. Hydrological studies have documented this crucial relationship of native forests intercepting rainfall and cloud moisture which significantly impacts the watershed. The native forest canopy intercepts rainfall and the layered forest structure with variation in the density and height of the trees helps mitigate the intensity and amount of rainfall reaching the forest floor. Furthermore, native forests at high elevations can capture moisture from passing clouds (fog drip), a process that can increase water capture by up to 30% beyond the total annual rainfall. Together, canopy interception and fog drip minimize soil runoff and erosion by allowing for controlled runoff to contribute to streamflow and water to slowly infiltrate into the ground and recharge the aquifer. Native forests therefore help maintain a stable water supply within the ecosystem which, in turn, provides clean drinking water.

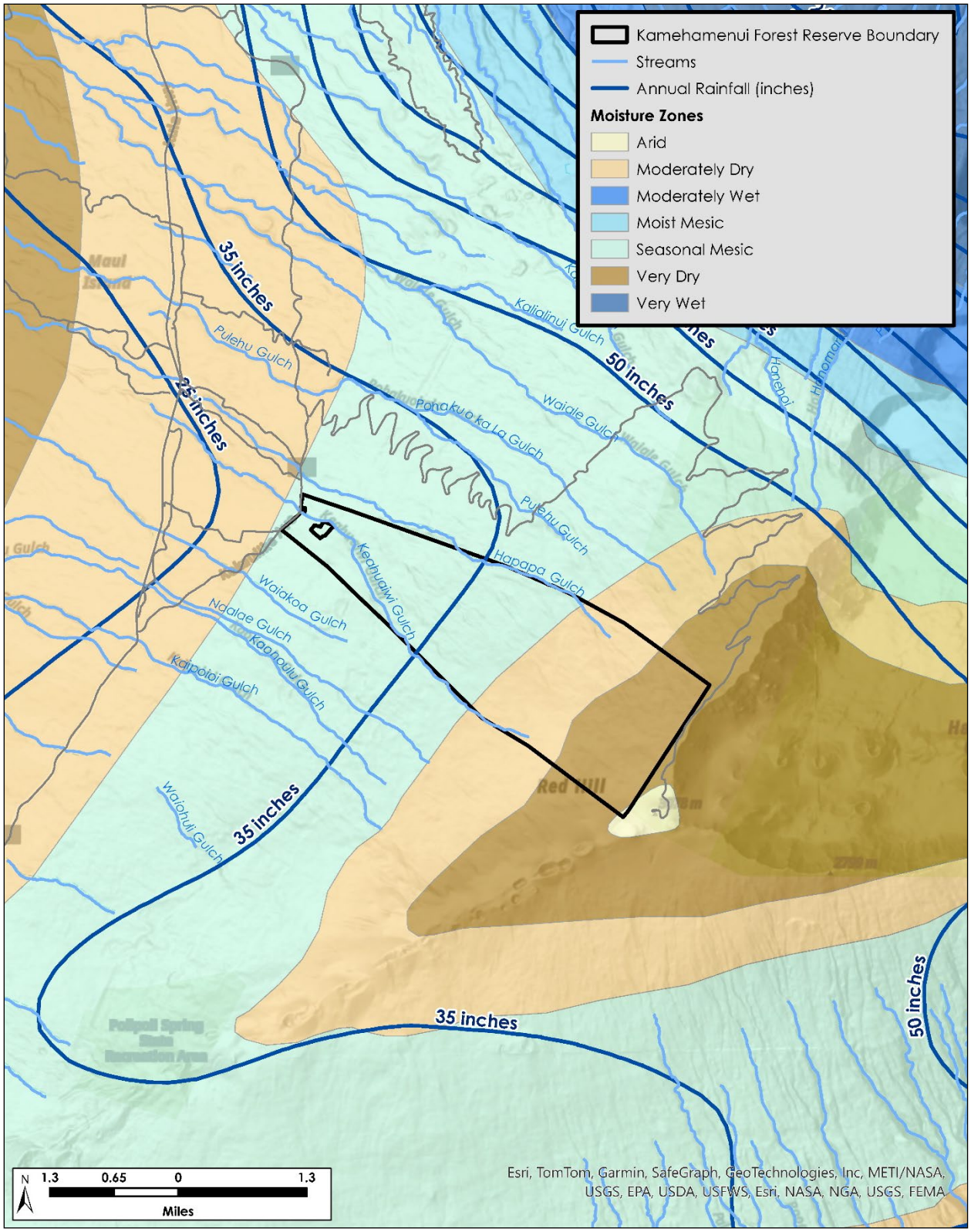


Figure 4. Moisture Zones, Surface Flows, and Rainfall at Kamehamenui

In contrast, forests dominated by introduced plant species—particularly those with dense uniform canopy forests such as strawberry guava, eucalyptus, and loblolly pine—do not intercept and partition rainfall as effectively. Such nonnative-dominated forests are heavy water users with significantly higher evapotranspiration rates than forests dominated by native trees. Rather than diverting water to recharge the aquifer, the alien dominated forests generally lose it through evapotranspiration and possibly from streams and groundwater. At a landscape level, conversion of native forests to nonnative-dominated forests reduces the watershed functions of the Reserve. Also, unlike in a native forest canopy, the impact of raindrops reaching the forest floor is not buffered in a nonnative-dominated forest which can cause heavy soil runoff and erosion.

2.1.2 Potential Impacts and Mitigation Measures

The Proposed Action will not affect the topography and stream channels in the Reserve. Several activities under the Proposed Action to implement the Management Plan can impact the soil and vegetative cover, and consequently, influence the functioning of the watershed. For example, DOFAW will continue construction of an ungulate-proof fence around the Phase II and Phase III areas to phase out feral ungulates and cattle. The process of constructing a fence will disturb the soil and can cause soil erosion. However, these negative impacts will be localized and short in duration and can be mitigated by employing best management practices (BMPs) to minimize soil erosion. Completion of the fence and the subsequent removal of all feral ungulates under the Proposed Action is expected to have large-scale and long-term positive impacts on the soil and watershed of Kamehamenui. Removal of hoofed feral ungulates and cattle is expected to reduce soil compaction in the entire Reserve, facilitate ground water absorption, and improve watershed functions in the long run. Constructing an ungulate-proof fence overtime will continue to keep feral ungulates out of the Reserve while minimizing soil erosion and runoff in the Reserve.

Several recreational activities such as hiking, biking, horseback riding, and camping are proposed for the Kamehamenui FR under the Management Plan. Hiking, biking and horseback riding over time can compact soil, reducing its porosity and ability to absorb moisture. These activities can also cause soil erosion, especially in areas with steep slopes or loose soil. Camping can also cause soil compaction while littering and improper waste disposal by people at a campsite can introduce pollutants into the soil. Under the Proposed Action, however, DOFAW would implement a series of measures to avoid and minimize potential impacts to soil, and consequently, to the watershed from these proposed recreational activities. There will be no recreational activity in the uppermost elevations of the Reserve that has sensitive loose cinder that is prone to compaction and erosion. In the remaining lower portion of the Reserve, biking and horseback riding will be limited to only designated trails and no motorized biking will be allowed in the Reserve. DOFAW will also manage the user levels consistent with the desired limits. Camping also will be limited to only three locations in the Reserve and will be through a reservation and fee system. Furthermore, a maximum duration of three nights will be permitted for camping, with two days per week as services days. Comfort stations will be built to minimize littering and polluting of the soil. Because these recreational activities under the Proposed Action

will be permitted at a local scale in the Reserve, with access and use controlled and enforced by DOFAW, they are unlikely to have a significant impact on the geography, soils and water of the Reserve.

2.2 Cultural and Traditional Resources

ASM Affiliates (2023a) prepared a cultural impact assessment (CIA) for the Kamehamenui Management Plan. See Appendix B in the Management Plan (Appendix I of this document). The CIA was prepared pursuant to Act 50 and in accordance with the Office of Environmental Quality Control guidelines for Assessing Cultural Impacts, adopted by the Environmental Council, State of Hawai'i, on November 19, 1997 (OEQC 1997, 417). Act 50, which was proposed and passed as House Bill No. 2895 and signed into law by the governor on April 26, 2000, specifically acknowledges the State's responsibility to protect native Hawaiian cultural practices. For the CIA, the traditional ahupua'a of Kamehamenui and Kealahou 3 & 4 are considered the study area, while the location of the Proposed Actions is referred to as the Project Area (i.e., the Reserve). Act 50 further states that environmental studies ". . . should identify and address effects on Hawai'i's culture, and traditional and customary rights" and that "native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the 'aloha spirit' in Hawai'i.

2.2.1 Existing Conditions

The existing conditions described in this EA have been summarized from the CIA prepared by ASM Affiliates (2023a). Kamehamenui is among the 17 ahupua'a that make up the expansive moku of Kula, in east Maui. Throughout much of the pre-contact and early historic period, the island of Maui was ruled by two independent chiefdoms, the West Maui Chiefdom of Ka'anapali and Lāhainā and the larger East Maui Chiefdom which included the moku of Kula. This political division is known to have existed up until the 16th century when the high chief Kiha-a-Pi'ilani consolidated the East and West Maui under his rule. The Kula region has a rich and dynamic history, characterized by its dry land and open country, consistent with its ecological zone. Historical accounts, including the mo'olelo of Kiha-a-Pi'ilani, reveal seasonal droughts and famine in Kula. Kiha-a-Pi'ilani and his wife outplanted the native 'uala (*'uala maoli*)—sweet potato at the time of famine in Kula.

It wasn't until November 1778 that the first Europeans were recorded off the windward coast of East Maui. The period from 1778 to 1854 is marked by the arrival of European explorers, drastic transformation in land use, culture, and economy. By 1820, Lāhainā was the seat of the Hawaiian government, which was heavily vested in trading 'iliahi—the prized Hawaiian sandalwood which eventually declined because of overharvesting of the trees. Overlapping the decline of the sandalwood trade was the rise in the whaling industry in Lāhainā. Between 1824 and 1861, thousands of acres of forests were harvested on Maui, including those in the Kula region to supply fuel wood to the whaling ships. Along with fuelwood, there was also demand for other provisions such as potatoes and wheat that led to the expansion of Kula's agricultural lands farther upslope into the forests which also led to an influx in Kula's population. In keeping up with the market economy, the native farmers shifted their focus to growing more foreign

produce, particularly wheat and Irish potatoes. Irish potatoes became the dominant cash crop and Kula was one of the first places in which Irish potatoes were grown on a large scale. Chinese farmers were brought in to meet the demand in production. With the arrival of the Chinese, came other vegetables like corn, beans, cabbage, onions, wheat, and cotton. By 1854, this demand for Hawaiian-grown Irish potatoes on the continental U.S. came to an end and agricultural production in Kula shifted mainly to domestic use.

As Hawai'i grew as a center for commerce and trade in the Pacific, the political powers sought ways to modernize the flourishing Kingdom. The Great Māhele (great land division) in 1848 marked the shift from a feudal system (where the King owned all the land) to an allodial system of private land ownership. It was in this year that chiefess Ane Keohokālole (mother of Queen Lili'uokalani and King David Kalākaua) was awarded Kamehamenui and Kealahou 3rd and 4th, lands that now comprises the Project Area. Following the death of chiefess Keohokālole, her lands were placed into her estate in which Charles R. Bishop was the trustee. Kamehamenui and Kealahou 3rd and 4th were then sold to James Louzada, who in 1864, sold half of his interest to his brother-in-law, William Henry Cornwell. These lands then passed to Kapua Louzada and several Cornwell heirs who later sold the land to Adelia Louzada Cornwell in 1888. In this same year, these lands were sold to Louis von Tempsky and his wife Amelia Ross (Bell).

Louis von Tempsky arrived on Maui in 1879 and a year later, was joined by his elder brother Randal von Tempsky and they became involved in Maui's ranching industry. In 1888, he formed Erehwon Cattle Company which later became known as Erehwon Ranch. Although much of the ranch's history focused largely on cattle ranching, during the Erehwon's early years Louis leased land to truck farmers who cultivated and exported vegetables such as corn, beans, and potatoes. In addition to being involved in ranching, they also served in various capacities including the Makawao Road Board, and the Board of Fence Commissioners, and were pivotal in the infrastructure improvements and development of Kula. Through petitioning, Randal and Louis were able to allocate funds for road improvements that eventually led to the construction of the new Upper Kula Road, known today as Kekaulike Avenue which bounds the Project Area on its *makai* end.

By 1897, Louis was hired as manager of Haleakalā Ranch and he sold Erehwon to his brother, Randal, who continued to oversee the day-to-day operations until his untimely death in 1898 after which Randal's wife, Dora Melville Dowsett, managed the ranch. Dora established a dairy at Erehwon and continued the leases that Louis established. She also initiated the construction of a diversion tunnel to reroute water to the ranch. The ranch lands of Erehwon remained in the von Tempsky family up until the passing of Randal's grandson, Robert "Ski" von Tempsky Jr., in 2002. Shortly before Robert's passing, the von Tempsky family put Erehwon Ranch up for sale. The land was purchased by John Zwaanstra. The property was then sold to Shizuka Asakawa and around 2018 was put up for sale again. In July of 2020, Trust for Public Land purchased the 3,276-acre property and the following month transferred ownership to the DLNR-DOFAW.

The above cultural-historical background information, combined with the results of the consultation process (conducted by ASM Affiliates), revealed insights regarding the following traditional and customary practices and valued cultural resources.

Agriculture

Kula's open country and dry climate allowed only certain crops to flourish, often facing prolonged droughts and famine as noted in some of Kula's moʻolelo. Despite harsh conditions, Kula's native inhabitants used traditional practices like *kilo* (astute observation of the natural world) to develop unique agriculture techniques. Planting methods identified for ʻuala (sweet potato) on Kula lands include maloʻeka and haʻaheo. The maloʻeka method involved building large bonfires to create smoke clouds that sheltered crops from the sun, making planters exceptionally dirty. The haʻaheo method was used in wetter areas, likely referring to the ease of cultivation with ample rainfall. Native planters also constructed terraces for soil retention, water run-off management, and plot delineation. Before westerners arrived, Kula's farmers primarily cultivated native ʻuala maoli varieties for subsistence. After the arrival of westerners, farming shifted to accommodate the market economy. Chinese laborers introduced crops like corn, beans, cabbage, onions, wheat, and cotton, with wheat becoming abundant and sold to foreigners. Aside from Kamehamenui being utilized for ʻuala maoli, Chinese laborers on the von Tempsky's ranch, built berms within Kamehamenui for further cultivation of crops such as corn, beans, cabbage, onions, wheat and cotton.

Cultural Value of the Forest

Culturally, the forest overlapping Kamehamenui is significant as a dwelling place for gods in various forms. Access to the upland forest was traditionally restricted to those who had a particular responsibility to carry out cultural ceremonies and who carried out appropriate protocols to enter. Kamehamenui ahupuaʻa is named after the endemic *Antidesma* sp. tree known by various Hawaiian names such as hame, hamehame, and haʻa. This tree is culturally significant for its medicinal properties, use in natural dyes, and hardwood. Its fruit and bark produce the red and purple dyes used for kapa. The hardwood is used for home framing and kapa anvils (kua). Historically, ʻiliahi and māmane trees were abundant in the area, supporting the ʻiliahi trade in the 1820s and providing māmane wood for fence posts during ranching. Mauʻu hōʻula ʻili, used in traditional tattooing, may be found in the upland regions. The forest once housed native birds, but early industries and ranching depleted their habitat.

Water Resources

Water is a highly valuable resource in Hawaiʻi, considered a kino lau (many body forms) of Kāne, essential for all life. As revealed during the interviews with the von Tempsky family members, despite Kula's typically dry nature, the Keāhuaiwi gulch in the Project Area flowed consistently and their memories include swimming and playing in this gulch, which also had multiple punawai (springs) used by the Mormon Church for baptisms. During interviews (with ASM Affiliates), one adjacent landowner mentioned the presence of punawai and Rockwall structures on his property and thought that they were utilized to divert water from punawai to potential ʻuala patches that were once cultivated in Kamehamenui.

Pig Husbandry, Hunting, and Ranching

One moʻolelo about Kula involves Kukeawe, a petty chief and friend of Chief Kahekili, who managed Kahekili's pigs on the slopes of Haleakalā and Kula, indicating pig husbandry in the

region. Consultation interviews informed that Maui had free-roaming piggeries until the late 1950s and early 1960s, with pigs traditionally domesticated and raised until needed. Pig hunting methods using dogs, guns, or bows and arrows are relatively modern. The von Tempsky family also discussed hunting wild game in the mauka portion of Kamehamenui.

Pu‘u Moho and Burial Traditions

Pu‘u Moho, a hill located on the boundary between the ahupua‘a of Kealahou and Waiakoa, partially lies within Kamehamenui. One interviewee during the consultation believed that Pu‘u Moho was a gathering place for warriors to tie their malo before battle and is also associated with the extinct flightless bird, moho. The von Tempsky family recalled spreading the cremated remains of some family members on Pu‘u Moho. In addition to using Pu‘u Moho for spreading ashes, family burials were identified near the Tudor home outside Kamehamenui. No burial sites within Kamehamenui were discovered.

2.2.2 Potential Impacts and Mitigation Measures

Because the Proposed Action does not involve major land development, it would not have significant permanent impacts on traditional customary practices and valued cultural or historical resources identified within Kamehamenui. Some Proposed Actions have the potential to have long-term and short-term positive or negative impacts on cultural or historical resources. These are discussed below along with the measures that would be undertaken to avoid or mitigate potential impacts.

Forest Restoration and Native Hawaiian Gathering Rights

Reforestation efforts proposed by DOFAW would have a long-term positive impact on the cultural and historical resources at Kamehamenui. One of the main goals for Kamehamenui is to restore the “mauna lei”—the band of native forest that historically occurred in the low to mid-elevations of Haleakalā. To fulfill this goal DOFAW would restore at least 75% of the Reserve to native forest cover. In doing so, the Proposed Action is expected to recreate a historical sense of place and therefore have a long-term positive impact. DOFAW will also include both ecologically and culturally appropriate native plant species such as *Antidesma* sp., ‘Iliahi, koa (*Acacia koa*), ‘ōhi‘a lehua (*Metrosideros polymorpha*), māmane, and ‘a‘ali‘i (*Dodonea viscosa*) for reforestation. Restoring the lands to native forest cover will increase the abundance and accessibility of gathering native plant species (excluding rare, threatened, and endangered species and with appropriate permits) that are important for various native Hawaiian traditional and cultural practices such as hula, lei making, dye production, and for food and medicinal use.

Hunting

The Reserve is not designated as a Public Hunting Area so the Proposed Action will not reduce public hunting opportunities at Kamehamenui. Any game mammals present will be managed with the goal to eventually remove ungulates from the Reserve. Restoring the native forest and enhancing the watershed at Kamehamenui is contingent upon removing feral ungulates from the Reserve. However, to mitigate for this essential long-term impact to historical hunting

opportunities, DOFAW will adopt a phased and community-based approach to the eradication of feral ungulates. DOFAW will utilize local hunters for a specified duration and whenever safe, feasible, and effective as the first steps to removing ungulates from all three Phase Areas of the Management Plan prior to staff control operations. To further minimize the overall impacts to historic hunting practices, DOFAW will consider allowing game bird hunting in areas not designated as critical habitat for endangered species, and to the extent that game bird hunting is compatible with other management goals, especially T&E species recovery for the state and federally protected species like the nēnē.

Historic Resources and Burials

Historical resources, including Site 50-50-11-T-1—the Erehwon Cattle Ranch, are identified in the Reserve. The limited improvements for amenities to support access, public use, and recreational activities have the potential to negatively impact these resources. Although any potential negative impacts on historical and cultural resources can be avoided by DOFAW. DOFAW will develop a preservation plan to be approved by SHPD and will avoid all potential impacts to these historical resources (also see Section 2.3. Archaeological Resources). Furthermore, where appropriate, DOFAW will also install interpretive signs to educate users of the Reserve about these historical resources.

Ranching and Traditional Agricultural Practices

Although ranching is an important part of the history of Kamehamenui, large-scale commercial ranching and agriculture are not consistent with the Project's goals to acquire lands threatened with private sale for the purpose of providing public benefits through reforestation, public access, and recreation. DOFAW would furthermore be in default of deed and acquisition obligations if it allowed for ranching activities to continue in the Reserve to the exclusion of those public benefits. Under the Proposed Action, DOFAW will phase out the lease of lands for commercial ranching activities at Kamehamenui. The lower approximately 1,234 acres (~500 hectares) of land is leased by DOFAW for grazing and cattle ranching. Under the lease, which expires in 2030, DOFAW retains the right to withdraw portions or all of this area from the lease at its discretion for any purpose. DOFAW has already initiated management actions to conserve and restore the 2,200 acres that were withdrawn from the lease. Under the Proposed Action, for the remaining approximately 1,234 acres, DOFAW will prioritize and continue to withdraw limited areas from the grazing lease, over the remaining time of the lease. Even though current or modern ranching activities will be phased out under the Proposed Action, DOFAW will preserve the resources associated with the historical Erehwon Cattle Ranch (also see Section 2.3 Archaeological Resources). Also whenever possible, DOFAW will seek to support local ranchers and employ ungulates for grazing as a tool to minimize fuel loads in the Reserve and maintain fire breaks as needed. The use of grazing permits consistent with public access and resource management goals, including control of invasive fuels, will enable grazing to continue in portions of the Reserve, benefiting both ranchers and the public.

Community First Approach

The Proposed Action will have a significant long-term positive cultural impact on the local community on Maui. Under the Proposed Action, whenever possible, DOFAW will engage the community in restoring native forest cover in Kamehamenui through volunteer and educational opportunities. DOFAW will encourage involvement of school and youth programs as well as the general public in forest management and traditional Hawaiian uses of the forest to promote land stewardship and to provide opportunities for the community to play an integral role in managing the Reserve. Such opportunities are also expected to restore and enhance the traditional and cultural connection between the people and their land.

The Reserve's native ecosystems and species are an essential part of Hawai'i's cultural-historical landscape. Protection and enhancement of the long-term survival of the natural resources in the Reserve through proposed management is the primary means to protect this valued cultural landscape.

2.3 Archaeological Resources

At the State level, Chapter 6E-8 of the HRS places responsibility on State agencies to evaluate their projects. The HRS Chapter 6E-8 review of potential project impacts on historic properties is conducted with SHPD, a division of the DLNR. Under HRS Chapter 6E-8, the proposing state or local agency—in this case, HDOT—carries the same burden to identify historic properties within the project study area (HAR 13-275-5), assess their significance (HAR 13-275-6), and evaluate the project's impacts (HAR 13-275-7).

ASM Affiliates (2023b) prepared an archaeological impact assessment (AIS) for Kamehamenui FR. See Appendix F of the Management Plan (Appendix I of this document). This AIS was prepared in accordance with HAR §13-275 (Rules Governing Procedures for Historic Preservation Review to Comment on Section 6E-8, HRS, Projects) as well as HAR §13-276 (Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports). Compliance with the above standards is sufficient for meeting the historic preservation review process requirements of both the DLNR-SHPD and the County of Maui with regards to the proposed project.

Hawai'i State Statutes define a "historic property" as any building, structure, object, district, area, or site, including heiau and underwater sites, that are over 50 years old. Only those resources that that meet the definition of "significant," as defined by Chapter 13-275-6(b) of the HAR, are protected by HRS 6E-8. This EA refers to these properties that meet the Significance Criteria (protected under Section 106 and HRS 6E-8) as "significant historic properties" to distinguish them from those that are considered historic because they are over 50 years old. The remainder of this section discusses the impact to historical and archaeological resources in this regulatory context. In this discussion, the term "Project Area" is used interchangeably with the Reserve.

2.3.1 Existing Conditions

Archaeological investigations conducted in Kamehamenui FR are limited to three separate locations: along the upper southeastern fence line for the Kamehamenui Forest Protective Fence project (Moore 2022), the 320 acres in the lower westernmost portion of the Reserve (ASM Affiliates 2023b), and a reconnaissance survey of 25 miles of proposed linear trail routes in the upper/eastern half of the Reserve (ASM Affiliates 2023b).

The 2023 AIS fieldwork in the lower westernmost portion of the Reserve documented one newly identified site, Site 50-50-11-T-1 ("Site T-1"). The site consists of 82 features associated with Erewhon Cattle Ranch that are spread throughout the 320-acre area. Historic Period ranching infrastructure, including features related to water management, livestock control, and potato cultivation remains are present at this site. Site T-1 retains sufficient integrity to be considered significant under Criterion B and D for the association of the site with the von Tempsky family and for information yielded relative to historic agriculture and ranching in Kula respectively. Details of the 82 Historical features are described in the AIS; see Appendix F of the Management Plan (Appendix I of this document). They include: 25 features related to water management within Keāhuaiwi Gulch and other gulches (e.g., check dams and weirs to retain and direct water, rock piles to prevent erosion, and CRM [Composite Reinforced Mortar] wall); four water features relating to Kula water pipeline (e.g., remnants of rock foundation and wooden pump houses); 10 features related to agricultural in open pasture (e.g., terraces and berms for retaining soil and defining field boundaries for potato farming [Figure 5]); 17 features related to livestock management along drainages and in pastureland (e.g., dry-stacked wall which likely served as a fence line); four features associated with historic habitation south of Keāhuaiwi Gulch (e.g., a retaining wall and a "U" shaped enclosure, ceramic shreds, and glass fragments); eight features related to dairy farm operations of Erehwon Ranch (e.g., concrete feature that served as a silo, wooden trough, barn, and watering hole); and 14 features whose functions are indeterminate (e.g., ten rock piles and two enclosures).

Archival research indicates that Erehwon Ranch utilized the area (Site T-1) for cattle ranching and agriculture from the mid-19th century through 1990. These activities likely disturbed any evidence of precontact and early historic agriculture or habitation.

The 2023 AIS fieldwork also identified and documented three new features and three previously (Moore 2022) identified features in upper two thirds of the Reserve. These include a modified outcrop (Temp. Site T-2), a cairn/rock mound (Temp. Site T-3), and a cairn (Temp. Site T-4). The previously identified features consist of two rock walls (Temp No. SM-03 and SM-04) and a rock pile (Temp No. SM-05). The significance of these features was not evaluated due to the limited scope of the reconnaissance survey.

2.3.2 Potential Impacts and Avoidance and Mitigation Measures

The limited improvements in amenities to support public use, access, and recreational activities under the Proposed Action have the potential to cause short and long-term negative impacts to the archaeological resources documented in the Reserve. Proposed trails for access, hiking,

biking, and horseback riding, the installation of an ungulate-proof fence, and construction of parking areas and an archery range have the potential to physically damage the archaeological features documented in Kamehamenui. However, all identified archaeological sites and features will be avoided during the proposed infrastructure improvements and will be protected by fencing and/or archaeological monitoring during construction work. DOFAW will coordinate with SHPD and as needed will submit a detailed mitigation plan (e.g., archaeological monitoring plan or a preservation plan) to SHPD for review and acceptance prior to initiation of project work, along with written and photographic documentation providing verification that appropriate interim protection measures have been implemented. If additional surface and/or subsurface evidence of historic properties or artifacts—including cultural deposits or features, human remains, lava tubes, structural remnants or concentrations of artifacts—are identified during any management activities, work will cease immediately in the area of the discovery. The discovery will be protected from further disturbance, and SHPD will be consulted regarding appropriate documentation. Because DOFAW will take these actions to avoid and mitigate for potential disturbance to archaeological features, no significant impacts are expected for these resources under the Proposed Action.



Figure 5. Feature 059 is a Terrace/Berm Located in the Southwestern Portion of Kamehamenui Forest Reserve and Situated in Open Pasture/Field Land (Notes: The feature is constructed with soil and a few sporadic small-sized boulders. Based on construction methods and feature morphology, it was likely constructed during the Historic Period for potato cultivation. Photo courtesy of ASM Affiliates.)

2.4 Biological Resources

Section 7 of the Endangered Species Act (ESA) of 1973 requires federal agencies to consider impacts on endangered or threatened species and critical habitat of such species. For terrestrial species, it requires that federal agencies consult with the U.S. Fish and Wildlife Service (USFWS) regarding the effects of any major construction activity on a listed species or species proposed as endangered, or those effects that could result in the destruction or adverse modification of designated critical habitat (40 CFR 402). The State's counterpart law to the ESA is HRS Chapter 195D, as amended, under which listed species are similarly protected. Chapter 195D identifies the protection of endangered species as a State responsibility. Projects conducted within the state must comply with the provisions of HRS Chapter 195D by avoiding take of listed species or obtaining authorizations for such take, as provided in the statute. This section discusses the potential impact on biological resources in compliance with the requirements for HRS Chapter 343.

Biological resources are an integrated part of the Reserve but the discussion of these resources for convenience is divided below into a section on Vegetation and Flora and another section on Fauna. Wildfire, pests and disease are also discussed here in a separate section below.

2.4.1 Vegetation and Flora

Existing Conditions

About 75% of the landcover at Kamehamenui is vegetated. The 25% of Kamehamenui is composed of very sparse to unvegetated areas, which mostly include the uppermost elevations, and a few locations associated with ranch activities in the lower elevations (Figure 6). Cattle grazing and ranching activities at Kamehamenui over the last century have severely altered the vegetation structure and composition, limiting most of the native landcover to the mid to the upper elevations of the Reserve. Starr Environmental completed an extensive aerial and field biological survey of Kamehamenui in 2021. See Appendix D of the Management Plan for the survey report (Draft Management Plan is located in Appendix I of this document). This section summarizes the three main vegetation types, flora, and fauna as reported from this survey.

Subalpine Shrubland—The mauka (upper eastern) part of the Reserve, between 6,500 and 9,800 ft in elevation, contains the subalpine shrubland—the only native-dominated ecosystem in the Reserve. Near the summit of Haleakalā, vegetation is sparse, featuring low-growing native plants like kūpaoa, pūkiawe, Haleakalā silversword, and pamakani. As elevation decreases, plant diversity and height increase, with native ferns, grasses, shrubs, and trees such as ʻaʻaliʻi, māmane, and Haleakalā sandalwood becoming more common. Kilau (bracken fern) is the most abundant ground cover and ʻaʻaliʻi is the most common tree. Some non-native grasses like sweet vernal grass and cheatgrass are also present. The subalpine shrubland in Kamehamenui is heavily grazed and impacted by feral ungulates with vast areas where the vegetation has been completely taken down to dirt. This habitat is scattered with many dead native trees and the live trees show a range of damage caused by ungulates such as heavily browsed foliage, stripped bark, and undermined roots due to heavy soil erosion.

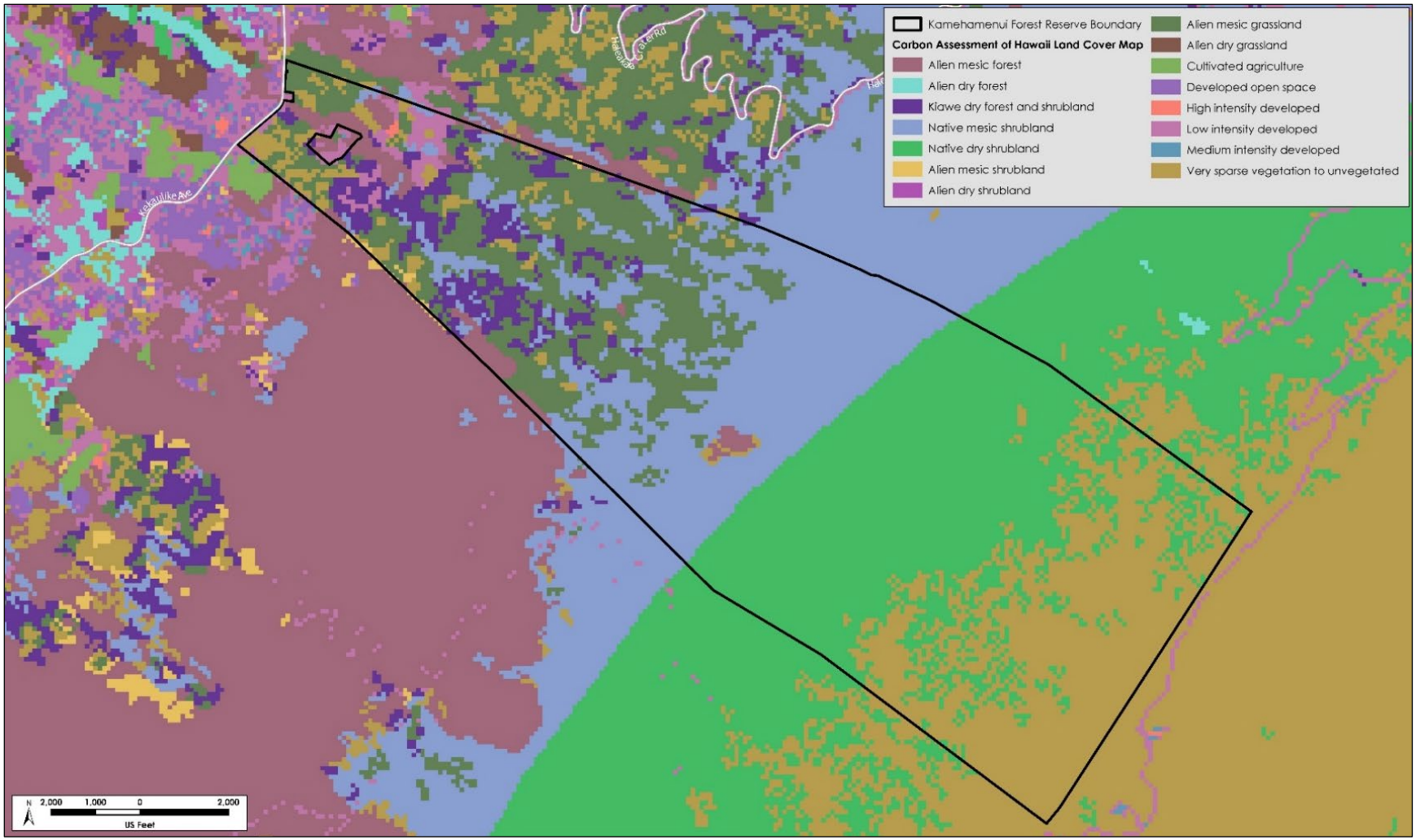


Figure 6. Land Cover Types of Kamehamenui Forest Reserve (Source: Jacobi, J. D., J. P. Price, L. B. Fortini, S. M. Gon III, and P. Berkowitz. 2017. Hawai'i Land Cover and Habitat Status: U.S. Geological Survey data release. <https://doi.org/10.5066/F7DB80B9>.)

About 1171 acres of the uppermost alpine and subalpine shrubland habitats in Kamehamenui overlap federally designated critical habitat. As outlined by the ESA, critical habitat is defined as "*specific areas within the geographic area, occupied by the species at the time it was listed, that contain the physical or biological features that are essential to the conservation of endangered and threatened species and that may need special management or protection. Critical habitat may also include areas that were not occupied by the species at the time of listing but are essential to its conservation*" (USFWS 2017). Ten species have critical habitat in Kamehamenui—eight plant and two bird species (more on these species below under flora and fauna).

Grassland/Pasture—Below 6,500 ft, the Reserve is mostly non-native grassland or pasture, dominated by kikuyu grass and other introduced grasses like natal red top, sweet vernal grass, weeping lovegrass, and Yorkshire fog. Around 1,233 acres are still used as active ranchland under a State grazing lease, where heavy grazing limits vegetation to low-growing grasses. Some native shrubs like pūkiawe appear above 5,500 ft, while non-native shrubs such as Canary Island St. John's wort, cotoneaster, and firethorn are scattered in lower areas. There are also small patches of mesic forest throughout the grassland and pasture areas.

Mesic Forest—In the mid-elevations below 6,500 ft, trees become more common within the grasslands and pastures, forming a relatively open mesic forest. The dominant non-native tree is the invasive black wattle, especially below 6,000 ft, with blue gum thickets along the northern border, though these are declining. Other scattered non-native and invasive trees include Monterey pine, maritime pine, redwood, and fire tree. Kikuyu grass remains the dominant ground cover, except under dense tree thickets where little else grows. Between 5,500 and 7,500 ft, remnant native ʻōhiʻa forests persist mainly in gulches and gullies, protected from grazing animals. The glabrous variety of ʻōhiʻa is common in this limited mesic forest of Kamehamenui. A small grove of koa trees exists around 4,500 ft. Pūkiawe is the most common shrub, with other native shrubs like ʻakala, pilo, and ʻaʻaliʻi, and native ferns such as ʻamaʻu, palapalai, and pohole also present.

Table 2 lists the 38 (22 endemic and 16 indigenous) native plant species seen during the 2021 survey of the Kamehamenui FR (Starr Environmental 2021). The relative abundance of many of these species in the Reserve was low and limited to areas such as gulch slopes and rocky areas that provide some protection from ungulates.

Table 3 below lists the eight endangered plant species for which critical habitat (Subalpine Unit 01 and Alpine Unit 01) has been designated, mostly overlapping the uppermost subalpine shrubland habitat of the Reserve. Seven out of these eight species have not been documented to occur in the Reserve but historically their distribution is known to overlap Kamehamenui. Only the Haleakalā silversword is known to be present in the Reserve while Koʻokoʻlau (*Bidens micrantha* ssp. *kalealaha*) and nohoanu (*Geranium arboretum*) although documented to occur have yet to be found in Kamehamenui.

Table 2. Native Plant Species Observed at Kamehamenui Forest Reserve

Scientific Name	Common Name	Status	*Abundance in the Forest Reserve
Acacia koa	Koa	Endemic	Rare
Argyroxiphium sandwicense subsp. *macrocephalum*	Hinahina, Haleakalā silversword	Endemic (Endangered)	Rare
Artemisia mauiensis	ʻAhinahina	Endemic	Rare
Asplenium trichomanes subsp. *densum*	Maidenhair spleenwort	Endemic	Occasional
Carex wahuensis	Carex	Endemic	Rare
Coprosma ernodeoides	Kukaenēnē	Endemic	Rare
Coprosma montana	Pilo	Endemic	Rare
Deschampsia nubigena	Hairgrass	Endemic	Occasional
Diplazium sandwichianum	Pohole	Endemic	Rare
Dubautia menziesii	Kūpaoa	Endemic	Common
Luzula hawaiiensis	Wood rush	Endemic	Rare
Metrosideros polymorpha var. *glaberrima*	ʻŌhiʻa	Endemic	Rare
Pittosporum confertiflorum	Hōʻawa	Endemic	Rare
Polystichum haleakalense	Polystichum	Endemic	Rare
Pseudognaphalium sandwicensium var. *sandwicensium*	ʻEnaʻena	Endemic	Rare
Rubus hawaiensis	ʻAkala	Endemic	Rare
Sadleria cyatheoides	ʻAmaʻu	Endemic	Rare
Santalum haleakalae var. *haleakalae*	ʻiliahi, Haleakalā sandalwood	Endemic	Rare
Sophora chrysophylla	Māmane	Endemic	Rare
Tetramolopium humile subsp. *haleakalae*	Haleakalā tetramolopium	Endemic	Occasional
Trisetum glomeratum	Pili uka	Endemic	Occasional
Vaccinium reticulatum	ʻŌhelo	Endemic	Rare
Asplenium adiantum-nigrum	ʻIwaʻiwa	Indigenous	Occasional
Carex macloviana subsp. *subfusca*	Carex	Indigenous	Rare
Cyrtomium caryotideum	Kaapeape	Indigenous	Rare
Dodonaea viscosa	ʻaʻaliʻi	Indigenous	Occasional
Dryopteris wallichiana	Laukahi	Indigenous	Occasional
Elaphoglossum paleaceum	Mākuʻe	Indigenous	Rare

Scientific Name	Common Name	Status	*Abundance in the Forest Reserve
Ipomoea indica	Koali ʻawa	Indigenous	Rare
Korthalsella complanata	Hulumoa	Indigenous	Rare
Lachnagrostis filiformis	Heʻupueo	Indigenous	Rare
Leptecophylla tameiameiae	Pūkiawe	Indigenous	Common
Microlepia strigosa	Palapalai	Indigenous	Rare
Pellaea ternifolia	Kalamoho	Indigenous	Occasional
Psilotum nudum	Moa	Indigenous	Rare
Pteridium aquilinum subsp. *decompositum*	Kīlau, bracken fern	Indigenous	Common
Pteris cretica	Cretan brake	Indigenous	Occasional
Solanum americanum	Pōpolo	Indigenous	Rare

Source: Starr Environmental. 2021. Flora and Fauna Survey. Kamehamenui Forest Reserve, Maui. Prepared by Forest and Kim Starr. Prepared for Division of Forestry and Wildlife, Department of Land and Natural Resources.

*Abundance in Kamehamenui Forest Reserve:

Common = Widely scattered throughout the Reserve or locally abundant within a portion.

Occasional = Scattered sparsely throughout the Reserve or occurring in a few small patches.

Rare = Only a few isolated individuals within the Reserve.

Table 3. Ecosystem Critical Habitat Designation in Kamehamenui Forest Reserve

Species	Critical Habitat Ecosystem Unit	
Plants	Subalpine 01	Alpine 01
Hinahina, Haleakalā silversword (*Argyroxiphium sandwicense* subsp. *macrocephalum*)	X	X
Asplenium peruvianum var. *insulare*	X	
Koʻokoʻlau (*Bidens micrantha* subsp. *kalealaha*)^	X	
Hawaiian red-flowered geranium (*Geranium arboreum*)^	X	
Nohoanu (*Geranium multiflorum*)	X	
*Phyllostegia bracteata**	X	
Schiedea haleakalensis	X	
Aʻe (*Zanthoxylum hawaiiense*)	X	

Source: U.S. Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokaʻi, Lānaʻi, Maui, and Kahoʻolawe for 135 species. Final Rule. Federal Register 81(61):17790–18110.

* This species may no longer occur in the wild on Molokaʻi, Lānaʻi, Maui, or Kahoʻolawe.

^ This species may occupy subalpine unit 01 but it is not clear if it is present in Kamehamenui Forest Reserve portion of unit 1.

Potential Impacts and Mitigation Measures

Several aspects of the Management Plan under the Proposed Action could have both adverse and positive impacts on the vegetation and flora. The following are proposed activities that have the potential to adversely impact vegetation and flora:

- Grazing, browsing and trampling from feral ungulates and cattle during the interim before the Reserve is not fully enclosed in an ungulate-proof fence.
- Ground disturbance due to fence construction and ungulate removal operations.
- Construction and use of trails, campsites, comfort stations, parking areas, and archery range all have the potential to negatively impact the vegetation.
- Weed control methods—manually, mechanical, or via application of herbicides—have the potential to negatively impact surrounding non-target species.
- Using sheep and goats to manage fuel loads in the Reserve has the potential to negatively impact native species as well.
- Opening the Reserve for public use increases fire risk and the chance of introducing forest pests and invasive species.

Because the above listed impacts are expected to be short in duration and localized, they are unlikely to have significant long-term impacts to vegetation and flora. Furthermore, under the Proposed Action, DOFAW will take the following measures to avoid and minimize potential negative impacts to the vegetation in the Reserve:

- Before establishing trails, access roads, campgrounds, shelters, and other facilities, DOFAW will survey areas for sensitive resources, including rare plants, and determine whether there is a potential for the facilities to cause direct impacts (e.g., cutting, trampling or vandalizing) or indirect impacts (fire, pest introduction). Facilities will be built and trails routed in non-sensitive areas or in ways that protect native vegetation and rare plants.
- Construction of an ungulate-proof fence around the Reserve is expected to have large-scale and long-lasting positive impacts on vegetation and flora. This is because release from grazing, browsing, and trampling from feral ungulates will allow native vegetation to thrive and recruit at Kamehamenui.
- Specific elements of the Management Plan are aimed at directly benefiting native plants, including:
    - Re-establishing forest cover on at least 75% of Kamehamenui. This includes restoring ranchland back to forest cover through both restoration activities such as outplanting and broadcasting seeds, as well as by facilitative nature regeneration and recruitment of native plants.
    - Conducting surveys, mapping, monitoring, and propagating material collection of rare plants.

- Propagating, reintroducing, and monitoring rare and endangered plants in appropriate protected habitat, in coordination with other agencies and organizations working on rare plant recovery.
- Protecting rare plants in areas outside fenced management units through the construction of small, fenced enclosures.
- Conducting biological surveys to collect and document baseline conditions for T&E and common species within the Reserve.
- Developing a comprehensive species inventory and diversity profile to guide the restoration of mesic to subalpine ecosystems across the Kamehamenui landscape.

- DOFAW will have a comprehensive (e.g., aerial, field, photo points) biological monitoring program in place to determine changes in vegetation and flora over space and time. This will help to inform DOFAW about factors impacting vegetation and employ measures accordingly to avoid and minimize negative impacts. For example, DOFAW will install and utilize RAWS that could alert managers to the presence of extreme dry conditions and help them prepare for wildfires and protect resources.
- DOFAW has extensive experience and proper training in working with rare plants around the State and knows how to effectively enhance their populations in protected areas while avoiding and minimizing threats to rare native plants.
- Invasive species control efforts to remove weeds, including manual, mechanical and herbicide, will be based on the characteristics of the target species, the sensitivity of the area in which the species are found, and the effectiveness of the control technique. Employing site-specific control measures will avoid and minimize impacts to non-target native species.
- DOFAW will conduct bi-annual aerial and ground surveys as needed to detect the presence of new forest pests and invasive species early such that a rapid response is effective toward eradication or control.
- As part of its district-wide comprehensive plan for the recovery of at-risk species and stabilization of biodiversity, DOFAW will implement guidance from the Maui Nui Landscape Conservation Plan to coordinate native ecosystem restoration with conservation throughout Maui Nui.

2.4.2 Fauna

Existing Conditions

Kamehamenui FR is home to several native and non-native animals. The following is a discussion of the faunal resources by group. Appendix E of the Management Plan provides a brief description and statewide status and distribution of the native mammal and bird species discussed below (see Appendix I of this document for the Management Plan).

Native Mammals—The ʻōpeʻapeʻa, or Hawaiian hoary bat (*Lasiurus cinereus semotus*), is the only native land mammal in Hawaiʻi and is found on all main islands except Niʻihau. It is a solitary and endangered species, protected under both federal and state laws. While much of ʻōpeʻapeʻa

behavior and population on Maui remains unknown, monitoring related to wind energy projects in the vicinity of the Kamehamenui suggest that the species is present in Kamehamenui FR. Also, the Kamehamenui FR located near these wind farms, is part of a broader conservation area aimed at protecting the species.

The ʻōpeʻapeʻa prefers habitats near waterways and forest or pasture edges, roosting in both native and non-native trees at heights of 3 to 29 ft. They rarely use lava tubes, rocks, or buildings for shelter. These bats hunt night-flying insects like moths, crickets, and mosquitoes using echolocation, often near artificial lights. Mating occurs from September to December, and females raise pups from June to September. Ongoing research uses radio telemetry to study their habitat use and food sources to better understand what makes an area suitable for them. Because of Kamehamenui FR's somewhat central location on the slopes of Haleakalā within that study area, it is likely that some of the bats being tracked as part of the study will travel across or occupy portions of the Reserve.

Native Birds—Three native forest bird species have been documented at Kamehamenui FR. Maui ʻamakihi (*Chlorodrepanis virens* var. *wilsoni*) are the most commonly seen native bird species in both native and non-native shrublands between 4,000–7,500 ft. ʻApapane (*Himatione sanguinea*) is less widespread but locally common in forested areas from 5,500–7,500 ft. Pueo, or Hawaiian owl (*Asio flammeus sandwichensis*), are seen gliding over grassland/pasture at around 6,000 ft. The upper subalpine habitat at Kamehamenui FR also supports native seabirds, including the Hawaiian petrel or ʻuaʻu (*Pterodroma sandwichensis*), which is known to nest in the area. Several burrows were found during surveys in 2021, and one dead petrel was discovered near summit powerlines. More detailed surveys encompassing 668 acres found additional 48 burrows, 26 of which were newly discovered, two showed signs of recent activity or chicks, and two showed evidence of predation from previous season.

Although not observed in the recent biological surveys conducted in 2021, the vast expanse of grassland/pasture at Kamehamenui FR are expected to provide foraging and loafing habitat for the endangered Hawaiian goose or nēnē as well.

The Pacific golden plover (*Pluvialis fulva*), or kōlea, are indigenous migratory birds that are present in the Reserve seasonally. They likely use the open areas in the Reserve up to 8500 ft.

Native Invertebrates—A comprehensive baseline survey for insects has not yet been conducted for Kamehamenui, however the biological surveys conducted by Starr Environmental in 2021 documented a variety of native invertebrates in the Reserve, especially in higher elevations. About 34% of the insects observed during this survey were endemic. Following is a summary of the native invertebrates found in Kamehamenui FR during this 2021 biological survey.

- *Spiders*—Three species of spiders (Order: Araneae)—wolf spider (*Lycosa hawaiiensis*), Hawaiian long-jawed spider (*Tetragnatha acuta*) and crab spider (*Mecaphesa* sp.). The carnivorous wolf spider lives under stones, while the crab spider and the long-jawed spider hunt for prey amongst the vegetation.

- *Bees*—Two yellow-faced bee species (Order: Hymenoptera; *Hylaeus nivicola* and *H. volatilis*) are abundant in subalpine shrublands.
- *Fruit Flies*—Several *Trupanea* species, associated with native plants like kūpaoa (*Dubautis* spp.) and silversword occur in the relatively undisturbed subalpine habitat.
- *Butterflies and Moths*—Koa butterfly (*Udara blackburni*) was abundant in the forested areas where the larvae feed on koa, ʻaʻaliʻi, and black wattle trees. The Haleakalā flightless moth (*Thyrocopa apatela*) were commonly seen on the cinder rocks in the summit region. The five fancy case caterpillar (*Hyposmocoma* spp.) species (*H. starrorum, H. kukilakila, H. desilvai, H. makaohuna*, and *H. kamehamenui*) were recorded for the first time; so far they have been found to only occur in Kamehamenui FR. "Burrito" and "cigar" shaped caterpillar cases suggest diverse feeding behaviors, including possible carnivory.
- *True Bugs*—Three species of true bugs (Order: Hemiptera)—planthoppers (*Oliarus* sp. and *Nesosydne* spp.) and false chinch bugs (*Nysius* spp.).
- *Wasps*—Potter wasp (Order: Hymenoptera, *Odynerus* sp.).
- *Native Plant Hoppers*—Are host-plant specific and found in all terrestrial native habitats in Hawaiʻi and few species also occur in the Reserve.
- *Mollusks*—Native tornatellid snails (*Tornatellides* sp.) (Gastropoda: Achatinellidae) were found during the 2021 surveys, but ground snails (*Vitrina tenella*) and amber snails (*Succinea* spp.) were not observed, though they are expected to be present.

Non-Native Animals in Kamehamenui—A diverse range of non-native species—including mammals, birds, insects, and mollusks—have been observed at the Reserve. A 2021 survey documented numerous non-native birds, such as Eurasian skylarks (*Alauda arvensis*) in open grasslands, and various passerines and game birds (e.g., ring-necked pheasant [*Phasianus colchicus*], chukar [*Alectoris chukar*], mourning dove [*Zenaida macroura*], zebra dove [*Geopelia striata*], and rock pigeon [*Columba livia*]) in forested areas.

Notable non-native mammals include axis deer (*Axis axis*), goats (*Capra hircus*), and pigs (*Sus scrofa*), though they are less common in the harsher higher elevations of the Reserve. Domesticated livestock are present on leased ranch lands.

While some invasive mammals, such as rats and mongooses, were not observed during the 2021 survey, it is likely that they occur in the lower elevations of the Reserve in the vicinity of human habitation. Two invasive ant species—Argentine ant (*Linepithema humile*) and the glaber ant (*Ochetellus glaber*)—occur at lower elevations. Absence of these ants at higher elevations possibly allows for the greater native insect diversity observed there. Also, garlic snails, which prey on smaller snails and serve as food for native moths, are present in the Reserve.

Potential Impacts and Mitigation Measures

Several aspects of the Management Plan under the Proposed Action could have both adverse and positive impacts on the native animal species. The following are proposed activities that have the potential to negatively impact native fauna:

- Construction of public amenities such as trails and comfort stations and associated use of a helicopter to transport construction material in the Reserve could temporarily displace native birds and the ʻōpeʻapeʻa.
- Under the Proposed Plan DOFAW will consider game bird hunting in the Reserve which has the potential to impact the Hawaiian goose, or nēnē.
- Control of non-native animals such as rats could include the use of rodenticides and other toxic baits which could potentially poison non-target animals.
- Increase in public access under the Proposed Action has the potential to cause inadvertent or intentional harm to native animals and their habitat in the Reserve through increased direct physical impacts as well as through carelessness, vandalism, fire or theft.
- Setting out traps to control small non-native mammals also has the potential to hurt non-target animal species.
- An increased presence of people in the Reserve can also increase the exposure of native animals to pests and diseases.

Because the above listed impacts are expected to be short in duration and localized, they are unlikely to have significant long-term impacts to native fauna. Furthermore, under the Proposed Action, DOFAW will take several conservation measures that are part of the Management Plan for Kamehamenui, are highly beneficial to native fauna, and are expected to avoid and minimize the potential negative impacts listed above:

- Under the Proposed Action, DOFAW will adopt landscape-level and long-lasting conservation measures such removing feral ungulates and enclosing the Reserve in an ungulate-proof fence, controlling the spread of invasive species, and re-establishing native forest cover on 75% of Kamehamenui FR through passive/natural restoration in addition to seeding and outplanting. These conservation measures are expected to have a significant and long-term beneficial impact on native fauna.
    - *Increase Habitat*—Recovery of native ecosystems in Kamehamenui will provide the appropriate and protected habitat not only for animals present in the Reserve but could also increase the overall habitat range of native birds and ʻōpeʻapeʻa in East Maui.
    - *Increase Food Sources*—Removal of feral ungulates will allow native understory plants and trees to regenerate, providing additional areas for birds to forage for fruit and nectar resources, and perpetuating the forest.
    - *Enhance Population*—Controlling non-native animals that predate on native birds will protect and contribute to enhancing their population locally as well as on Maui.

- Toxic bait, if used by DOFAW, will be used in accordance with the toxicant registration. DOFAW will use approved baits with a low toxicity to non-target wildlife such as birds and enclosed bait stations to limit the availability of bait blocks to rodents only. The

controls and practices will avoid impacts on endangered animal species as well as plants and water resources.

- DOFAW has extensive experience in predator control operations. Traps to capture non-native small mammals will be used judiciously. DOFAW will consider several factors such as the potential to impact native animals and proximity to public use areas when deploying traps and the traps will also be routinely monitored.
- To mitigate impacts to endangered birds and ʻōpeʻapeʻa from fence construction to the extent practical, construction activities and helicopter transport of fence materials will be scheduled before or after the peak breeding season for endangered forest birds (February through July). DOFAW will consult with USFWS on additional mitigation needed for endangered flora and fauna prior to project implementation, if the project is federally funded. In addition, DOFAW will avoid the use of barbed wire, which can entangle bats' wings and injure or kill them.
- Under the Proposed Action, DOFAW will periodically assess whether game bird hunting is sustainable in the Reserve and will close this activity if needed to protect native fauna. Hunter check-in stations will carry relevant information to inform hunters about the presence and movement of nēnē in the area.
- Potential negative impacts from proposed public use activities in the Reserve can be mitigated through education and enforcement. Public access can benefit the native forest by generating public awareness and support, promoting citizen monitoring of ecological conditions, and fostering professional and volunteer conservation efforts. Also, DOFAW will increase enforcement of FR Rules and applicable HAR to protect DOFAW infrastructure and State resources.

2.4.3 Pests and Disease

Existing Conditions

Rapid ʻŌhiʻa Death (ROD) is caused by two pathogenic fungi, *Ceratocystis lukuohia* and *C. huliohia*. It is a serious disease affecting ʻōhiʻa forest across Hawaiʻi Island, Oʻahu, Kauaʻi, and Maui, and hundreds of thousands of infected ʻōhiʻa trees have died. ROD has not been detected in the Kamehamenui FR but continues to remain a high priority threat. Storms and wind that wound trees increase infection risk. Ambrosia beetles can carry the fungus but are not the main vector. Hoofed animals (like pigs and cattle) may contribute by wounding trees or spreading spores in soil.

Koa wilt (*Fusarium oxysporum* f.sp *koae*; Foxy-koae) is a soil borne fungal disease that causes dieback and death of endemic koa trees. The fungus, which is thought to have been introduced through the planting of ornamental acacia (possibly *Formosa koa* or *Acacia confusa*), is now widely present in Hawaiian soils. *Fusarium oxysporum* (Foxy) is a common pathogen on many plant species worldwide, although the origin of Foxy-koae strains that are virulent to koa in Hawaiʻi is currently unknown (Dudley et al. 2017, Dobbs et al. 2019). Koa wilt has not been observed at Kamehamenui FR, probably due to the high elevation and relative cooler ambient

and soil temperatures. However, rising temperatures could facilitate the spread of this disease, impacting koa trees in the Reserve.

Mosquitos *Culex* spp. (especially *Culex quinquefasciatus*) are vectors for avian malaria. Hawai'i has lost nearly half of its native birds and diseases, particularly avian malaria, have contributed significantly to this decline. Many native birds are limited to higher elevations where temperatures are too cold for the life cycle of the malaria parasite and its principal mosquito vector, *C. quinquefasciatus*. Mosquitoes are probably present in the mid to lower elevations of Kamehamenui. Because of rising temperatures, their spread to the upper elevations of the Reserve where rare native birds occur is an increasing threat.

The two-line spittle bug (*Prosapia bicincta*), although not yet found in Kamehamenui, is a high priority pest for the Reserve due to the presence of pasture habitat. In Kona, Hawai'i Island, this species affected over 142,000 acres of kikuyu grass (*Cenchrus clandestinus*) by late 2018. This damage is leading to the spread of invasive weeds like pamakani, fireweed, and hilo grass. Because kikuyu grass is the most abundant species in the pasture habitat of Kamehamenui, the two-line spittle bug is of concern to the Reserve. While Kikuyu is a non-native species, it helps suppress more problematic weeds. However, widespread dieback caused by the spittle bug could disrupt this balance and pose ecological challenges for the Reserve.

Potential Impacts and Mitigation Measures

Several aspects of the Proposed Action have the potential to increase (negative) and decrease (positive) the risk of introducing and spreading pests and diseases in the Reserve. The following are some factors under the Proposed Action that could increase the likelihood of introducing and spreading pests and diseases:

- Construction of the ungulate-proof fence and various public use amenities such as trails, campsites, comfort stations, and parking areas could introduce pests and diseases via construction materials.
- Restoration activities that involve outplanting native plant species could introduce pests and diseases via seedlings (and associated soil) raised off site at local nurseries.
- Invasive species control efforts could inadvertently introduce pests and diseases via equipment that is not clean.
- Opening up the FR to public use for activities such as hiking, biking, camping, horseback riding, and game bird hunting (when allowed) can introduce pests and disease.

Under the Proposed Action, DOFAW will take several conservation measures that will avoid and minimize the introduction and spread of insects and disease in the Reserve. DOFAW's overall approach to mitigating the introduction and spread of insects and diseases will vary depending on potential impacts, the distribution of the insects/diseases in the FR, and available control methods. Approaches include:

- *Prevention*—As needed, DOFAW will implement biosecurity measures such as quarantines for organic materials, inspections of construction materials, and enforcing

intra-island policies, departmental and division policies and protocols, optional vs. mandatory restrictions to minimize the introduction and spread of invasive species. Also, DOFAW staff will adopt strategies such as disinfecting tools before use in the FR.

- *Early Detection and Rapid Response*—Early detection and rapid response is critical defense against the establishment of invasive pests and diseases. Under the Proposed Action, DOFAW will conduct periodic aerial and ground surveys as needed to detect the presence of new insect pests or pathogens. For example, DOFAW already conducts statewide aerial surveys for ROD symptomatic trees on Maui. Aerial surveys for east Maui and leeward Haleakalā are conducted quarterly, and thus, far there have not been any new detections of ROD on the island.
- *Containmen*t—DOFAW will adopt appropriate manual, chemical, biological, and mechanical methods to contain (that is to stop or minimize growth and/or geographic spread) a harmful pest or disease from spreading in the Reserve, particularly into areas with a high diversity of native species.
- *Eradicatio*n—If possible, DOFAW will use appropriate manual, chemical, biological, and mechanical methods to eliminate a pest or disease within Kamehamenui.
- *Control*—DOFAW will use appropriate manual, chemical, biological, and mechanical methods to control (that is to reduce populations and/or vigor of pests and diseases) the spread of insects and disease in the Reserve.
- *Public Education*—The increased likelihood of introducing a pest or disease from proposed public use activities in the Reserve can be mitigated through education and enforcement. DOFAW will use public access as a means to avoid and minimize the introduction and spread of pests or disease by generating awareness and support, promoting citizen monitoring of high priority pests and diseases, and fostering professional and volunteer conservation efforts. Also, DOFAW will increase enforcement of FR Rules and applicable HAR to protect DOFAW infrastructure and State resources.

2.4.4 Fire

Existing Conditions

The overall fire risk at Kamehamenui is moderate at lower elevations and transitions to low risk at higher elevations. Moderate fuel loads (31–70% vegetated), fuel structure that is contiguous with 6–12-inch grasses and light brush with few ladder fuels, and a moderate ignition risk due to proximity to roads and residential units are the main factors that contribute to the moderate fire risk rating at lower elevations in the Reserve (Hawai‘i Wildfire Management Organization 2016). In comparison, based on the same set of characteristics, the fire risk in the mid to upper elevations of Kamehamenui is considered to be lower. This is because these higher elevations are farther away from ignition sources such as roads and residential neighborhoods, and the vegetation also becomes sparser and more patchily distributed. Prevailing winds in the area make it difficult for wildfires to move upslope as well. In the north-south direction, the fire risk along the northern border of the Reserve is lower compared to the area along the southern

border. The difference in fire risk is due to the fact that the northern border is adjacent to a working private ranch that is covered with low growing and grazed grassland whereas the southern border is next to forested land in and surrounding the Kula FR.

Potential Impacts and Mitigation Measures

Wildfire poses a threat to the Reserve, particularly during times of drought and in areas adjacent to human activity. Some aspects of the Proposed Action can increase the fire risk in the Reserve while other proposed activities are expected to lower the overall fire risk at Kamehamenui. Proposed recreational activities such as hiking, biking, and camping under the Management Plan will attract visitors to the Reserve. Under uncertain weather conditions, catalytic converters, the hot surfaces of vehicles or heavy equipment, and illegal campfires could increase the risk of fires at Kamehamenui. However, because DOFAW will mitigate these risks under the Management Plan, they are not considered significant. DOFAW is responsible for fire protection within DOFAW lands and cooperates with the Hawai'i Fire Department and federal fire control agencies in developing plans, programs and mutual aid agreements for fire prevention on other lands. The following proposed actions by DOFAW under the Management Plan will lower the risk of wildfires at Kamehamenui:

- Implement several fire prevention, pre-suppression, and suppression measures at Kamehamenui such as installing water storage and dip tanks for use during wildfire suppression activities, implement fuel break/firebreak installation and maintenance projects around common ignition sites, proposed access points, and other potential high use areas, remove fire prone invasive trees and plant native species strategically in fuel break areas, identify potential sites for fuel grazing treatments/prescriptions, and explore feasibility of managed grazing and fuel treatments throughout the Reserve to limit potential fire spread and severity.
- Participate in specific target outreach activities as appropriate based on fire preparedness levels and post Smokey the Bear fire prevention signs at entrances/access points during high fire risk levels.
- Use fire-resilient native plant species where appropriate for restoration of the Reserve to stabilize soils following wildfires to prevent post-burn erosion.
- Install and utilize RAWS to monitor environmental conditions relating to forest health.

2.5 Access, Parking, and Traffic

2.5.1 Existing Conditions

Route 377 or Kekaulike Avenue runs along the western border of Kamehamenui FR. However, at present, there is no public access to the Reserve from this highway (Figure 7). Kekaulike Avenue is a major collector which provides north-south access and mobility in Upcountry Maui. Route 377 originates at its north intersection with Route 37 (Kula Highway) as Haleakalā Highway. Haleakalā Highway travels east before turning south around milepost (M.P.) 2. It continues south, parallel to Kula Highway, before becoming Kekaulike Avenue at M.P. 5.972 at its

intersection with Crater Road. Kekaulike Avenue terminates at its south intersection with Kula Highway at M.P. 9.137. Kekaulike Avenue is a two-lane, undivided roadway in the vicinity of the Reserve and the posted speed limit is 30 miles per hour. There is no legal parking available along Kekaulike Avenue for public to access Kamehamenui FR. Table 4 provides the peak hour traffic volume for Kekaulike Avenue obtained from Traffic Station 37707 for the year 2022; it averages to approximately 1 vehicle in each direction per minute.

There is also no legal public access to the Reserve through the adjacent private lands of the Haleakalā Ranch Company to the north or through the federal lands of the Haleakalā National Park to the east. The mauka fenced portions of Kamehamenui FR can be accessed from the adjacent Kula FR at the southern boundary from the #5 Forest Access Road.

Table 4. Existing Peak Hour Traffic Volumes at Kekaulike Avenue at Milie Post 7.38

Year	South Bound (Vehicles per Hour)	North Bound (Vehicles per Hour)
Weekday Morning Hours	49	49
Weekday Afternoon Hours	51	63
Saturday Peak Hour	60	57

2.5.2 Potential Impacts and Mitigation Measures

Some aspects of the Proposed Action, while improving access to the Reserve, have the potential to negatively affect parking and traffic in the vicinity of Kamehamenui. This is because under the Proposed Action, the new Reserve will offer a suite of managed public recreational activities (also see Section 2.6) such as hiking, biking, camping, horseback riding, archery, and game birds hunting (if determined to be safe and not impacting conservation efforts). Because of these proposed recreational amenities, Kamehamenui FR is expected to be popular for public recreation attracting both residents as well as visitors to Maui. Also, because Kekaulike Avenue runs along the western border of Kamehamenui, the Reserve will be an accessible public use areas that offers a wide range of recreational amenities. An overarching mitigative measure that DOFAW will take to mitigate Proposed Actions regarding access, parking, and traffic is to manage levels of visitor use consistent with the capacity for the Reserve to support those uses, which is estimated to be approximately 180 visitors per day.

For the reasons discussed below, despite an expected demand for visits to the Kamehamenui FR, no significant impacts are expected regarding access, parking, and traffic in the vicinity of the Reserve and a positive impact is anticipated on access to and within the Reserve.



Figure 7. Existing Access and Infrastructure at Kamehamenui

Multiple Entrances

Under the Proposed Action, there will be a positive impact on access to Kamehamenui because there will be dispersed points of entry to the Kamehamenui FR.

- Kekaulike Avenue (north access point)—Located on Kekaulike Avenue around M.P. 6.8, south of Kamehameiki Street. This driveway will lead approximately 0.5 miles up Haleakalā to an approximate 40-vehicle capacity parking lot which is screened from Kekaulike Avenue and residences by eucalyptus trees.
- Kekaulike Avenue (south access point)—Located on Kekaulike Avenue approximately 100 ft north of Ioio Place. This driveway will lead to a smaller 5–10 standard vehicle capacity parking lot along with 10 additional equestrian parking stalls.
- Kula FR Access—The #5 Forest Access Road gate will be left open, allowing for a direct connection between the Kula FR and Kamehamenui and direct access to the upper Phase I Area and the mid-elevation Phase II Area of the Reserve.
- A fourth access point from Haleakalā's summit may be added in the future.

These multiple entrances under the Proposed Action will significantly improve access to not only Kamehamenui FR but also to the neighboring Kula FR.

Separate Parking Areas

Under the Proposed Action, the two main access points from Kekaulike Avenue will lead to separate parking areas. The north access point leads to a proposed approximate 40-car parking area and an additional small parking area for up to five cars designated for users of the archery range. The south access point leads to a 5–10 car parking area and another parking area designated for up to ten equestrian stalls. Having multiple parking areas from separate access points will alleviate potential issues related to access and parking at Kamehamenui FR.

Parking Restrictions

DOFAW will work with the Hawai'i Department of Transportation to address potential parking issues along Kekaulike Avenue by designating the shoulder of the road section as a 'No Parking' zone. The public will also be allowed to park along the shoulder area along the #5 Forest Access Road near the boundary between the Kamehamenui and Kula FRs as long as vehicles do not block access. If necessary, under the Management Plan for Kamehamenui, DOFAW will implement a reservation and fee system to manage capacity issues in the parking area. DOFAW will also continue to look at other means to prevent and deter unwanted parking along Kekaulike Avenue to minimize impacts of the Proposed Action. Implementation of such parking restrictions will significantly alleviate potential issues related to access and traffic congestion under the Proposed Action.

Traffic Analysis

Historical data obtained from the Traffic Station 377073 indicates that there was no growth in the Annual Average Daily Traffic on Kekaulike Avenue from 2016 to 2020 (Table 5). Nonetheless,

a 1% annual growth rate was assumed to estimate the future traffic growth between 2022 and 2025. The 1% annual growth rate was applied to the existing 2022 peak hour traffic volumes (shown above in Table 4) to obtain projected 2025 background traffic volumes. Trips to Kamehamenui FR were estimated based on conversations with DOFAW and comparisons with Makawao FR, Maui's most popular reserve, providing 2000 acres of hiking trails and allowing mountain bikes and equestrian uses. Two parking lots are provided, containing a total of approximately 45 parking stalls. Users tend to stay 2-4 hours and the parking lots are generally 70% full throughout the day. Based on this data, 15 vehicles in and 15 vehicles out per day were assumed for the north access of Kamehamenui FR and 4 vehicles in and out were assumed for the south access of Kamehamenui FR.

Table 5. Historical Annual Average Daily Traffic at Kekaulike Avenue at Milepost 7.38

Year	Annual Average Daily Traffic
2016	1109
2017	1067
2018	1101
2019	1065
2020	927

The two Kamehamenui access points were analyzed in Synchro 11 using the methodologies for unsignalized intersections outlined in the Highway Capacity Manual 6th Edition (see Appendix II of this document for details). Operating conditions at an intersection by approach are expressed as a qualitative measure known as Level of Service (LOS) ranging from A to F. LOS A represents free-flow operations with short delays, while LOS F represents congested conditions with relatively long delays. Results show that the left and right turns out of the two Kamehamenui driveways are projected to operate at LOS A during all analysis periods. In addition, the southbound Kekaulike Avenue approaches are also projected to operate at LOS A during all analysis periods. Based on the traffic analysis, the Proposed Action will not significantly impact traffic operations on Kekaulike Avenue.

2.6 Infrastructure and Pubic Use Opportunities

2.6.1 Existing Conditions

Existing infrastructure at Kamehamenui (Figure 7) includes:

- A newly built ungulate-proof fence enclosing 2,210 acres of the uppermost elevations of the Reserve.
- Two private residences (including the historic von Tempsky home) in the western area, which are not part of Kamehamenui FR.
- Three above-ground water storage tanks in the central and eastern part of the Reserve.
- Infrastructure associated with historic and current ranching:

- Two sheds (built in 1947 and 1952)
- Two redwood water tanks (from 1952 and 1980)
- Additional ranch infrastructure: small water pump sheds, more water tanks, a historic 1926 silo, and two corrals

At present, there are no improvements for public use opportunities (hiking, biking, horseback riding, camping etc.) at Kamehamenui. Game species include axis deer, feral pigs, goats, and several game birds. Hunting is presently restricted to the leaseholder under an existing grazing and hunting lease. Regarding gathering, non-timber forest products (e.g., flowers, fruits, ferns) may be collected in the upper portion of the Reserve with either a free personal collection permit or a paid commercial harvest permit.

2.6.2 Potential Impacts and Mitigation Measures

In the management plan for Kamehamenui, DOFAW has proposed several recreational activities such as hiking, biking, camping, and horseback riding. As a result of proposed public use amenities, there will be an increase in the number of people using the Reserve. A potential negative impact to the existing ungulate-proof fence from the Proposed Actions could be vandalism, for example it is possible that someone cuts an opening into the fence for easy access. The increase in the number of visitors to the Reserve also increases the chances of historic infrastructure being vandalized or mutilated. Under the Proposed Action, the private residence which shares its border with the Reserve could potentially experience some vandalism as the recreational activities proposed in the surrounding Reserve will attract visitors. Such negative impacts to the existing infrastructure, however, can be discounted as infrequent and will be mitigated. As needed DOFAW will increase enforcement of FR Rules and applicable HAR to protect DOFAW infrastructure. Under the Proposed Action, DOFAW also proposes to secure funding for additional nighttime surveys and patrols, periodically evaluate the parking situation, and modify or enforce rules to prevent disruption to neighboring community. DOFAW also plans to adjust the timing of actions (e.g., open/close dates, road or trail closures, special use permits) to minimize risk to the infrastructure and the public. Overall mitigative actions will also include installing information signs as needed to increase public awareness and deter nuisance and illegal activities. Therefore, the impacts to existing infrastructure in Kamehamenui will not be significant.

As there are no existing recreational activities in Kamehamenui no impacts are anticipated. There will be no short-term negative impacts to the recreational hunting lease restricted to the leaseholder under an existing grazing and hunting lease until the lease expires in 2030.

The Proposed Actions are expected to have a positive impact on gathering of non-timber forest products since the Management Plan for Kamehamenui aims to restore 75% of the Reserve to native forest cover. Recovery of native forests would provide native Hawaiian practitioners and gatherers more native plants to gather from as well as make these resources more accessible.

2.7 Social and Economic Conditions

2.7.1 Existing Conditions

There are two privately owned residential properties (TMK Nos.: [2] 2-3-005: Parcels 007 and 008) that were not acquired by the State and are not part of the Kamehamenui FR. There are also several residences outside of the Reserve west of Kekaulike Avenue that forms the western border of the FR and a few residences outside in the southwestern portion outside of the Reserve along Copp Road. There are no commercial areas within the Reserve. The Haleakalā Ranch Company is the largest local business and is located along the northern border of Kamehamenui FR.

2.7.2 Potential Impacts and Mitigation Measures

The two private properties located in the Reserve could potentially be affected by the Proposed Actions in the Reserve. Positive impacts on these properties include assurance that no development and no commercial activities in the immediate surroundings on FR lands would occur, assurance that scenic views surrounding their property would be preserved, and elimination of incursion from feral ungulates such as pigs and deer. Potential negative impacts to these properties include increased human activity around the property due to the recreational activities proposed for Kamehamenui FR and associated vandalism. Another potential negative impact could be an increased risk of fire due to an increase in human activity because of proposed recreational opportunities in the Reserve. Because these potential negative impacts can be mitigated, they are not considered to be significant. Under the Proposed Action DOFAW will manage and monitor vehicles, access, infrastructure, and amenities. The proposed trails for hiking, biking, and horseback riding can be set back far away from the residences to minimize interference. Similarly, the parking areas and the archery range can be situated to minimize obstructing views and minimize noise in the surrounding area. Under the Proposed Action there will be law enforcement presence to enforce rules pertaining to the Reserve. To minimize fire risk in the vicinity of the private properties, DOFAW will revegetate with and maintain fire-resistant native plant species.

Potential effects on the Haleakalā Ranch Company business next to the northern border of Kamehamenui FR also can be positive and negative, similar to the potential effects on the private properties. Positive effects include assured no development and no commercial activities in the south and assured scenic views south of their property, and no incursion from feral ungulates such as pigs and deer from the southern border. Potential negative impacts could be increased trespassing due to the proposed recreational activities at the Reserve and increased fire risk due to increased human presence. Under the Proposed Action, DOFAW will manage and monitor vehicles, access, infrastructure, and amenities, the potential negative impacts can be mitigated for and therefore are not considered to be significant. For example, DOFAW will work with Haleakalā Ranch to resolve issues related to trespassing and access. DOFAW will employ grazing along the northern border to maintain fuel break between the Reserve and Haleakalā Ranch.

2.8 Scenic Resources

2.8.1 Existing Conditions

Kamehamenui FR is situated along the western slopes of Haleakalā Volcano. The gradual sloping terrain of the Reserve offers spectacular views of the summit of Haleakalā anywhere from the mid to lower elevation areas including Kekaulike Avenue that runs along the western border. The mid to upper elevation of Kamehamenui offer spectacular views of central Maui down to the coastline and the Pacific Ocean, the Kula FR to the south, and the rolling pastures of the Haleakalā Ranch to the north. The scenic natural beauty of the Reserve includes the striking contrast between open lava and cinder with little to no vegetation in the uppermost elevations, shrublands and grasslands below, and mesic forests in the shallow to deep gullies that run along the gradual slope of the Reserve.

2.8.2 Potential Impacts and Mitigation Measures

Implementation of the Management Plan would help restore and preserve the native vegetation of the Reserve, one of the contributing scenic elements. It would also provide additional access and trails and other facilities to enable users to enjoy different vantages and vistas.

Habitat protection and restoration measures under the Proposed Action are expected to enhance the scenic elements of the Reserve from up close as well as afar. Recovery of native plants in the upper elevation will over time replace an eroded landscape with scattered dead native trees to one that has intact soil supporting healthy native plants. Revegetating the lower to mid elevations with native plants will restore the “mauna lei,” or the band of native forests, on Haleakalā and is also expected to contribute to the scenic value of the Reserve. A forested landscape is likely to attract native wildlife which will also add to the enjoyment of the Reserve.

Several recreational activities and supporting amenities proposed for Kamehamenui, such as creating parking areas, can potentially interfere with the scenic view of Kamehamenui. However, parking areas are unlikely to have a significant impact on the scenic resources of Kamehamenui with planned mitigation in place. For example, DOFAW will strategically locate the parking areas behind a row of tall trees or revegetate around the parking area so that the parking lot will not interfere with scenic views. As for camping, the five campsites will be spread out across the mid to upper elevations and will also be strategically and esthetically situated to not hinder scenic views. The Proposed Action would also provide additional access points, trails, and other facilities to enable users to enjoy different vistas at Kamehamenui.

2.9 Secondary and Cumulative Impacts

Secondary impacts occur when a project induces physical and social impacts that are only indirectly related to the Project. For example, infrastructure expansion projects frequently involve secondary impacts, as they create opportunities for additional development. Large natural area projects, such as the creation of a National Park, can induce substantial population

influx, economic activity, and demand for local services. Few if any secondary impacts are expected from the Proposed Action of implementation of the Kamehamenui FR Management Plan. This is because the Proposed Action is mostly focused on habitat and watershed protection and enhancement. The recreational activities under the Proposed Action may draw more visitors but the magnitude of these effects will be small and no substantial demand on new services is expected.

Cumulative impacts are effects on the environment that result from the incremental impact of a project when added to past, present, and reasonably near future actions of any government or private entity. Cumulative impacts can result from individually minor but collectively significant projects taking place over a period. There are no new FRs proposed, however, there are large tracts of federal, state, and private lands in the vicinity of Kamehamenui FR in East Maui, e.g., the Kula FR, Nakula Natural Area Reserve, Kahikinui FR, Haleakalā National Park, Haleakalā Ranch, TNC Preserve, and the Makawao FR. These lands and several smaller private lands are also part of the East Maui Watershed Partnership. Resource management activities implemented by these landowners in the past, present, and that are likely to continue in the foreseeable future include habitat protection, restoration of degraded areas, clearing vegetation to install fences, control of invasive plants and animal species, recovery of T&E species, cultural resource protection, managing fuel loads, and supporting sustainable recreational activities. The incremental effects of the Proposed Action when added to the past, present, and foreseeable future effects from management actions by these landowners will likely result in cumulative beneficial effects on soils, aquifers, and natural and cultural resources. For example, habitat protection will lead to increased species diversity and ecosystem resilience; restoring degraded areas will improve watershed function, aquifer recharge, and enhance ecological connectivity; controlling invasive species will enhance the recruitment and spread of native species; and sustainable recreational opportunities and outdoor educational programs will raise awareness and foster stewardship. Potential negative cumulative effects include increased infrastructure developments such as trails, signage, and comfort stations at campsites, which could lead to increased habitat disturbance, littering, and wildlife stress. However, such impacts are either short-term or can be managed and, therefore, are not considered significant.

Section 3.0 CONSISTENCY WITH GOVERNMENT PLANS AND POLICIES

This section describes state and local government plans and policies that are directly relevant to the Project (i.e., implementation of the Management Plan). A brief discussion follows each policy description to illustrate the Project's consistency with state and local government plans and policies.

3.1 Hawai‘i State Plan

The Hawai‘i State Plan (HSP) (State of Hawai‘i 1986), which is a long-range comprehensive plan that includes an overall theme, goals, objectives, policies, priority guidelines, and implementation mechanisms. The HSP acts as a roadmap for long-term state development, setting goals, policies, and priorities. It also aids in resource allocation, enhances coordination among federal, state, and county plans and programs, and establishes a systematic approach to integrate major State and County activities.

Relevant HSP objectives and policies are listed below in italics with discussion following.

Section 226-4: *In order to guarantee, for present and future generations, those elements of choice and mobility that ensure that individuals and groups may approach their desired levels of self-reliance and self-determination, it shall be the goal of the State to achieve: ... (2) a desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.*

Discussion: The Project is consistent with this overall State goal as it will help to maintain a stable natural system.

The “overall direction” of the HSP states that: *The State shall strive to improve the quality of life for Hawai‘i’s present and future population through the pursuit of desirable courses of action in five major areas of statewide concern which merit priority attention: economic development, population growth and land resource management, affordable housing, crime and criminal justice, and quality education.*

Discussion: One of the main purposes of this project is to manage land resources, namely native forests that are in decline due to impacts from feral ungulates and invasive species. Additionally, the Project seeks to improve the watershed functions dependent on proper land management. As such, the Project is consistent with this overall direction of the HSP.

Sections of the HSP most relevant to this project are those centered on the theme of the physical environment, Sections 226-11, 226-12, and 226-13.

Section 226-11 regarding land-based, shoreline and marine resources in the physical environment:

Planning for the State’s physical environment with regard to land-based, shoreline and marine resources shall be directed towards achievement of the following objectives: (1) prudent use of Hawai‘i’s land-based, shoreline and marine resources and (2) effective protection of Hawai‘i’s unique and fragile environmental resources.

To achieve these objectives, the HSP notes it shall be the policy of the state to:

- *Exercise an overall conservation ethic in the use of Hawai‘i’s natural resources.*

- *Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.*
- *Manage natural resources and environs to encourage their beneficial and multiple use without generating costly or irreparable environmental damage.*
- *Encourage the protection of rare or endangered plant and animal species and habitats native to Hawai'i.*
- *Pursue compatible relationships among activities, facilities, and natural resources.*
- *Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational, and scientific purposes.*

Discussion: The Project embodies a strong conservation ethic by prioritizing the protection and restoration of native ecosystems and species. It promotes the sustainable use of natural resources through activities that are ecologically compatible and avoids long-term environmental harm. The plan supports the preservation of rare and endangered Hawaiian flora and fauna, while encouraging multiple, beneficial uses of the land, including recreation, education, and scientific research. By enhancing public access and fostering community involvement, the Project ensures that inland resources are used responsibly and remain accessible for future generations, aligning land-based activities with the broader ecological health of the region.

Section 226-12 regarding the scenic, natural beauty, and historic resources of the physical environment:

Planning for the State's physical environment shall be directed towards achievement of the objective of enhancement of Hawai'i's scenic assets, natural beauty, and multi-cultural/historical resources. To achieve that objective, it shall be the policy of this State to:

- *Promote the preservation and restoration of significant natural and historic resources.*
- *Provide incentives to maintain and enhance historic, cultural, and scenic amenities.*
- *Promote the preservation of views and vistas to enhance the visual and aesthetic enjoyment of mountains, ocean, scenic landscapes, and other natural features.*
- *Protect those special areas, structures, and elements that are an integral and functional part of Hawai'i's ethnic and cultural heritage.*

Discussion: The Project is designed to preserve and restore the area's significant natural and cultural resources, ensuring that both ecological integrity and historical value are maintained. The Project includes measures to protect scenic vistas and landscapes, enhancing the visual and aesthetic experience of the region's mountains, forests, and open spaces. It also supports the conservation of culturally significant sites and features that reflect Hawai'i's rich ethnic heritage. By encouraging community engagement and stewardship, the Project provides incentives to maintain and celebrate the Reserve's historic, cultural, and scenic assets for future generations.

Section 226-13 regarding land, air and water quality of the physical environment:

Planning for the State's physical environment with regard to land, air, and water quality shall be directed towards achievement of the following: (1) Maintenance and pursuit of improved quality in Hawai'i's land, air, and water resources, and (2) Greater public awareness and appreciation of Hawai'i's environmental resources.

To achieve those objectives, it shall be the policy of the State to:

- *Foster educational activities that promote a better understanding of Hawai'i's limited environmental resources.*
- *Promote the proper management of Hawai'i's land and water resources.*
- *Reduce the threat to life and property from erosion, flooding, tsunamis, hurricanes, earthquakes, volcanic eruptions, and other natural or man-induced hazards and disasters.*
- *Foster recognition of the importance and value of the land, air and water resources to Hawai'i's people, their cultures and visitors.*

Discussion: The Project will support educational initiatives that deepen public understanding of Hawai'i's limited and precious environmental resources. Through responsible stewardship of land and water, the plan promotes sustainable resource management practices that help mitigate risks from natural and human-induced hazards such as erosion and fire. By preserving the integrity of the forest's ecosystems and promoting awareness of their cultural and ecological value, the Project fosters a broader recognition of the essential role that Hawai'i's land, air, and water resources play in the lives of residents, cultural traditions, and the visitor experience.

Other sections of the HSP relevant to this project are those centered on the theme of socio-cultural advancement.

Section 226-25 dealing with culture:

Planning for the State's socio-cultural advancement with regard to culture shall be directed toward the achievement of the objective of enhancement of cultural identities, traditions, values, customs, and arts of Hawai'i's people.

To achieve the objective, it shall be the policy of this State to:

- *Foster increased knowledge and understanding of Hawai'i's ethnic and cultural heritages and the history of Hawai'i.*
- *Support activities and conditions that promote cultural values, customs, and arts that enrich the lifestyles of Hawai'i's people and which are sensitive and responsive to family and community needs.*
- *Encourage increased awareness of the effects of proposed public and private actions on the integrity and quality of cultural and community lifestyles in Hawai'i.*

Section 226-23 regarding leisure and sociocultural advancement:

Planning for the State's socio-cultural advancement with regard to leisure shall be directed towards the achievement of the objective of the adequate provision of resources to accommodate diverse cultural, artistic, and recreational needs for present and future generations.

To achieve the leisure objective, it shall be the policy of the State to:

- *Promote the recreational and educational potential of natural resources having scenic, open space, cultural, historical, geological, or biological values while ensuring that their inherent values are preserved.*
- *Ensure opportunities for everyone to use and enjoy Hawai'i's recreational resources.*
- *Assure the availability of sufficient resources to provide for future cultural, artistic, and recreational needs.*
- *Assure adequate access to significant natural and cultural resources in public ownership.*

Section 226-27 pertaining to government and socio-cultural advancement:

Planning the State's socio-cultural advancement with regard to government shall be directed towards the achievement of efficient, effective, and responsive government services at all levels in the State.

To achieve that objective, it shall be the policy of this State to:

- *Provide for necessary public goods and services not assumed by the private sector.*

Other relevant portions of the sections pertaining to socio-cultural advancement include Section 226-20, which calls for the fulfilling of basic individual health needs and maintaining environmentally healthful conditions in Hawai'i's communities through the prevention of contamination by pesticides and other potentially hazardous substances; and Section 226-21, which seeks the promotion of educational programs which enhance understanding of Hawai'i's cultural heritage. Also applicable is Section 226-8, objective and policies for the economy as it involves the visitor industry, which calls for the fostering of an understanding by visitors of the aloha spirit and of the unique and sensitive character of Hawai'i's culture and values.

Discussion: The Project will actively support the preservation and celebration of Hawai'i's rich cultural heritage by fostering educational programs that deepen understanding of the islands' history, values, and traditions. The plan encourages volunteer and community-based activities that reflect and sustain local customs and family-centered values, while promoting respectful visitor engagement with the aloha spirit and Hawai'i's unique cultural identity. By enhancing access to natural and cultural resources, the Project ensures inclusive recreational and educational opportunities for residents and visitors alike. It also safeguards scenic, biological, and historical features, ensuring their long-term availability for cultural, artistic, and recreational needs.

3.2 Hawai‘i FR Laws, Regulations, and Policies

2024 Hawai‘i Revised Statues. Title 12. Conservation and Resources, Chapter 183, Part II, FRs (DLNR).

The FR System is managed under the guidance of the Hawai‘i State Constitution, HRS (Chapter 183). This law provides for the establishment and maintenance of FRs and directs the department to carry out programs and actions for their sustainable management.

§183-1.5 Duties in general. *The Department shall:*

(3) Have the power to manage and regulate all lands which may be set apart as FRs

(4) Devise ways and means of protecting, extending, increasing, and utilizing the forests and FRs, more particularly for protecting and developing the springs, streams, and sources of water supply to increase and make that water supply available for use

(5) Devise and carry into operation, ways and means by which forests and FRs can, with due regard to the main objectives of title 12, be made self-supporting in whole or in part

§183-19 Exclusion of livestock from FRs, game management areas, public hunting areas, and natural area reserves; notice. *When branded wild cattle or horses are found on any forest land, game management area, public hunting area, or natural area reserve in the State, which land is duly set apart and established as an FR, game management area, public hunting area, or natural area reserve, or if the land is privately owned and surrendered as defined in section 183-15, the department, in all cases where the land is so set apart and established as an FR, game management area, public hunting area, or natural area reserve, whether from privately owned lands or public lands, may remove, shoot, or destroy the cattle or horses without compensation to the owner, after thirty days' public notice of the intended action in the county where the cattle or horses are found*.

Discussion: The Project has been specifically designed to fulfill and be consistent with all aspects of Chapter 183, Part II, including the sections cited above.

DOFAW Management Guidelines

DOFAW has a set of Management Guidelines that the Division uses to balance desired levels of human activities on DOFAW managed lands. DOFAW periodically revisits these guidelines and updates them as needed. The guidelines emphasize the following four program areas that have potentially conflicting and compatible resource demands or user groups: Conservation Resources, Hunting Management, Recreation Management, and Forest Products Management. Current management guideline maps show classification of native vegetation according to its relative intactness and habitat quality, and recommended levels of human use within these vegetation classifications for outdoor recreation, forest products, and game management and hunting. Appendix G of the Management Plan (Appendix I of this document) contains a detailed assessment, and Section 5.3 of the Management Plan includes maps illustrating the

development of the Management Plan with respect to the objectives related to each classification. In short, the permitted activities in the Plan have been designed to be consistent within each classification. It should be noted that although nearly half of Kamehamenui is composed of pasture/grassland with limited native biological resources, it has the potential for habitat reforestation for native plant and animal species while also allowing for sustainable recreational opportunities.

3.3 State Wildlife Action Plan

The State Wildlife Action Plan (SWAP) (DLNR 2015) details the strategy and plans of the DLNR and its partners to address the conservation needs of over 10,000 species native to Hawai'i. Native species in Hawai'i, nearly 10,000 of which are found are found nowhere else on earth, continue to face tremendous challenges due to habitat loss, the introduction of non-native invasive species, and the adverse effects of climate change. More than half of native habitats have been lost, and the introduction of non-native plants, animals, and diseases—such as miconia, coqui frog (*Eleutherodactylus coqui*), and West Nile virus—constitute an ongoing threat to native animals. In order to continue to receive funds for SWAP projects under the USFWS State Wildlife Grant program, each state must maintain an updated SWAP document and include the following eight required elements:

1) *Information on the distribution and abundance of species of wildlife identified as "Species of Greatest Conservation Need," including low and declining populations, as the state fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the state's wildlife;*
2) *Descriptions of the locations and relative condition of key habitats and community types essential to the conservation of species identified in (1);*
3) *Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats;*
4) *Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions;*
5) *Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions;*
6) *Descriptions of procedures to review the plan at an interval not to exceed ten years;*
7) *Plans for coordinating the development, implementation, review, and revision of the plan with federal, state, and local agencies and Indian tribes that manage significant land and water areas within the state or administer programs that significantly affect the conservation of identified species and habitats; and*
8) *Provisions to ensure public participation in the development, revision, and implementation of projects and programs.*

SWAP comprehensively outlines a statewide strategy for conserving native wildlife species, encompassing species found from the mountains to the seas, and from the Northwestern Hawaiian Islands to the Main Hawaiian Islands. This plan assesses threats to species and their habitats and conservation needs at three levels: statewide, island-wide, and taxa-specific. To address these threats, the SWAP identifies multiple strategies to implement the following seven priority conservation objectives for the state:

1) *Maintain, protect, manage, and restore native species and habitats in sufficient quantity and quality to allow native species to thrive;*
2) *Combat invasive species through a three-tiered approach combining prevention and interdiction, early detection and rapid response, and ongoing control or eradication;*
3) *Develop and implement programs to obtain, manage, and disseminate information needed to guide conservation management and recovery programs;*
4) *Strengthen existing and create new partnerships and cooperative efforts;*
5) *Expand and strengthen outreach and education to improve understanding of our native wildlife resources among the people of Hawai'i;*
6) *Support policy changes aimed at improving and protecting native species and habitats; and*
7) *Enhance funding opportunities to implement needed conservation actions.*

Discussion: Successful implementation of the SWAP includes efforts by the State in partnership with private and other government parties to manage its FRs and protect native habitat and watershed functions. The Project is specifically designed to accomplish these objectives and is fully consistent with the SWAP.

3.4 Maui County General Plan

The Maui County 2030 General Plan (County of Maui 2010), specifically the Countywide Policy Plan, is a long-term, comprehensive framework that guides the physical, economic, environmental, and cultural development of Maui County through the year 2030. Adopted in 2010, it serves as the foundation for the Maui Island Plan and the nine Community Plans. Key Goals of the Countywide Policy Plan include:

- Protecting the Natural Environment: Safeguarding ecosystems, natural resources, and scenic beauty.
- Preserving Local Cultures and Traditions: Supporting cultural heritage, values, and practices.
- Improving Education: Enhancing educational opportunities and facilities.
- Strengthening Social and Healthcare Services: Ensuring access to essential services for all residents.
- Expanding Housing Opportunities: Promoting affordable and diverse housing options.
- Strengthening the Local Economy: Supporting sustainable economic development.

- Improving Parks and Public Facilities: Enhancing recreational and community infrastructure.
- Diversifying Transportation Options: Promoting accessible and sustainable transportation.
- Improving Physical Infrastructure: Upgrading utilities and public works.
- Promoting Sustainable Land Use and Growth Management: Encouraging smart growth and resource conservation.
- Striving for Good Governance: Ensuring transparency, accountability, and community engagement in decision-making.

Discussion: The Project directly supports several key goals of the Maui County 2030 General Plan by promoting environmental stewardship, cultural preservation, and community well-being. Through the protection and restoration of native ecosystems, the Kamehamenui Management Plan advances the goal of safeguarding Maui's natural resources and scenic beauty. It also fosters educational and recreational opportunities that align with the County's vision for lifelong learning and public engagement. By enhancing access to public lands and encouraging community participation in conservation efforts, the Plan contributes to sustainable land use, cultural enrichment, and the overall quality of life for residents and visitors alike.

3.5 Makawao-Pukalani-Kula Community Plan

The Makawao-Pukalani-Kula Community Plan is one of nine regional plans under the Maui County General Plan. Each regional community plan provides recommendations concerning land use, density and design, transportation, community facilities, infrastructure, visitor accommodations, commercial and residential areas and other matters related to development that are specific to the region of the plan. The Project is situated in Kula and the community plan relevant to this project is the Makawao-Pukalani-Kula Community Plan. Originally adopted in 1987 and updated in 1996, the Makawao-Pukalani-Kula Community Plan provides a framework for guiding land use, development, and resource management in the Upcountry region of Maui. The Makawao-Pukalani-Kula Community Plan reflects the unique character, values, and needs of the Makawao, Pukalani, and Kula communities, and aligns with the broader goals of the Maui County General Plan to ensure sustainable and community-driven growth.

Key goals of the Makawao-Pukalani-Kula Community Plan include:

- Preserving the rural character of the region while accommodating responsible growth.
- Protecting natural and cultural resources, including native ecosystems, agricultural lands, and historic sites.
- Enhancing infrastructure and public services, such as transportation, water, and waste management.
- Supporting economic vitality through diversified agriculture, small businesses, and sustainable tourism.

- Promoting community well-being by improving access to housing, education, healthcare, and recreational opportunities.
- Encouraging public participation in planning and decision-making processes.

Discussion: The Project aligns closely with the goals of the Makawao-Pukalani-Kula Community Plan by preserving the region's rural character and protecting its natural and cultural resources. Through native forest restoration, invasive species control, and habitat conservation, the Kamehamenui Management Plan safeguards the ecological integrity of Upcountry Maui. It also enhances public access and recreational opportunities, supporting community well-being and encouraging outdoor education. By promoting sustainable land use and fostering community involvement, the Kamehamenui Management Plan contributes to the long-term vitality of the region while honoring the agricultural heritage and scenic landscapes of Kamehamenui.

3.6 Federal and State Endangered Species Laws and Plans

The federal ESA of 1973, as amended (16 USC 1531-1544), and the State's Chapter 195D, HRS, provide protection for T&E plant and animal species. These laws jointly provide a program for the conservation of T&E plants and animals and the habitats in which they are found. The lead federal agencies for implementing the ESA are USFWS and the National Oceanic and Atmospheric Administration National Marine Fisheries Service (jointly referred to here as the Services). USFWS maintains a worldwide list of endangered species including birds, insects, fish, reptiles, mammals, crustaceans, and plants.

The federal ESA requires federal agencies, in consultation with the Services, to ensure that actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of any listed species or result in the destruction or adverse modification of designated critical habitat. The law also prohibits any action that causes a "taking" of any listed species of endangered fish or wildlife. Likewise, the import, export, interstate and foreign commerce of listed species are all prohibited. State laws also prohibit the taking of endangered species.

In addition, the ESA requires the federal government to designate "critical habitat" for any listed species. Critical habitat is defined as specific areas within the geographical area occupied by the species at the time of listing that contain physical or biological features essential to the conservation of the species as well as features and areas that require special management considerations or protection. The Services may also require protection of specific areas outside the geographical area occupied by the species if the agency/agencies determines that the area is essential for conservation of the species.

The Services also prepare, in consultation with other agencies and organizations, recovery plans and follow-up 5-year review plans for individual species or groups of species that spell out the measures necessary to recover the populations of threatened or endangered species. Section 4(f) of the ESA directs the Services to develop and implement recovery plans for T&E species, unless such a plan would not promote conservation of the species. These plans include a description of site-specific management actions necessary to achieve recovery of the species; objective and measurable criteria which, when met, would result in a determination that the

species be removed from the list; and estimates of the time and costs required to achieve the plan's goal. Many recovery plans are written and sometimes guided by recovery teams.

The Kamehamenui FR Management Plan was developed in consideration of, and is highly consistent with, the intent of recovery plans and critical habitat designations listed in Table 6.

Table 6. U.S. Fish and Wildlife Service (USFWS) Critical Habitat Designations, Recover Plans, and 5-Year Review Plans for Listed Taxa Associated with Kamehamenui

USFWS Recovery Plan for the Hawaiian Hoary Bay (1998)	Identifies threats and discusses management of populations of the Hawaiian hoary bat; https://ecos.fws.gov/docs/recovery_plan/980511b.pdf
USFWS Revised Recovery plan for Hawaiian Forest Birds (2006)	Discusses recommendations for management ʻākohekohe or crested honeycreeper and kiwikiu or Maui parrotbill; https://www.fws.gov/sites/default/files/federal_register_document/E6-15950.pdf
USFWS Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokaʻi, Lānaʻi, Maui, and Kahoʻolawe for 135 species (2016)	Discusses management actions for the benefit and recovery of Haleakalā silversword, koʻkoʻlau, Hawaiian red-flowered geranium, nohoanu, *Phyllostegia bracteate*, *Schiedea haleakalensis*, and aʻe; https://www.fws.gov/sites/default/files/federal_register_document/2016-06069.pdf
Argyroxiphium sandwicense ssp. *macrocephalum* (ʻahinahina) 5-Year Review (2023)	Discusses threats to and management actions for the recovery of the Haleakalā silversword; https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/7112.pdf
USFWS Draft Recovery Plan Amendments for 42 Species Across the United States (2019)	Discusses management actions for the recovery of Hawaiian petrel; https://www.fws.gov/sites/default/files/federal_register_document/2019-00436.pdf
USFWS Hawaiian Petrel 5-Year Review (2022)	Discusses threats to and management actions for the recovery of Hawaiian Petrel; https://ecosphere-documents-production-public.s3.amazonaws.com/sams/public_docs/species_nonpublish/3885.pdf

Section 4.0 PUBLIC INVOLVEMENT, AGENCY COORDINATION, AND COMMENTS

This section summarizes public and agency consultation and coordination activities associated with this project that have been conducted to date. Early consultation and coordination activities included meetings and correspondence with government agencies and the affected communities. Details such as meeting announcements, presentation materials, and comments are included in Appendix A of the Management Plan (Appendix I of this document).

4.1 Internal Scoping Within DOFAW

DOFAW's consultants organized a virtual meeting with the following pertinent project staff from DOFAW's Maui Branch Office on February 23, 2022—Lance DeSilva, Jan Pali, John Mederios,

Shane DeMattos, Stephanie Franklin, and Tanya Rubenstein. Maui's Divisions' DOFAW staff are the stewards of conservation lands on Maui with expertise in resources at Kamehamenui and are tasked with the challenges of managing it in perpetuity. The purpose of this first internal scoping meeting for the Management Plan was to gather firsthand information from them to discuss the opportunities and challenges that Kamehamenui offers, develop overarching goals and objectives for the Management Plan, and produce a draft of potential actions for implementation at the Reserve to gather input on during the public scoping process. The 3-hour virtual meeting focused on systematically gathering and documenting input on DOFAW's eight major management categories: Resource Protection, Watershed Values, Invasive Species Control, T&E Species Management, Native Ecosystems, Game Animal Management, Commercial Activity, Access, Trail, and Other Public Uses.

4.2 Scoping Meeting with Neighboring Landowners

On July 7, 2022, DOFAW mailed a letter of invitation to landowners whose properties were next to the Reserve or across the street from Kekaulike Avenue fronting the Reserve. Invitations were sent out to 31 landowners (see Appendix A of the Management Plan [Appendix I of this document]) and about 75 people attended; many of them were not adjacent landowners. This scoping meeting with neighboring landowners was organized on August 10, 2023, at the Kula Elementary School Cafeteria. The purpose of this meeting was to gather input from neighboring landowners on the State's potential plans and management activities for Kamehamenui FR and how the activities might impact their neighboring lands. The meeting started with a brief introduction to Kamehamenui and its potential for conservation and public use. The meeting was then opened to the neighboring stakeholders to provide comments. DOFAW staff addressed questions throughout the meeting.

4.3 Public Scoping Meetings

Two scoping meetings were organized to guide the development of the Management Plan and draft details of the Proposed Action (i.e., implementation of the Management Plan). The meeting announcement was posted on the DLNR website. The first meeting was organized on October 12, 2023, at the Kula Community Center. Fifty-four people signed up but it is estimated that about 100 people attended this meeting. The purpose of this meeting was to gather input from the community on potential activities that DOFAW should consider when developing the Management Plan for Kamehamenui FR. The meeting started with a brief introduction to the resources at Kamehamenui, and the Reserve's potential for conservation and public use. The organizers then split up the meeting into four separate stations in the room to allow people to provide focused input on the following four major topics: 1) Public Access, 2) Trails and Recreation, 3) Hunting, and 4) Conservation Needs. Relevant information materials were posted and available at each station. DOFAW staff assisted by members from the consulting team were present at each station to gather input from the people and address their questions. Written comments were also solicited and gathered at this public meeting; see details in Appendix A of the Management Plan (Appendix I of this document).

A second scoping meeting was organized virtually to gather input from members of the community who were not able to attend the meeting in-person on Maui, in particular residents of neighboring islands. The meeting was organized via Microsoft Teams and links to join this meeting via video or audio were provided on the DLNR website. Like the in-person meeting, the purpose of this virtual meeting was to gather input from the community on potential activities that DOFAW should consider when developing the Management Plan for Kamehamenui FR. The meeting started with a brief introduction to the resources at Kamehamenui and its potential for conservation and public use. The organizers then split up the meeting into four separate "virtual rooms" where the discussion was focused on the following four major topics: 1) Public Access, 2) Trails and Recreation, 3) Hunting, and 4) Conservation Needs. DOFAW staff assisted by members from the consulting team were present in each "virtual room" to gather input from the people and address their questions. In addition, the main link to the meeting was also live during the meeting to welcome people throughout the duration of the meeting and direct them to either of the four "virtual rooms" of their preference. Attendees also had the option to move between the four ongoing topic discussions in the four separate virtual rooms.

About 400 verbal and written comments were gathered during the public scoping meetings. Appendix A—Scoping, of the Management Plan (Appendix I of this document) illustrates how these comments were systematically compiled and analyzed by DOFAW to guide the development of the Management Plan. An overwhelming 97% of the respondents were in favor of some activity being offered at Kamehamenui FR. Comments regarding recreation included archery, camping, trails, hiking, biking, equestrian use, and hunting. About 41% of comments received addressed trails, either for hiking, biking, or horseback riding. There was strong advocacy for equestrian use and associated amenities in the Reserve. There were also comments regarding access from Kekaulike Avenue, parking, concerns about nighttime use of the Reserve, illegal activities, and overuse of the Reserve. All comments were taken into consideration by DOFAW and appropriately incorporated into the Management Plan.

Section 5.0 ANTICIPATED DETERMINATION

To determine whether a proposed action may have a significant impact on the environment, the approving agency needs to consider all phases of the action, the expected impacts, and the proposed mitigation measures. The agency's review and evaluation of the proposed action would result in a determination that either: 1) the action may have a significant effect on the environment and issuance of an EIS Preparation Notice is required; or 2) the action is not likely to have a significant effect and notice of a FONSI should be issued.

Based on the findings presented in this Draft EA, the Proposed Action is not expected to result in a significant impact on the environment, and a FONSI is anticipated.

The anticipated determination was based on a review and analysis of the significance criteria specified in Section 11-200.1-13, HAR. An action shall be determined to have a significant effect on the environment if it meets any of the following criteria:

1. *Irrevocably commit a natural, cultural, or historic resource*—This project (i.e., implementation of the Management Plan) would not irrevocably commit natural, cultural, or historic resources at Kamehamenui. Implementation of the Management Plan would benefit natural resources as the Proposed Action will minimize erosion, improve watershed functions, and enhance habitat for native plants and animals. Implementation of the Management Plan will protect the cultural and historical resources that occur at Kamehamenui. DOFAW will work with the SHPD to develop a preservation plan and install interpretive signage to educate users about the Reserve's cultural and historical resources. Impacts to hunting and ranching, which are considered by many to be cultural practices, would occur under the Proposed Action but would be less than significant due to the proposed mitigative measures. DOFAW seeks to offer game bird hunting at the Reserve if it does not interfere with the recovery of native bird populations. DOFAW will continue to support local ranchers by employing grazing as a tool to reduce fuel loads and maintain fire breaks in the Reserve. Also, implementation of the Management Plan will increase the availability of native plants used in traditional cultural practices such as lei making and hula.
2. *Curtails the range of beneficial uses of the environment*—No aspect of the Management Plan would curtail any beneficial use in the long term, and implementation would sustain many beneficial habitat and watershed uses that would otherwise be jeopardized, if not lost.
3. *Conflicts with the State's environmental policies or long-term environmental goals established by law*—The Project is consistent with the environmental goals and objectives of the State, as demonstrated in Section 3.0 Consistency with Government Plans and Policies.
4. *Have a substantial adverse effect on the economic welfare, social welfare, and cultural practices of the community or State*—The Proposed Action will not substantially affect the economic or social welfare of the community or State. It is expected to contribute to the economic and social well-being of local communities and the State through long-term improvement in the health of native forests and watersheds. Restoring the lands to native forest cover will increase the abundance and accessibility of native plant species that are important for various native Hawaiian cultural practices such as hula, lei making, dye production, and for food and medicinal use. Healthy native forests offer recreational, cultural and watershed values that contribute to social welfare.
5. *Have a substantial adverse effect on public health*—The Project will not adversely affect public health. On the contrary, the Project will contribute to improving public mental health by providing open green space and physical health by providing a variety of sustainable recreational opportunities such as hiking, biking, and horseback riding.
6. *Involve adverse secondary impacts, such as population changes or effects on public facilities*—There will be no foreseeable adverse secondary effects of the Project such as population changes or increased demand for public facilities. Implementation of the Management Plan will provide quality and sustainable recreational opportunities in the Reserve. The Proposed Action is limited to small-scale infrastructure improvements such as installing comfort stations within the Reserve. The Project does not require any

large-scale developments that would increase demand for recreational resources and public services.

7. *Involve a substantial degradation of environmental quality*—The environmental quality of the area would not change because of the Proposed Action. The Proposed Action will be implemented in accordance with all applicable environmental rules and regulations. Standard construction and erosion control BMPs would be employed for anticipated small-scale construction projects that will minimize short-term impacts (e.g., noise, solid waste generation, and traffic). Implementation of the Proposed Action is expected to improve environmental quality by enhancing forest cover and improving watershed function.
8. *Be individually limited but cumulatively have substantial adverse effect upon the environment or involves a commitment for larger actions*—The Proposed Action would not have negative cumulative effects on the environment and does not involve a commitment for larger actions. The Proposed Action is expected to have significant beneficial cumulative impacts as it will restore forest cover on the southwest slopes of Haleakalā and would thereby increase benefits such as habitat creation and watershed enhancement when added to past, present, and foreseeably future conservation efforts in the region. Regarding game bird hunting, DOFAW will monitor impacts to determine if adverse impacts occur that could accumulate with impacts from other actions and mitigate accordingly.
9. *Have a substantial adverse effect on a rare, threatened, or endangered species or their habitat*—The Project will protect rare, T&E species and their habitat.
10. *Have a substantial adverse effect on air or water quality or ambient noise levels*—The Proposed Action will not have detrimental effects on air quality, water quality, or noise levels. Long term benefits to air and water quality are expected as a result of protecting forest health.
11. *Have a substantial adverse effect on or be likely to suffer damage by being located in an environmentally sensitive area such as a floodplain, tsunami zone, sea-level-rise exposure area, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters*—The Project Area (i.e., the Reserve) is not located within a floodplain, tsunami zone, or sea-level-rise exposure area, and is not located on a beach, erosion-prone area, geologically hazardous land, estuary, or coastal waters. The Proposed Action is also not expected to adversely affect any environmentally sensitive areas.
12. *Have a substantial adverse effect on scenic vistas and view planes, during day or night, identified in county or state plans or studies*—The Proposed Action is not anticipated to adversely affect any vistas or view planes identified in county or State plans or studies and will benefit visual quality through enhancing native forest cover.
13. *Require substantial energy consumption or emit substantial greenhouse gases*—The Proposed Action does not require substantial energy consumption or emit substantial greenhouse gases.

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APPENDIX I. KAMEHAMENUI FOREST RESERVE MANAGEMENT PLAN

KAMEHAMENUI

State Forest Reserve



DRAFT Management Plan
2025

State of Hawai‘i
Department of Land and Natural Resources
Division of Forestry and Wildlife
Forest Management Section

Executive Summary

This ten-year Management Plan for Kamehamenui State Forest Reserve (FR; henceforth also referred to as Kamehamenui FR or the Reserve) on Maui is one in a series of site-specific natural resource management plans prepared by the Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW) for individual forest reserves in the State of Hawai‘i. These plans present a brief history of the specific forest reserve, a complete record of land transactions and boundary changes over time, a description of natural and cultural resources, as well as an account of infrastructure and intended use(s) of the area. These plans serve to: (1) assist in preparation of regulatory compliance documents required to implement management actions outlined in the plan; (2) support DOFAW efforts to secure funding for plan objectives; (3) prioritize implementation of management objectives; (4) solicit requests for proposals or bids to implement plan objectives; and (5) inform the public of short and long-term goals.

The lands of Kamehamenui have had a rich history of land use. In the pre-contact period, Kamehamenui was one of the 17 ahupua‘a in Kula that had a sizeable population of native Hawaiians. Land use then was limited to locally clearing forests for subsistence farming. The post-contact period (1778 to 1888) brought drastic transformations in land use as well as the culture and economy of the Hawaiian Islands. Trade for the prized ‘iliahi (Hawaiian sandalwood), demand for fuelwood by the whaling industry, and expansion and intensification of westernized agriculture contributed to the loss of vast areas of forestland on Maui.

The Great Māhele (great land division) in 1848 marked a shift to a western system of private land ownership. The lands of Kamehamenui passed through several owners, including Louis von Tempsky who purchased it in 1888 and established the Erehwon Cattle Company. Kamehamenui was largely a dairy and cattle ranch under the von Tempsky family’s ownership. Even after the family sold it, the land continued to be leased for ranching without any major development. The lands of Kamehamenui were acquired by DLNR DOFAW in September of 2020 for integration into the State Forest Reserve System and will be held in public trust for the people of Hawai‘i in perpetuity.

Kamehamenui FR encompasses approximately 3,434 acres (~1,390 hectares) and is situated in the ahupua‘a of Kamehamenui. It ranges from approximately 3,650 feet (ft) (about 1,113 meters [m]) above mean sea level in the west to approximately 9,700 ft (about 2,957 m) above mean sea level in the east. Three distinct vegetation types occur in the Reserve: 1) Subalpine Shrubland—the eastern area above 6,500 ft (1,981 m) is very sparse with remnant native tree species such as māmane (*Sophora chrysophylla*) and Haleakalā sandalwood (*Santalum haleakalae* var. *haleakalae*); 2) Grassland/Pasture—the vast majority of land below 6,500 ft (1,981 m). This vegetation is heavily grazed and is dominated by the non-native kikuyu grass (*Cenchrus clandestinus*). The shrubs scattered in the grassland/pasture regions are also largely non-native; 3) Mesic Forest—the mid-elevation areas from about 5,500 to 7,500 ft (1,676 to 2,286 m) contain scattered patches of non-native invasive trees such as black wattle (*Acacia mearnsii*) and blue gum (*Eucalyptus globulus*). The native trees, shrubs and ferns such as ‘ōhi‘a

(*Metrosideros polymorpha*), ʻamaʻu (*Sadleria cyatheoides*), ʻaʻaliʻi (*Dodonaea viscosa*) and koa (*Acacia koa*) are limited to the steep gulch slopes and gullies that offer protection from ungulates. About 1,171 acres (474 hectares) of the uppermost alpine and subalpine habitats of Kamehamenui FR overlap federally designated critical habitat for 10 plant species and two bird species.

Native vertebrates currently found at Kamehamenui include ʻōpeʻapeʻa (Hawaiian hoary bat, *Lasiurus cinereus semotus*), ʻUaʻu (Hawaiian petrel, *Pterodroma sandwichensis*), nēnē ʻapapane (*Himatione sanguinea*), ʻamakihi (*Chlorodrepanis virens* var. *wilsoni*), and pueo (*Asio flammeus sandwichensis*). Native forest birds are mostly limited to the heavily forested mid-elevation areas. Native invertebrates at Kamehamenui include species such as yellow-faced bee (*Hylaeus nivicola* and *Hylaeus volatilis*), wolf spider (*Lycosa hawaiiensis),* planthoppers (*Oliarus* sp. and *Nesosydne* spp.), koa butterfly (*Udara blackburni*), and the native tornatellid snails (*Tornatellides* sp.).

Feral ungulates, invasive plants and insects, forest pathogens, fire, and climate change are a constant threat to the watershed and the native plants and animals found in Kamehamenui FR. At the time of acquisition Kamehamenui was encumbered by a grazing and hunting lease granted by the prior landowner. Under the lease with DOFAW, 2,200 acres (890 hectares) have been removed from active grazing for ecosystem protection and restoration.

Scattered throughout the lower 320 acres of Kamehamenui FR are 82 archaeological and cultural features associated with the operation of the Erehwon Cattle Ranch from the mid-19th century through 1990. Ranch activities here likely disturbed any evidence of Precontact and early Historic agriculture or habitation. Nonetheless, historic ranching created the landscape as it is today. The physical landscape tells the story of ranching and other historic activities that once occurred here, and, as such, meets the description of a cultural landscape under HAR §13-276. During surveys conducted in 2021 and 2023, six additional archaeological features were found scattered in the upper portion of the Reserve.

Since acquisition in 2020, management actions completed for Kamehamenui FR by DOFAW include conducting field surveys to assess baseline biological and cultural resource conditions, and construction of an ungulate-proof fence along the southern border to start enclosing the 2,200 acres (890 hectares) to remove feral ungulates. DOFAW has nine priorities for management of lands in the Forest Reserve System, these are: watershed values; natural resource protection; cultural resource protection; game animal management; threatened and endangered (T&E) species management; native ecosystems; invasive species control; access, trails, and other public uses; and commercial activity. Summarized below are the management goals under each of these nine priorities for the Kamehamenui FR.

- *Watershed Values*—Minimize impacts of soil erosion, effectively monitor and assess landscape level needs in a timely manner, collaborate with partners, and implement strategies to adapt to climate change.

- *Natural Resource Protection*—Implement a robust fire pre-suppression and mitigation program, an efficient system to monitor weather conditions in a timely manner, and protect forest health and cultural resources.
- *Cultural Resource Protection*—Increase understanding of cultural resources in need of protection, increase biocultural landscape-based planning, pair habitat restoration with cultural resource management, protect traditional and customary practices, maintain a permit process for protected cultural activities that require a Reserve Permit.
- *Game-Animal Management*—Manage hunting to ultimately remove ungulates from Kamehamenui FR.
- *T&E Species Management*—Protect existing populations and recover rare and listed endangered plants and animals.
- *Native Ecosystems*—Restore 75% of the Kamehamenui FR lands to native forest, maintain zero tolerance for feral ungulates, implement strategies to adapt to climate change, and monitor status and distribution of native species over time.
- *Invasive Species Control*—Cooperate with conservation agencies for invasive-species management, minimize introduction and spread of invasive species, and effectively control existing invasive species to minimize impact on native species and habitats.
- *Access, Trails, and other Public Use*—Provide safe and available public access and construct and manage infrastructure to achieve public use goal.
- *Commercial Activity*—Generate income from sustainable commercial forestry activities to support natural-resource management.

DOFAW plans to employ a phased approach to achieve the management goals for Kamehamenui FR. In general, each phase involves withdrawing a portion of land from the grazing lease, enclosing the area with an ungulate-proof fence, removing all ungulates via public hunting followed by staff control efforts by DOFAW, and implementing various conservation and public use activities that vary slightly for each phase. The timing of moving from one phase to the next will be determined by DOFAW based on the availability of funds and resources, and the timing of completion of prior phases. The three phases correspond to the following areas of the Reserve:

- *Phase I Area*—Encompasses about 2,210 acres (890 hectares) of the upper Reserve that have been removed from the grazing lease.
- *Phase II Area*—Encompasses about 714 acres (289 hectares) in the mid-elevations of the Reserve.
- *Phase III Area*—Encompasses about 510 acres (206 hectares) in the lower/western portion of the Reserve.

This is the first Management Plan for the Kamehamenui FR. This plan is intended to describe short-term resource management planning and implementation strategies. It will serve as the basis for future updates and modifications to accommodate adaptive management of natural and cultural resources as well as improving public access and recreational opportunities at Kamehamenui FR.

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Kamehamenui Forest Reserve Management Plan Signature Page

Maui District certification: This plan was prepared by a team of Division of Forestry and Wildlife (DOFAW) staff to provide a management framework for Kamehamenui State Forest Reserve.

_____ _____

Scott Fretz – DOFAW Maui District Manager Date

DOFAW Administrator's approval: I have reviewed the enclosed Forest Reserve Management Plan and concur with the recommendations herein. I agree that resource management implementation will follow those specified in the Management Plan for Kamehamenui State Forest Reserve.

_____ _____

David G. Smith – DOFAW Administrator Date

Department of Land and Natural Resources Board approval: This plan is in accordance with the mandates of the State Forest Reserve System which includes Chapter 183, Hawai'i Revised Statues, and Chapter 13-104, Hawai'i Administrative Rules.

_____

Dawn N.S. Chang – BLNR Chairperson

Approved by the Board of Land and Natural Resources at its meeting held on _____

Development Process Timeline

Kamehamenui State Forest Reserve, Maui

State of Development	Date Achieved	Comments
District review	December 2024	Incorporated
DOFAW review	January 2025	Incorporated
Partner agency consultation	Ongoing	
Public consultation	Ongoing	
DOFAW approval	Pending	
BLNR approval	Pending	

Section 1.0 INTRODUCTION

The Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW), henceforth also referred to as the Division, conducts ongoing planning efforts to develop and update management plans for all forest reserves across the State. The format and content of reserve plans are generally consistent across the State and serve to guide field operations, assist in budgeting and funding concerns, and make the management process transparent for partner organizations and the public. These plans also help to fulfill certain recommendations made in the Hawai‘i Tropical Forest Recovery Action Plan, which resulted from the 1992 Federal Hawai‘i Tropical Forest Recovery Act. Management plans will be developed for each individual forest reserve, which will in part reflect the Division’s management guidelines specific to that area. This document represents the Management Plan for Kamehamenui State Forest Reserve (FR; henceforth also referred to as Kamehamenui FR or the Reserve).

This is the first Management Plan prepared for Kamehamenui FR since its acquisition by the State in 2020. Several documents that were prepared for the land acquisition were used to develop this management plan. These include the Kamehamenui Forest Project vision (DOFAW 2020) document, DOFAW and Trust for Public Lands (TPL) applications for the federal financial assistance grants from the U.S. Department of Agriculture (USDA) Forest Service and Habitat Conservation Plan (HCP) Land Acquisition grant from the U.S. Department of Interior Fish and Wildlife Service (USFWS), the submittal to the Board of Land and Natural Resources (the Board or BLNR, DLNR 2020) requesting approval for acquisition of private lands, legal description and survey of the property, the recorded deed, and the grazing and hunting lease. DOFAW’s general statewide guiding documents such as the State of Hawai‘i Forest Action Plan (DLNR 2016), Hawai‘i’s State Wildlife Action Plan (DLNR 2015), and the State’s Interagency Biosecurity Plan (HDOA 2016) were also used to guide the preparation of this management plan for Kamehamenui FR. In addition, several site-specific studies conducted at Kamehamenui for environment site assessments, flora and fauna, minerals, seabirds, cultural and archaeological resources, and traffic were also used and referenced accordingly.

The development of this management plan involved an extensive internal and public scoping process that is detailed in Appendix A. The first meeting was an information gathering session with Maui’s DOFAW staff, the stewards of forest reserve lands on Maui who best know the resources at Kamehamenui and are tasked with the challenges of managing it in perpetuity. A second in-person meeting was organized in Kula, with the neighboring landowners of Kamehamenui FR as these stakeholders would be directly impacted by any activities and associated infrastructure planned at the Reserve. Two additional meetings were organized with the public at large—first an in-person meeting in Kula and a second virtual meeting to allow for off-island stakeholders to participate. At these meetings, after providing a brief overview of the natural resources at Kamehamenui FR and the potential it holds for conservation and public recreational activities, input was gathered from stakeholders regarding parking and access, trails and recreation, hunting, and conservation needs. Questions and comments gathered from these

stakeholder scoping meetings provided the foundational framework for the development of this draft management plan.

Once finalized by DOFAW, this Management Plan for Kamehamenui FR will be submitted for review and approval by the Board. If approved by the Board, the following actions may be triggered:

- Preparation of regulatory compliance documents as required for implementation of management actions as outlined in the plan.
- DOFAW efforts to secure operational and planning funding for plan objectives.
- Prioritized implementation of plan objectives by DOFAW.
- Periodic solicitation of requests for proposals or bids for implementation of plan objectives, including issuance of permits, licenses, or contracts as necessary.

Section 2.0 HISTORY

The lands of Kamehamenui are situated on the southwestern slopes of Haleakalā and have a rich history of land use. This section summarizes the use of Kamehamenui lands from pre-contact time to its recent acquisition by the State for integration into the State Forest Reserve System. The Cultural Impact Assessment prepared by ASM Affiliates (2023) was primarily used to prepare this section (Appendix B).

2.1 Land Use: Pre-Contact (Around 400 to 1778 C.E.)

The original inhabitants in Hawai‘i were from the southern islands of Polynesia (County of Maui 2010). The core belief of these early settlers, that all life forms are intimately connected, steered the cultural transformations in the islands through intensive interaction with the local environment to form a uniquely Hawaiian culture. For hundreds of years prior to western contact, early Hawaiians thrived and managed their territories through a sophisticated and unique land division system grounded in a strong sense of land stewardship. The ahupua‘a was the principal land division managed by a chief who controlled the resources within it. In general, each ahupua‘a was a large tract of land that extended from the mountain (mauka) to the ocean (makai) and comprised of three ecoregions—mountain, plain, and the sea (Gonschor and Beamer 2014, Pulelo 2023). These three ecoregions shared one common factor: the stream that originated up in the mountain forests, flowed through the plains, and emptied into the sea (Gonschor and Beamer 2014, Pulelo 2023). Hawaiians made and retained extensive and detailed observations of an area’s natural cycles and resources, and they passed this knowledge down over the generations through mele (songs), oli (chants), pule (prayers), inoa ‘āina (place names), and ‘ōlelo no‘eau (proverbial sayings). These keen observations informed their land management strategies and decisions and allowed them to adapt their subsistence practices to sustainably meet the need of the growing Hawaiian population (ASM Affiliates 2023).

Each ahupuaʻa varied in size and shape and functioned for both taxation purposes and to provide its residents with subsistence and household necessities. Many ahupuaʻa were divided into smaller land units called ʻili which were often passed down in the caretaker's families and retained over multiple generations. Passed along with the ʻili were the kuleana (responsibilities, privileges) that were associated with it. Several ʻili and ahupuaʻa together were part of a large moku or district governed by a chief who claimed the abundance of the entire moku or district. The ʻili, ahupuaʻa, and moku were integral to Hawaiian life and this form of land division represented an advanced natural resources management system.

The island of Maui was composed of twelve moku (districts): Kaʻanapali, Lāhainā, Wailuku, Kula, Honuaʻula, Kahikinui, Kaupō, Kīpahulu, Hāna, Koʻolau, Hāmākua Loa, and Hāmākua Poko. Kamehamenui is among the 17 ahupuaʻa that make up the expansive moku of Kula, in east Maui. Kula was always an arid, lava-strewn region, practically devoid of streams, comprising vast stony *kula* lands. Precontact populations in the vicinity of Kamehamenui were believed to be large, likely supported by sweet potato cultivation and fishing (Handy and Handy 1972). Farming the *kula* lands was challenging as they were not favorable for growing dryland or wetland taro. The population here primarily depended on ʻuala (sweet potato), and employed dryland farming techniques, including constructing earth embankments and using rainfall to irrigate their fields. They planted sweet potatoes in natural forest openings and cleared forest vegetation with fire. When the soil became depleted of nutrients, the fields were left fallow and another area of the forest would be cleared for planting. They rotated between fields periodically, returning to areas with second-growth forests. In addition to these methods, native farmers in Kula also constructed features such as terraces to help with soil retention, to channel and absorb water run-off, and to delineate individual plots.

Throughout much of the pre-contact and early historic period, the island of Maui was ruled by two independent chiefdoms: the West Maui Chiefdom of Kaʻanapali and Lāhainā, and the larger East Maui Chiefdom which included the moku of Kula. This political division is known to have existed up until the 16th century when High Chief Kiha-a-Piilani consolidated the East and West Maui under his rule. The first Europeans were recorded off the windward coast of east Maui in November 1778.

2.2 Land Use: Post-Contact Historic Period (Around 1778 to 1888 C.E.)

The period from 1778 to 1854 is marked by the arrival of European explorers and a drastic transformation in the land use practices, culture, and economies of the Hawaiian Islands. By 1820, Lāhainā was the seat of the Hawaiian government, which was heavily vested in the sandalwood trade. The demand for sandalwood severely impacted populations of the prized ʻiliahi (Hawaiian sandalwood) on Maui and greatly depleted forests throughout the island. By the 1830s, the declining sandalwood trade was accompanied by the rise of the whaling industry. Between 1824 and 1861, at least 10,000 acres of forest were reported to have been harvested on Maui and sold to whaling ships to use as fuel wood (ASM Affiliates 2023). Also, around this time sawmills were constructed to process koa (*Acacia koa*) that were harvested from Maui's forests.

The increase in whaling ships increased the demand for produce such as wheat and potato. This demand for Hawaiian agricultural products was also partly stirred by the California Gold Rush and the consequent neglect of agriculture in the state of California. The expansion and intensification of westernized agriculture required vast areas of forests to be cleared. The first wheat plantations were in Kula. However, growing wheat was a laborious process on Kula lands, and fields were often ravaged by the peʻelua (caterpillar) in this region. The high cost of cleaning wheat to remove caterpillars contributed to the decline of its cultivation in the mid-1850s, at which point plantations of foreign varieties of potatoes started to boom. Kula farmers were one of the first to pioneer large scale plantations of Irish potatoes and this region was also referred to as the "Potato District" However, over time, meager crops combined with poor farming techniques and drought devastated the potato market and the demand for Hawaiian grown potatoes declined.

As Hawaiʻi became recognized internationally as the center for commerce and trade in the Pacific, the political elites sought ways to modernize the flourishing Kingdom. The Great Māhele (great land division) occurred in 1848 and marked a shift from a feudal system (where the king owned all the land) to an allodial system of private land ownership. It was in this year that Chiefess Ane Keohokālole (mother of Queen Liliʻuokalani and King David Kalākaua) was awarded about 5,067 acres in Kamehamenui. Per an unpublished manuscript provided to ASM Affiliates by the von Tempsky family, following the Māhele, these lands were held in a trust with Charles R. Bishop as the trustee who then sold it to James Louzada. James Louzada then sold about half of his interest to his brother-in-law, William Henry Cornwell. It is reported that Henry Cornwell also leased a large tract of land in Kula from King Kalākaua for ranching. Although the exact location of the leased lands is not clear, it is speculated that it may be within the existing Kamehamenui FR. In 1888, a Kapua Louzada and four Cornwell heirs sold it to Adelia Louzada who in the same year sold these lands to Louis von Tempsky.

2.3 The Legacy of the von Tempsky Erehwon Ranch (1888 to Early 1990s)

In 1879 Louis von Tempsky (Figure 1) arrived in Maui from Scotland. A year later he was joined by his brother Randal von Tempsky, and they both established themselves in ranching. After purchasing the land at Kamehamenui in 1888, they established the Erehwon (nowhere spelled backward) Cattle Company. While managing Erehwon from 1888 to 1897, Louis leased portions of the land to farmers for growing corn, potatoes, and beans. In 1897, Louis sold his share of the land to Randal and was hired to manage the Haleakalā Ranch. That same year, Randal suddenly passed away and his wife, Dora, managed the company. Under Dora's stewardship, the lands of Kamehamenui supported a flourishing dairy ranch, including the construction of a



Figure 1. Louis von Tempsky (Photo courtesy of Hawaiʻi Cattleman's Council)

dairy barn (Figure 2) to enhance production of Erehwon butter. During this time most of the property was under potato cultivation and land was set aside for the USDA to conduct an experimental study with 45 potato varieties to study the quick blight diseases that was affecting potato cultivation.



Figure 2. Erehwon Dairy Barn Seen on Right (Photo courtesy of von Tempsky family collection)

During drought periods from 1911 to 1915, several water-catchment structures were installed at Kamehamenui including dams on the gulches, a pipeline, and a tunnel to secure local flow into the ranch. In 1914, management of Erehwon was transferred to Dora's son, Robert ("Boy") von Tempsky and he started to transform the dairy ranch into a cattle ranch. In 1917, he purchased 50 heads of Hereford stock from Parker Ranch on Hawai'i Island and was able to sufficiently build beef production at Erehwon. Under Boy's management, Erehwon ranch was involved in all aspects of cattle ranching from breeding, raising young animals, slaughtering, and selling beef. He also continued to diversify agriculture on about 400 acres of land, cultivating corn, beans, cabbage, potatoes, and onions. The Pu'u Lani Ranch Hotel on the slopes of Haleakalā was also located on the property and managed by Boy's sister, Alexa Zabriskie. In 1958, 1,200-square-foot (ft) parcel ([TMKs]: [2] 2-3-005: Parcel 014) was created from the larger Erehwon lands and leased to Maui Electric. After Boy's death in 1976, management of Erehwon went to his son Robert Gordon "Ski" von Tempsky. Ski had proposed that a restaurant and tramway be developed to the crater rim in Haleakalā National Park, which was met with strong opposition and the proposal was dropped.

During their tenure as landowners, the von Tempsky family utilized Kamehamenui for a variety of industries including dairy, cattle ranching (Figure 3), diversified agriculture, and even as a place of leisure and relaxation. The property remained largely undeveloped as pastureland under the ownership of the von Tempsky family up until 2002 (Table 1). The historic topographic maps (from 1922, 1923, 1957, 1961, 1983, and 1991) and aerial photographs (taken in 1951, 1976, and 1995) all show that there was no major development at Kamehamenui other than small structures such as water tanks, a water tower, homesteads, silo, corrals, other barn structures, and the construction of the "Upper Kula Road" (currently Kekaulike Avenue).



Figure 3. Cattle Ranching on Erehwon, Kamehamenui (Photo courtesy of von Tempsky family collection)

2.4 From Ranch to Reserve (2002 to Present)

In 2002, the Erehwon lands were sold to KJZ LLC. In 2006, KJZ LLC leased the land (TMK [2] 2-3-005:002) for grazing and hunting to Brendan Balthazar (lessee). In 2015, the land was sold to John and Shizuka Zwaanstra and was placed in the Shizuka Asakawa Trust in 2016. However, during these years the lands were still leased for ranching, grazing, and hunting purposes. Ownership and lease records for Kamehamenui were compiled by Ford & Associates (2020) and are listed in Table 1.

Table 1. Historical Ownership and Lease Records for the Kamehamenui Property

Parcel	Year	Property Transaction
TMK: (2) 2-3-005: Parcel 002	Prior to 1940	Earliest available record, indicating this parcel was owned by Robert G. von Tempsky and wife, Mary S., and sister, Alexa G. Zabriskie.
	1958	1,200 square feet added to Parcel 014 (see below).
	1961	Added 0.930 acres into new TMK (2) 2-3-005: Parcel 015, which was deeded to Maui Electric.
	1963	Parcel deeded to the Trust of Robert G. von Tempsky, Robert G. von Tempsky Jr., Raymond M. von Tempsky and A. W. Morriss, III.
	1964	Parcel leased to Haleakalā Ranch Company; lease was canceled in 1984.
	1971	Parcel deeded to the Trustees, Robert G. von Tempsky Jr., Raymond M. von Tempsky and A. W. Morriss, III.
	1978	Parcel deeded to the Trustees, Robert G. von Tempsky Jr. and Raymond M. von Tempsky.
	1984	Parcel leased to William E. Eby and wife, Beatrice Z.
	1984	Parcel subleased to Stephen Cabral Levin Enterprises.
	1992	Assignment of lease into Trust to William E. Eby & Beatrice Eby, Trustees under the William & Beatrice Eby Family Trust.

Parcel	Year	Property Transaction
	1993	Raymond von Tempsky portion of the ownership listed to Helen Troy von Tempsky, Deborah A. von Tempsky and Alexa V. T. Dudoit as Trustees of the Raymond M. von Tempsky Trust.
	1993	Parcel deeded to Robert Gordon von Tempsky Jr. and Mary B. von Tempsky as Trustees of the Gordon von Tempsky Jr. Trust.
	2002	Parcel deeded to KJZ LLC.
	2009	Granted waterline easement.
	2014	Granted Maui Electric Company, Limited and Hawaiian Telcom, Inc. utility easements.
	2015	Parcel deeded to John Zwaanstra (Husband of Shizuka Zwaanstra).
	2015	Granted waterline easement to State of Hawai'i by Board of Agriculture.
	2016	Parcel deeded to the Shizuka Asakawa Trust.
TMK: (2) 2-3-005: Parcel 014	1958	Earliest available record, indicating this parcel was created from a portion of TMK No.: (2) 2-3-005: Parcel 002 (see records above) and was owned by Robert G. von Tempsky and wife, Mary S., and sister, Alexa G. Zabriskie. Parcel was leased to Maui Electric Co.
	1963	Parcel deeded to the Trust of Robert G. von Tempsky, Robert G. von Tempsky Jr., Raymond M. von Tempsky, and A. W. Morriss, III.
	1971	Parcel deeded to the Trustees, Robert G. von Tempsky Jr., Raymond M. von Tempsky, and A. W. Morriss, III.
	1978	Parcel deeded to the Trustees, Robert G. von Tempsky Jr. and Raymond M. von Tempsky.
	1984	Correction of ownership to Robert G. von Tempsky Jr. and Raymond M. von Tempsky Trustees.
	1990	Parcel deeded to Robert Gordon von Tempsky Jr. and wife Mary B. von Tempsky Trustees of the Robert Gordon von Tempsky Jr. Trust.
	1993	Raymond von Tempsky portion of the ownership listed to Helen Troy von Tempsky, Deborah A von Tempsky and Alexa V. T. Dudoit as Trustees of the Raymond M. von Tempsky Trust.
	1993	Parcel deeded to Robert Gordon von Tempsky Jr. and Mary B. von Tempsky Trustees of the Gordon von Tempsky Jr. Trust.
	2002	Parcel deeded to KJZ LLC.
	2006	Grazing lease and hunting license agreement between KJZ LLC (lessor) and Brandon Balthazar (lessee) effective January 1, 2006, and expired on December 31, 2020, for TMK (2) 2-3-005:002.
	2009	Granted waterline easement.
	2015	Parcel deeded to John Zwaanstra (husband of Shizuka Zwaanstra).
	2015	Parcel deeded to Shizuka Zwaanstra.
	2016	Parcel deeded to the Shizuka Asakawa Trust.

Parcel	Year	Property Transaction
	2020	Grazing lease and hunting agreement for Brandon Balthazar (lessee) extended and then assigned to Division of Forestry and Wildlife (lessor).
	2020	Kamehamenui Parcels (2) 2-3-005:002 and (2) 2-3-005:014 deeded to Department of Land and Natural Resources Division of Forestry and Wildlife.
	2025	On March 12, 2025, Governor Josh Green signed an Executive Order No. 4732 designating 3,433.75 acres of TMK (2) 2-3-005:002 and 014 as Kamehamenui FR.

Source: Ford & Associates, Inc. 2020. Phase I Environmental Site Assessment 3,433.722-Acre Kamehamenui Property Tax Map Key Nos. (TMKs): (2) 2-3-005: Parcels 002 and 014, Kula, Maui, Hawai'i. Prepared for The Trust for Public Land.

As evidenced from the series of topographic maps (from 2013) and aerial photographs (2011, 2012, 2013, 2014, and 2016), Kamehamenui has remained undeveloped pastureland since 2002. In 2016, the Shizuka Asakawa Trust put the Kamehamenui parcels up for sale. The property was on the market for a couple years when DOFAW started contemplating its purchase and integration into the State's Forest Reserve System. DOFAW's rationale for purchasing Kamehamenui included the following:

- Protect the watershed and restore watershed function.
- Protect threatened and endangered (T&E) wildlife and plants.
- Revegetate the grassland to restore the "mauna lei," the band of forest that once existed around the Haleakalā Mountain.
- Preserve scenic value, including the majestic views of Kula and the southwestern slopes of Haleakalā.
- Protect the lands in perpetuity given its potential for conservation of natural resources and opportunities for nature-based recreation.

With this vision to protect open space and natural resources in perpetuity for the residents and visitors of Maui, DOFAW acquired the lands of Kamehamenui in September of 2020 with the help of the TPL and federal partners. At the time of acquisition, the lands (TMK [2] 2-3-005:002) were still encumbered by a grazing lease issued to Brandon Balthazar. Upon purchase of the lands, DOFAW withdrew 2,200 acres from the lease but continued to lease the lower approximately 1,234 acres (~500 hectares) to the same lessee. The lease is set to expire in 2030, however the lease allows DOFAW to withdraw portions of the land any time before expiration. Kamehamenui was officially designated as a FR on March 12, 2025, with Governor Josh Green's Executive Order No. 4732.Table 2 provides the funding sources and amounts contributed toward the acquisition of Kamehamenui, and Figure 4 provides a map of Kamehamenui and the surrounding lands.

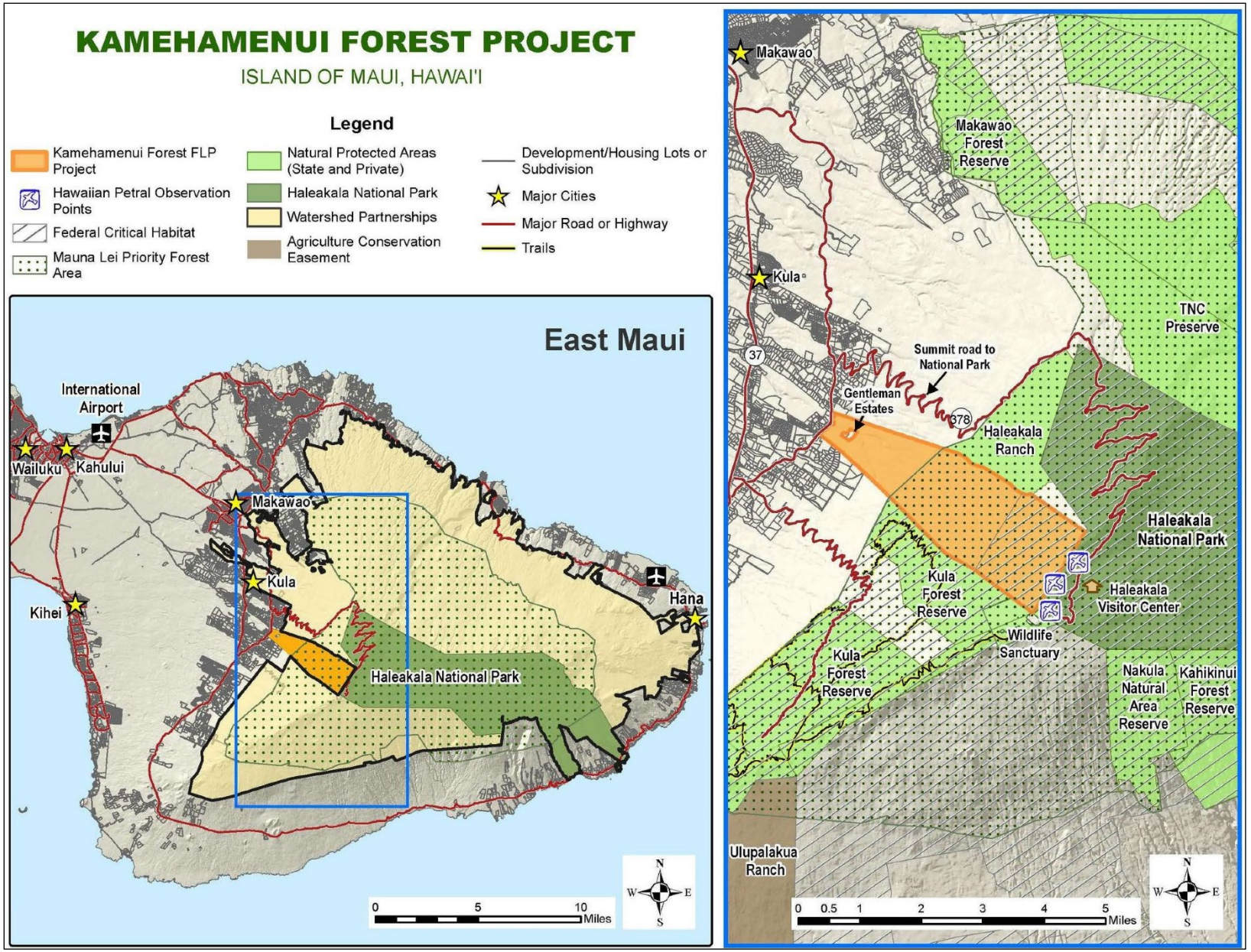


Figure 4. Kamehamenui—Surrounded by Lands Protected by Federal, State, and Private Entities (Symbolized by Green Shading and Dots)
(Source: Department of Land and Natural Resources. 2020. Item C-1. Submission made to the Board of Land and Natural Resources on May 8 by the Division of Forestry and Wildlife requesting approval of acquisition of Kamehamenui private lands.)

Table 2. Funding Contributions toward the Purchase of Kamehamenui Property for Integration into State Forest Reserve System

Contributing Partner	Amount	% of Total
State of Hawai'i Capital Improvement Projects	$4,000,000	41
U.S. Forest Service – Forest Legacy Program/Department of Land and Natural Resources	$3,830,000	39
U.S. Fish and Wildlife Service – Habitat Conservation Plan/Department of Land and Natural Resources	$2,000,000	20
Total	**$9,830,000**	**100**

This management plan is being funded in part by the Forest Legacy Program of the State and Private Forestry Branch of the Pacific Southwest Region of the USDA Forest Service, Region 5.

Section 3.0 FOREST RESERVE DESCRIPTION

3.1 Location

Kamehamenui FR is located in the central portion of the island of Maui, in the district of Kula (Figures 5). The property is recorded with the County of Maui Real Property Tax Assessment Office as Tax Map Keys (TMKs): (2) 2-3-005: Parcels 002 and 014. The State Land Use designation is "Rural," and the County Property Tax Class is listed as "Agricultural" and "Conservation." The total area of the Reserve is 3,433.74 acres (~1,390 hectares), with parcel 002 encompassing 3,433.72 acres and parcel 014 comprising 0.0275 acres (about 0.01 hectares) (Figure 6). There are two privately owned residential properties (TMK Nos.: [2] 2-3-005: Parcels 007 and 008) that were not acquired by the State and are not part of the FR (Figure 6).

Situated on the western slopes of the Haleakalā Mountain, the FR lies within the ahupua'a of Kamehamenui. Haleakalā Ranch Company lies to the north with a few residential properties along the northwestern border. The Kula State FR lies to the south and there are a few private properties along the southwestern border. Haleakalā National Park borders the upper eastern side of the Reserve and Kekaulike Avenue borders the western limit of the Reserve, with Maui Electric Company substation adjoining the center of this west boundary (Figure 6). Kamehamenui FR ranges from approximately 3,650 ft (~1,113 meters [m]) above mean sea level on the west side to approximately 9,700 ft (~2,957 m) above mean sea level on the east side, just below the Haleakalā summit (U.S. Geological Survey 2013).

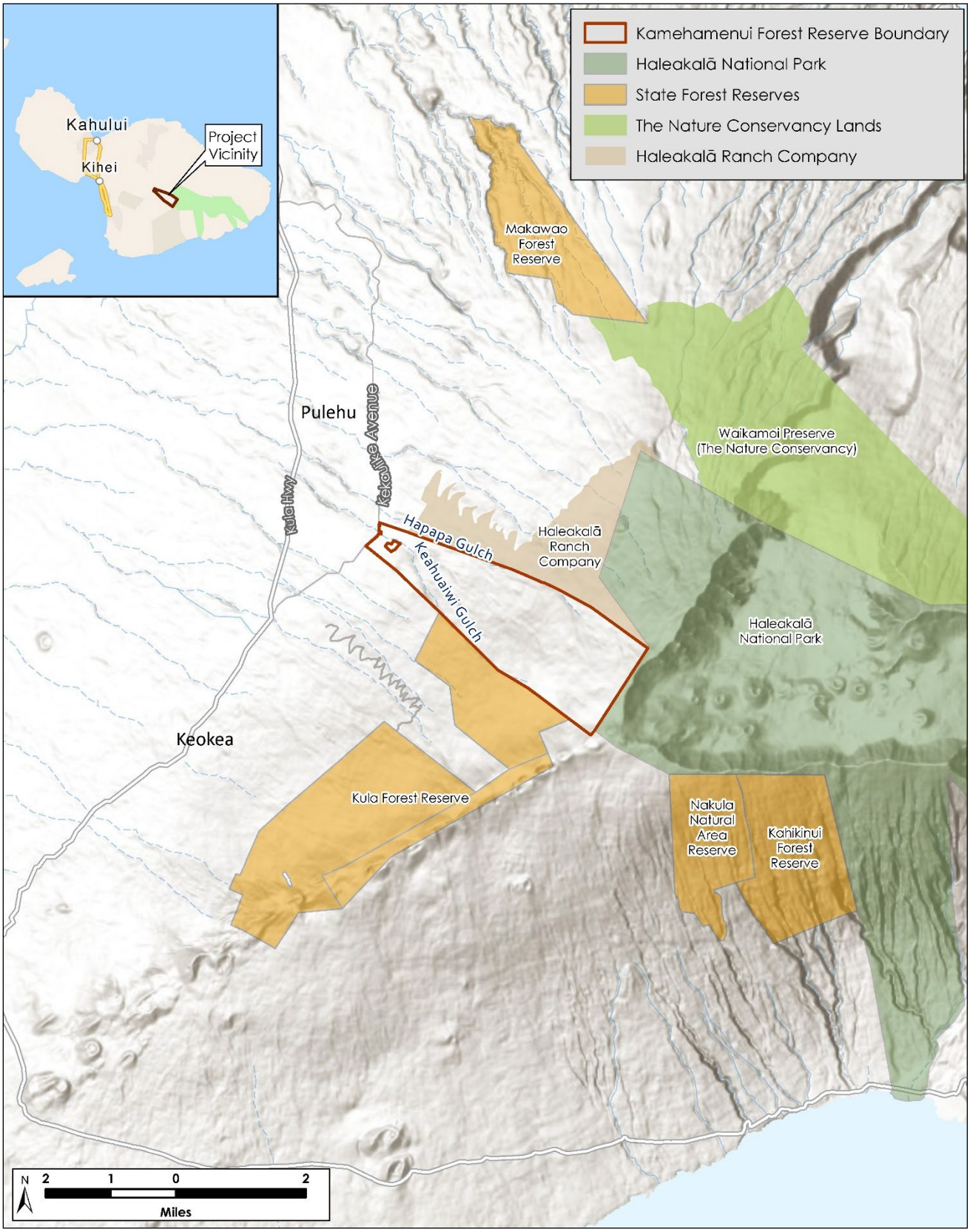


Figure 5. Vicinity Map

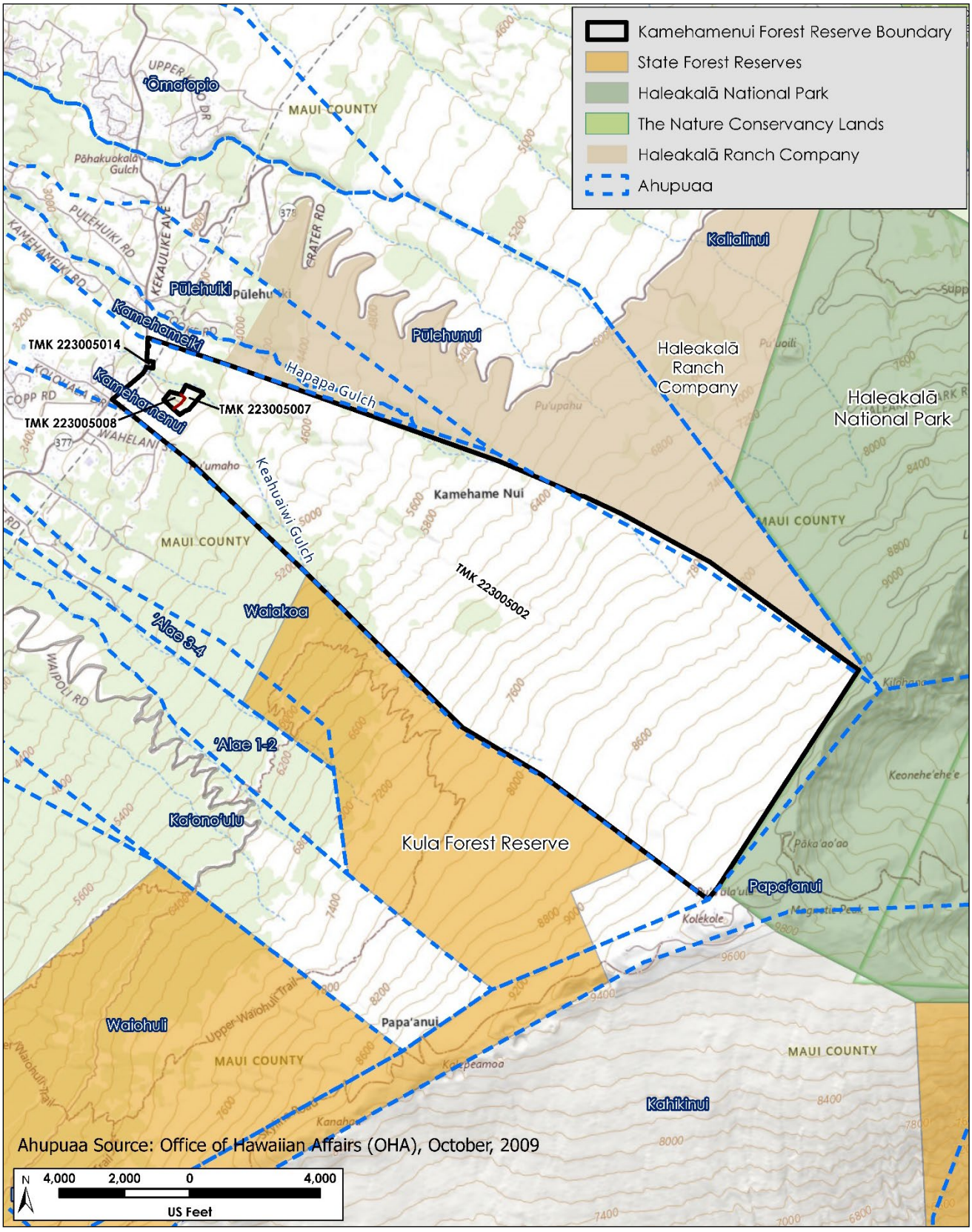


Figure 6. Kamehamenui Forest Reserve

3.2 Geology

Two volcanoes make up the island of Maui—the older West Maui Volcano and the younger East Maui Volcano, also called Haleakalā Volcano. The broad lowland that lies between these two volcanoes gives Maui its nickname of the "Valley Isle." Maui was once part of the ancient island of Maui Nui, which was composed of West Maui, East Maui (Haleakalā), Kahoʻolawe, Lānaʻi, East Molokaʻi, West Molokaʻi, and Penguin Bank (a volcano that was part of the Hawaiian Islands and seamount chain, now submerged underwater). Maui Nui was about 2,000 square miles larger than present day Hawaiʻi Island. Approximately 300,000 to 400,000 years ago, Maui Nui collapsed into two island masses, one consisting of Lānaʻi, Molokaʻi, and Penguin Bank and the other consisting of Maui and Kahoʻolawe. In the last 100,000 to 200,000 years Kahoʻolawe separated from Maui, and Lānaʻi separated from Molokaʻi, while Penguin Bank became submerged within the last several hundred thousand years (Juvik and Juvik 1998). The West Maui Volcano, formed 1.6 million years ago is considered extinct however, Haleakalā Volcano, formed about 1.1 million years ago, is still considered active with eruptions occurring every few hundred years (Sherrod et al. 2007).

Three different periods of volcanic activity at Haleakalā formed East Maui: Honomanū Basalt, Kula Volcanics, and Hāna Volcanics. Surface geology of Kamehamenui FR consists of lava flows from the Kula Volcanic Series (Figure 7) that span the period from 150,000 to 950,000 years ago during the Pleistocene (Sherrod et al. 2007, U.S. Geological Survey 2023). There are two main geological features in the Reserve: Hāpapa Gulch borders and extends into the northern side of the Reserve, and the Keāhuaiwi Gulch borders the western side of the Reserve (Figure 5), then cuts through the center of the western portion of the Reserve (U.S. Geological Survey 2013).

3.3 Surface and Groundwater

Two non-perennial surface flows occur in Kamehamenui FR, one in Keāhuaiwi Gulch along the southwestern corner of the Reserve near Kekaulike Avenue, and one in Hāpapa Gulch that runs along the northwestern border of the Reserve (Figure 8). Surface flows in these gulches are limited to short-duration flash rain events. There are no perennial streams in the Reserve. With regard to ground water, the Reserve contributes to the recharge of the Makawao Aquifer of the central sector of Maui. According to the U.S. Geological Survey's groundwater recharge modeling dataset, Kamehamenui currently contributes approximately 3.37 million gallons of water per day (Izuka et al. 2018).

3.4 Climate

Kamehamenui is located on the leeward side of Haleakalā and climate conditions vary with elevation. The driest months occur in April through October and the wettest months occur in November through March. Mean annual rainfall increases with elevation. The lower elevations below 5,000 ft receive about 28 inches (711 millimeters [mm]) of average annual rainfall. Rainfall here ranges from about 0.9 to 1.8 inches (23 to 46 mm) in the dry months and about 3 to 5 inches (76 to 127 mm) during the wet season. The mid-elevations between 5,000 and 7,500 ft

receive about 35 inches (889mm) of average annual rainfall (Figure 8). Rainfall here ranges from about 0.8 to 2.5 inches (23 to 46 mm) in the dry season and about 4 to 6.7 inches (102 to 170 mm) in the wet season (Giambelluca et al. 2013). Rainfall in the upper elevations of the Reserve is influenced by cloud inversion layer that traps moisture below. Therefore, moisture availability in the uppermost elevations of the Reserve is very dry above this cloud inversion layer compared to moderate dry and seasonal mesic conditions below the inversion layer. The rockier, less developed soils in the uppermost portion of the Reserve also contribute to the arid conditions here (Figure 8). Inverse of the pattern for rainfall, mean annual air temperatures decrease with elevation. It ranges from being around 61 °F (16 °C) below 5,000 ft to around 46 °F (8 °C) at elevations above 8,500 ft (Giambelluca et al. 2014).

3.5 Soils

USDA's Natural Resource Conservation Service mapped eight soil types (Table 3 and Figure 9) in Kamehamenui FR (see Appendix C for soil descriptions). The agency provides online soil maps and data at https://websoilsurvey.sc.egov.usda.gov.

Table 3. Soils of Kamehamenui Forest Reserve

Map Unit	Name	% Cover of Kamehamenui Forest Reserve
8	Lava flows-Cinder land complex, 2 to 40 percent slopes	36
LNE	Laumaia extremely stony loam, 7 to 40 percent slopes	19
LME	Laumaia loam, 7 to 40 percent slopes	15
KDIE	Kaipoioi loam, 7 to 40 percent slopes	14
LMF	Laumaia loam, 40 to 70 percent slopes	7
rRk	Rock Land	4
KxD	Kula loam, 12 to 20 percent slopes	3
KxC	Kula loam, 4 to 12 percent slopes	1
rCl	Cinder land	1

Source: Natural Resources Conservation Service. 2023. Web Soil Survey. <https://websoilsurvey.nrcs.usda.gov/>. U.S. Department of Agriculture

Soil excavation was performed near the new corral in the southwestern corner of Kamehamenui FR in February 2019 for a Phase 1 Environmental Assessment as part of due diligence for State acquisition. Soils at this site consisted of dark brown reddish clayey soil, with a layer of scattered lava rock at approximately 4 to 5 ft below ground surface at the site (Ford & Associates 2019).

3.6 Vegetation

Cattle grazing and other ranching activities over the last century has severely altered the vegetation at Kamehamenui FR. The introduction of pasture grasses and spread of invasive plant species during this time led to a landscape largely dominated by alien species. Table 4

summarizes the approximate acreage of the major land cover types in Kamehamenui FR based on the Carbon Assessment of Hawai‘i Land Cover (Jacobi et al. 2017) also illustrated in Figure 10.

The definition of “forest” per the Hawai‘i Forest Action Plan (DLNR 2016) includes shrubland and short tree species due to high elevation and low rainfall. Based on this definition the estimated current forest cover at Kamehamenui FR is over 35% and these forests are primarily in the upper/higher elevations of the Reserve. Nearly 19% of the uppermost areas of the Reserve are characterized as very sparsely vegetated to unvegetated.

Table 4. Major Land Cover Types of Kamehamenui Forest Reserve

Land Cover Type	Approximate Area (acres)	Approximate % of the Forest Reserve
Native Dry Shrubland	1032	30
Very Sparse Vegetated to Unvegetated	808	24
Native Mesic Shrubland	740	22
Alien Mesic Grassland	555	16
Kiawe Dry Forest and Shrubland	170	5

Starr Environmental (2021) completed an extensive aerial and field botanical survey (Appendix D) of the Kamehamenui parcel and described three main vegetation types—subalpine shrubland, grassland/pasture and mesic forest.

3.6.1 Subalpine Shrubland

The mauka portion of the reserve (upper eastern area), between 6,500 ft (1,981 m) and 9,800 ft (2,987 m) in elevation, encompasses the subalpine shrubland (Figure 11). This is the only native-dominated ecosystem in Kamehamenui. Along the eastern border, directly below the summit of Haleakalā, the vegetation is very sparse and mostly consists of low growing kūpaoa (*Dubautia menziesii*) and pūkiawe (*Leptecophylla tameiameiae*). The Haleakalā silverswords or hinahina (*Argyroxiphium sandwicense* subsp. *macrocephalum*) and the native pamakani (*Tetramolopium humile* subsp. *haleakalae*) also occur in this zone. As you go down in elevation, the plants are relatively taller and more diverse with other native species such as kilau or bracken fern (*Pteridium aquilinum* subsp. *decompositum*), hairgrass (*Deschampsia nubigena*), ‘ōhelo (*Vaccinium reticulatum*), kukaenēnē (*Coprosma ernodeoides*), kalamoho (*Pellaea ternifolia*), ‘iwa‘iwa (*Asplenium adiantum-nigrum*), and maidenhair spleenwort (*Asplenium trichomanes* subsp. *densum*). Native tree species scattered in the shrubland include ‘a‘ali‘i (*Dodonaea viscosa*), māmane (*Sophora chrysophylla*), Haleakalā sandalwood (*Santalum haleakalāe* var. *haleakalae*), and hō‘awa (*Pittosporum confertiflorum*). Kilau or bracken fern is the most abundant native ground cover (Figure 12) and ‘a‘ali‘i is the most common tree in the subalpine shrubland. Some of the non-native plants growing in the shrubland include herbaceous species such as sweet vernal grass (*Anthoxanthum odoratum*), Yorkshire fog (*Holcus lanatus*), rattail (*Vulpia* sp.), and cheatgrass (*Bromus tectorum*).

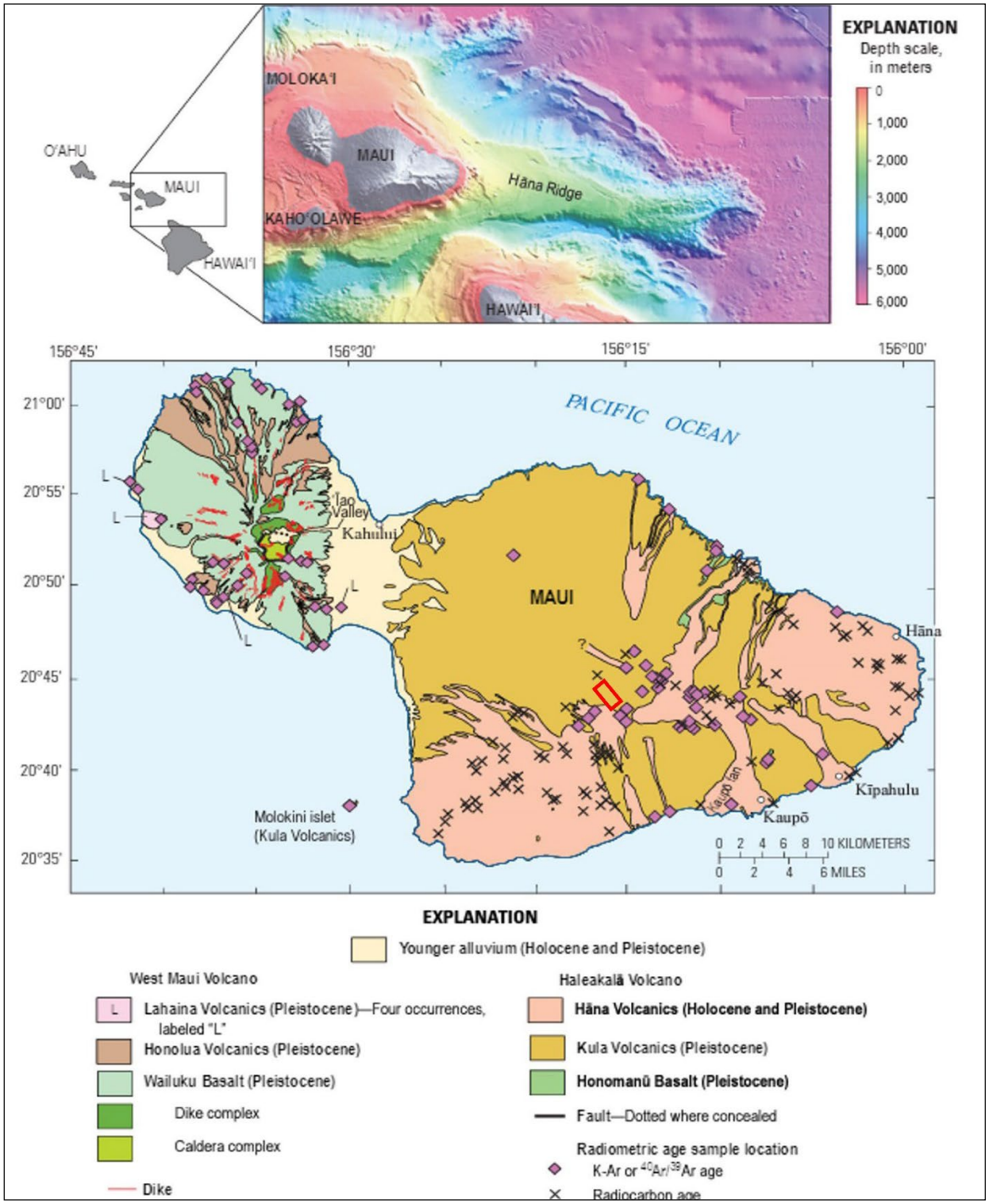


Figure 7. Geologic Map of the Island of Maui (Notes: The red box shows the approximate location of Kamehamenui Forest Reserve at the western flank of Haleakalā volcano. The insert box above the geologic map shows a shaded relief map with the seafloor surrounding Maui [only the gray areas are above sea level]. Source: Sherrod, D. R., J. M. Sinton, S. E. Watkins, and K. M. Brunt. 2007. Geologic Map of the State of Hawai'i. U.S. Geological Survey Open-File Report 2007-1089.)

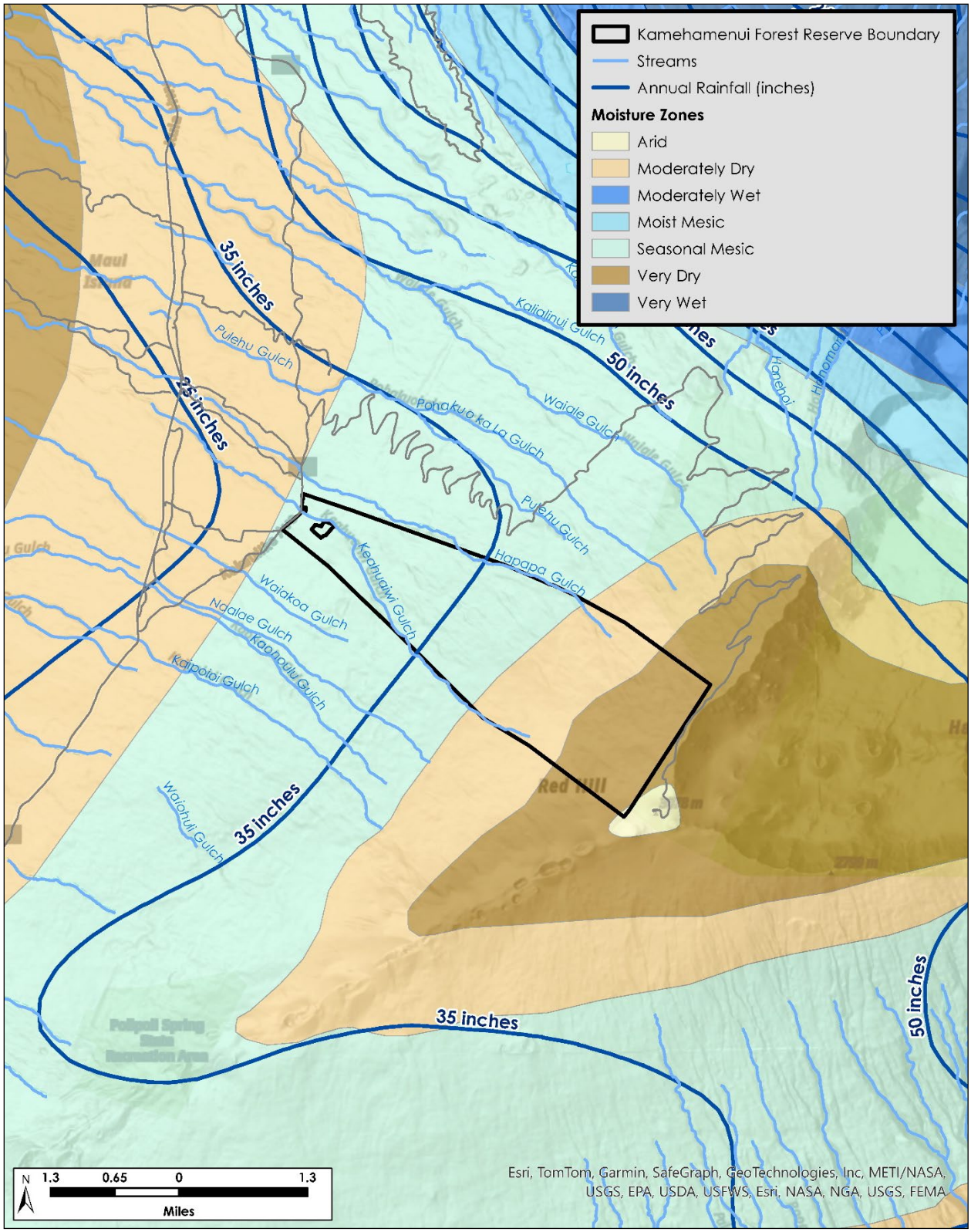


Figure 8. Moisture Zones, Surface Flows, and Rainfall

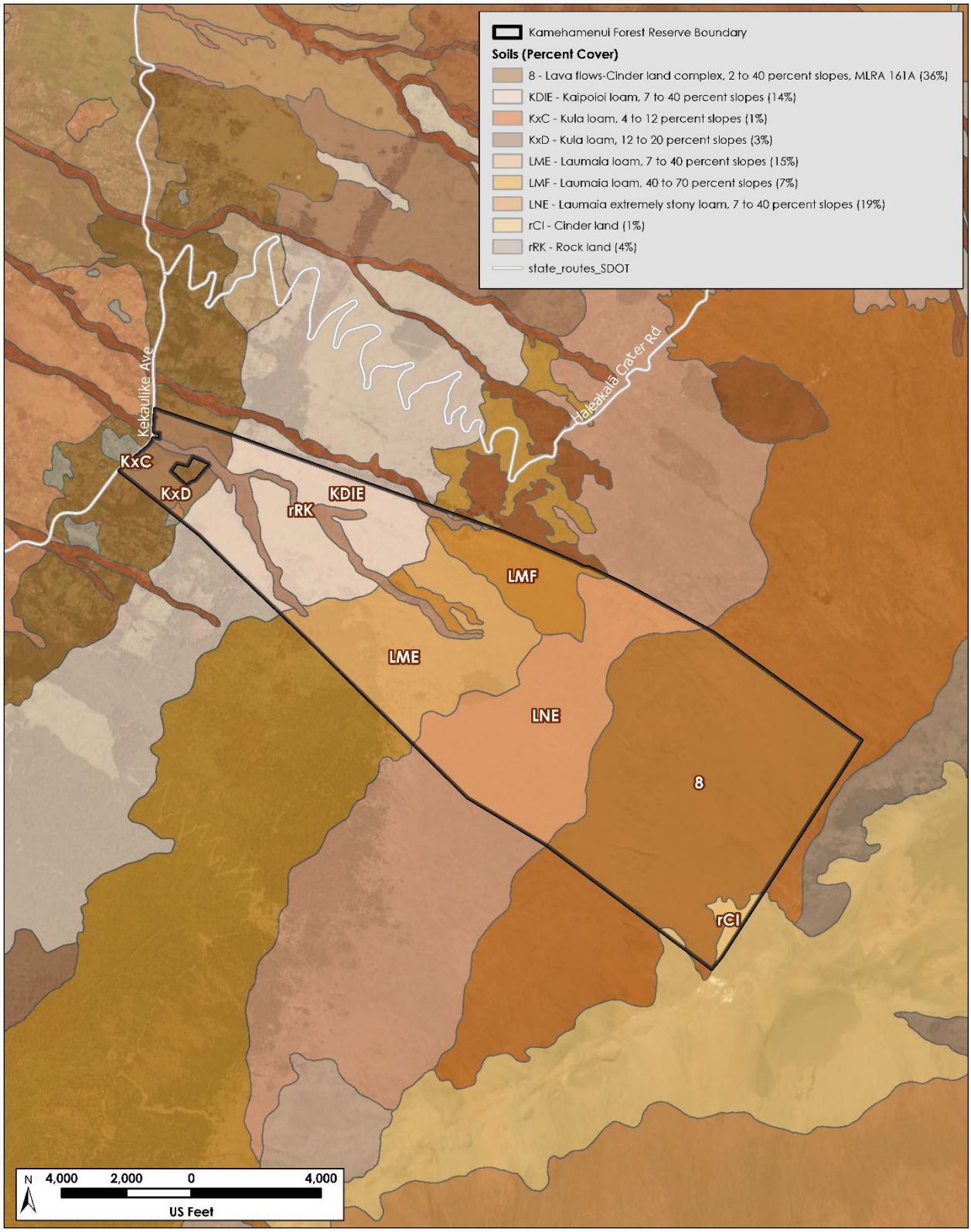


Figure 9. Kamehamenui Forest Reserve – Soils (*Source: Natural Resources Conservation Service. 2023. Web Soil Survey. <https://websoilsurvey.nrcs.usda.gov/>. U.S. Department of Agriculture.*)

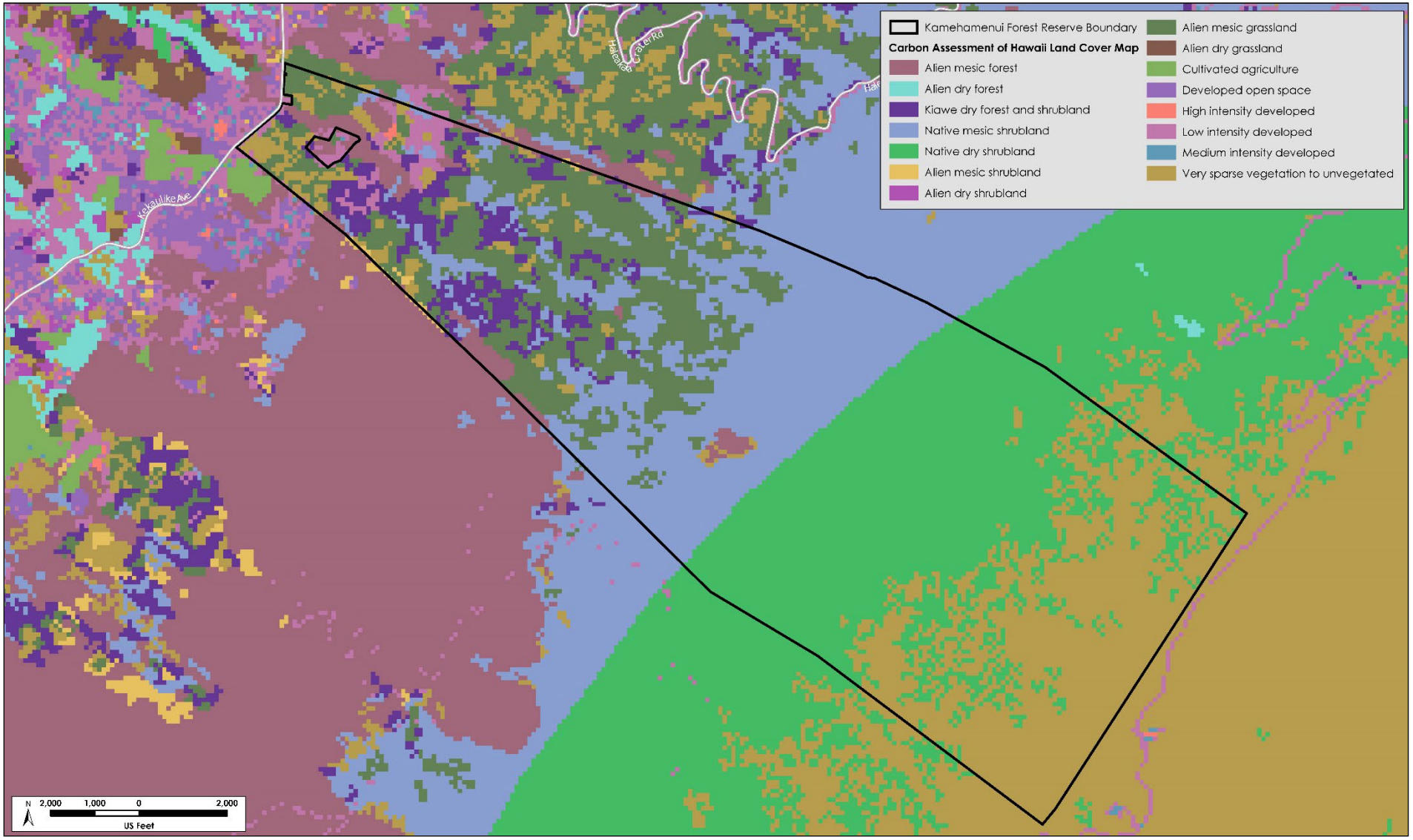


Figure 10. Land Cover Types of Kamehamenui Forest Reserve (Source: Jacobi, J. D., J. P. Price, L. B. Fortini, S. M. Gon III, and P. Berkowitz. 2017. Hawai'i Land Cover and Habitat Status: U.S. Geological Survey data release. <https://doi.org/10.5066/F7DB80B9>.)

3.6.2 Grassland/Pasture

The majority of vegetation below 6,500 ft (1981 m) is grassland or pasture that are dominated by non-native species. Kikuyu grass is the most abundant, and other grass species present include natal red top (*Melinis repens*), sweet vernal grass, weeping lovegrass (*Eragrostis curvula*), and Yorkshire fog.

About 1,233 acres of the reserve in this zone are still actively grazed under a lease with the State (see Section 5 for details). The vegetation here is restricted to low-growing grasses (Figure 13). However, there are a few scattered native and non-native shrubs. Pūkiawe, a native species, is limited to the upper portion above 5,500 ft while mostly non-native shrubs such as Canary Island St. John's wort (*Hypericum canariense*), cotoneaster (*Cotoneaster pannosus*), and firethorn (*Pyracantha* spp.) are scattered in the lower reaches of the reserve. There are pockets of mesic forest scattered throughout the grassland/pastures.

3.6.3 Mesic Forest

Below 6,500 ft (1,981 m) in the mid-elevations of the Reserve, trees start to become more prevalent within the grasslands/pastures, and a relatively open mesic forest occurs. Black wattle (*Acacia mearnsii*) is the most common non-native tree, especially below 6,000 ft (1,829 m) and along the southern border of the Forest Reserve (Figure 14). Ranchers have been controlling the spread of black wattle into the pasture lands. Thickets of non-native blue gum (*Eucalyptus globulus*) trees occur along the northern border but are mostly in decline due to impacts from multiple insects and pathogens. Other non-native tree species found scattered in this region include Monterey pine (*Pinus radiata*), maritime pine (*Pinus pinaster*), redwood (*Sequoia sempervirens*), and fire tree (*Morella faya*). The non-native kikuyu grass (*Cenchrus clandestinus*) is the dominant ground cover in the mesic forest except in thickets of non-native trees that are devoid of any understory vegetation.

Between 5,500 and 7,500 ft (1676 m and 2286 m) there are remnant stands of the endemic ʻōhiʻa (*Metrosideros polymorpha*) (Figure 15). These pockets of native mesic forest are mostly limited to the steep slopes of gulches and gullies in the Reserve, where they are protected from ungulates. The glabrous variety of ʻōhiʻa (*M. p.* var. *glaberrima*) is also common here. There is also a small grove of endemic koa trees at around 4,500 ft in elevation along a steep gulch. Pūkiawe is the most common shrub in this zone and other native shrubs that are present include ʻakala (*Rubus hawaiensis*), pilo (*Coprosma montana*), and ʻaʻaliʻi. Native ferns such as ʻamaʻu (*Sadleria cyatheoides*), palapalai (*Microlepia strigosa*), and pohole (*Diplazium sandwichianum*) are also present.



Figure 11. Subalpine Shrubland at Kamehamenui Forest Reserve (Photo courtesy of Starr Environmental)



Figure 12. Vast Areas of the Subalpine Shrubland are Dominated by the Native Bracken Fern (Pteridium aquilinum *subsp.* decompositum*) at Kamehamenui Forest Reserve (Photo courtesy of Starr Environmental)*



Figure 13. Heavily Grazed Pasture Habitat at Kamehamenui Forest Reserve (Photo courtesy of Starr Environmental)



*Figure 14. The Southern Boundary of Kamehamenui Forest Reserve Dominated by Black Wattle (*Acacia mearnsii*) Trees (Photo courtesy of Starr Environmental)*



Figure 15. Remnants of Native Mesic Forest Dominated by ʻŌhiʻa Trees are Limited to the Steep Gulch Slopes such as Hapapa Gulch at Kamehamenui Forest Reserve (Photo courtesy of Starr Environmental)

3.6.4 Native Plants

Starr Environmental (2021) observed 22 endemic and 16 indigenous plant species (Table 5) during their reconnaissance survey of the Kamehamenui FR (Appendix D). The abundance of endemic and indigenous species relative to the size of the property was low, and their distribution is limited to areas such as gulch slopes and rocky areas that provide some protection from ungulates.

3.7 Wildlife

3.7.1 Native Vertebrates

Hawaiian Hoary Bat

The ʻōpeʻapeʻa, or the Hawaiian hoary bat (*Lasiurus cinereus semotus*) (Figure 16), is the only terrestrial mammal native to Hawaiʻi. A solitary bat species, the ʻōpeʻapeʻa is known to occur on all main Hawaiian Islands except Niʻihau (DLNR 2015). There is still much to be learned about the species' foraging, breeding, dispersal patterns and population status on the islands. The ʻōpeʻapeʻa is listed as endangered under the federal Endangered Species Act (ESA) as well as under the Hawaiʻi State Endangered Species Law. Several monitoring efforts, particularly for the planning and permitting for the three wind energy facilities (Kaheawa 1, Kaheawa II, and Auwahi

Wind Farms), have documented ʻōpeʻapeʻa activity on Maui (SWCA Environmental Consultants 2006, 2011; Tetra Tech 2012), indicating that the species is present and may use habitats at Kamehamenui FR. The FR is within a large conservation unit on the west slope of Haleakalā that is included in conservation and mitigation efforts for ōpeʻapeʻa due to adjacent wind farm development.



Figure 16. Hawaiian Hoary Bat (Photo courtesy of U.S. Geological Survey)

Water courses and forest/pasture edges are important habitats for ʻōpeʻapeʻa. They roost in native and non-native vegetation from 3 to 29 ft (1 to 9 m) above ground level and rarely use lava tubes, rocks, or human-made structures for roosting. Using echolocation, they feed on a variety of native and non-native night-flying insects such as moths, crickets, and mosquitoes; sometimes feeding around artificial lights that attract such insects. ʻŌpeʻapeʻa are known to mate during September to December, and the females give birth to and raise pups from June to September. Research and recovery projects use radio telemetry to document habitat use and food availability, and to understand the key factors that define habitat suitability for bats.

Because of Kamehamenui FR's central location within that study area, it is likely that some of the bats being tracked as part of the study will travel across or occupy portions of the Reserve. Management of Kamehamenui FR by DOFAW will facilitate continued research on ōpeʻapeʻa, and in return, the results from studies on habitat suitability for ʻōpeʻapeʻa are expected to be directly applicable to habitat restoration efforts at Kamehamenui FR. As such, the Reserve is expected to expand available habitat for ʻōpeʻapeʻa and contribute to their recovery.

Birds

Three species of native birds were seen during the field surveys conducted by Starr Environmental (2021) at Kamehamenui FR—ʻapapane (*Himatione sanguinea*) (Figure 17), Maui ʻamakihi (*Chlorodrepanis virens* var. *wilsoni*) (Figure 17), and the Hawaiian owl or pueo (*Asio flammeus sandwichensis*). Of these native birds, the Maui ʻamakihi was the most common, found in forested or densely vegetated native as well as non-native shrubland from 4,000–7,500 ft. ʻApapane were less widespread, but locally prevalent, and were encountered in heavily forested areas from 5,500–7,500 ft. A pueo, or Hawaiian owl, was observed gliding over grassland/ pasture habitat in the Reserve at around 6,000 ft in elevation. Two endangered forest bird species, the 'ākohekohe, or crested honeycreeper (*Palmeria dolei*), and kiwikiu, or Maui parrotbill (*Pseudonestor xanthophrys*) were not observed during the 2021 survey but may be present in Kamehamenui Reserve (also see Section 3.8).

Table 5. Native Plant Species Observed at Kamehamenui Forest Reserve

Scientific Name	Common Name	Status	*Abundance in Forest Reserve
Acacia koa	Koa	Endemic	Rare
Argyroxiphium sandwicense subsp. *macrocephalum*	Hinahina, Haleakalā silversword	Endemic (Endangered)	Rare
Artemisia mauiensis	ʻAhinahina	Endemic	Rare
Asplenium trichomanes subsp. *densum*	Maidenhair spleenwort	Endemic	Occasional
Carex wahuensis	Carex	Endemic	Rare
Coprosma ernodeoides	Kukaenēnē	Endemic	Rare
Coprosma montana	Pilo	Endemic	Rare
Deschampsia nubigena	Hairgrass	Endemic	Occasional
Diplazium sandwichianum	Pohole	Endemic	Rare
Dubautia menziesii	Kūpaoa	Endemic	Common
Luzula hawaiiensis	Wood rush	Endemic	Rare
Metrosideros polymorpha var. *glaberrima*	ʻŌhiʻa	Endemic	Rare
Pittosporum confertiflorum	Hōʻawa	Endemic	Rare
Polystichum haleakalense	Polystichum	Endemic	Rare
Pseudognaphalium sandwicensium var. *sandwicensium*	ʻEnaʻena	Endemic	Rare
Rubus hawaiensis	ʻAkala	Endemic	Rare
Sadleria cyatheoides	ʻAmaʻu	Endemic	Rare
Santalum haleakalae var. *haleakalae*	ʻIliahi, Haleakalā sandalwood	Endemic	Rare
Sophora chrysophylla	Māmane	Endemic	Rare
Tetramolopium humile subsp. *haleakalae*	Haleakalā tetramolopium	Endemic	Occasional
Trisetum glomeratum	Pili uka	Endemic	Occasional
Vaccinium reticulatum	ʻŌhelo	Endemic	Rare
Asplenium adiantum-nigrum	ʻIwaʻiwa	Indigenous	Occasional

Scientific Name	Common Name	Status	*Abundance in Forest Reserve
Carex macloviana subsp. *subfusca*	Carex	Indigenous	Rare
Cyrtomium caryotideum	Kaapeape	Indigenous	Rare
Dodonaea viscosa	ʻAʻali'i	Indigenous	Occasional
Dryopteris wallichiana	Laukahi	Indigenous	Occasional
Elaphoglossum paleaceum	Māku'e	Indigenous	Rare
Ipomoea indica	Koali ʻawa	Indigenous	Rare
Korthalsella complanata	Hulumoa	Indigenous	Rare
Lachnagrostis filiformis	He'upueo	Indigenous	Rare
Leptecophylla tameiameiae	Pūkiawe	Indigenous	Common
Microlepia strigosa	Palapalai	Indigenous	Rare
Pellaea ternifolia	Kalamoho	Indigenous	Occasional
Psilotum nudum	Moa	Indigenous	Rare
Pteridium aquilinum subsp. *decompositum*	Kīlau, bracken fern	Indigenous	Common
Pteris cretica	Cretan brake	Indigenous	Occasional
Solanum americanum	Pōpolo	Indigenous	Rare

Source: Starr Environmental. 2021. Flora and Fauna Survey. Kamehamenui Forest Reserve, Maui. Prepared by Forest and Kim Starr. Prepared for Division of Forestry and Wildlife, Department of Land and Natural Resources.

*Abundance in Kamehamenui Forest Reserve:

Common = Widely scattered throughout the area or locally abundant within a portion of the Reserve.

Occasional = Scattered sparsely throughout the area or occurring in a few small patches.

Rare = Only a few isolated individuals within the Reserve.



*Figure 17. Maui ‘amakihi (*Chlorodrepanis virens *var.* wilsoni*) and ‘apapane (*Himatione sanguinea*)*
(Photo courtesy of Maui Forest Bird Recovery Project)

In addition to forest birds, the upper subalpine habitat at Kamehamenui FR is home to native seabirds. ‘Ua‘u, or Hawaiian petrels (*Pterodroma sandwichensis*), are known to nest in the Reserve. During bird surveys conducted in April and June 2021, Starr Environmental (2021) found several burrows that appeared to be recently active and found one dead petrel below the powerlines near the summit in Kamehamenui FR. In October 2021, more focused and organized surveys were conducted by DOFAW, AEP Energy Partners, and Starr Environmental overlapping about 668 acres (about 270 hectares) in the subalpine shrubland of the Reserve. They identified a total of 48 burrows; 22 burrows had been previously identified by the National Park Service and the remaining 26 were newly discovered burrows. Of these 48 burrows, two burrows showed signs of recent activity or chick presence, and two showed signs of predation from the previous season.

Kōlea, or Pacific golden plovers (*Pluvialis fulva*), were regularly observed during the first survey day in late April 2021. By the following week, in early May 2021, none were observed because they started their migration to Alaska. Seasonally, kōlea are likely present in all open areas in the Reserve up to 8,500 ft.

Although not observed in the 2021 field surveys by Starr Environmental, the vast expanse of grassland/pasture lands at Kamehamenui FR are expected to provide foraging and loafing habitat for the endangered nēnē, or Hawaiian goose, as well. For a brief description of each species and their statewide status and distribution, see Appendix E which provides a profile of each native vertebrate discussed in this section.

3.7.2 Native Invertebrates

A comprehensive baseline survey for insects has not yet been conducted for Kamehamenui, however, Appendix D lists the insects that Starr Environmental (2021) encountered during their surveys. About 34% of the insect species they observed were endemic, and the majority were found to occur in the highest elevations of the Kamehamenui FR. Species included three species of spiders (Order: Araneae)—wolf spider (*Lycosa hawaiiensis),* Hawaiian long-jawed spider (*Tetragnatha acuta*) and crab spider (*Mecaphesa* sp.); several Hawaiian fruit fly (Order: Diptera)

species (*Trupanea* spp.); three species of true bugs (Order: Hemiptera)—planthoppers (*Oliarus* sp. and *Nesosydne* spp.) and false chinch bugs (*Nysius* spp.); two yellow-faced bee (Order: Hymenoptera) species (*Hylaeus nivicola* and *Hylaeus volatilis*) (Figure 18); potter wasp (Order: Hymenoptera, *Odynerus* sp.); and seven butterfly and moth species (Order: Lepidoptera)—five fancy case caterpillars (*Hyposmocoma* spp.), koa butterfly (*Udara blackburni*), and the Haleakalā flightless moth (*Thyrocopa apatela*). The five fancy case caterpillar species (*H. starrorum, H. kukilakila, H. desilvai, H. makaohuna*, and *H. kamehamenui*) were collected for the very first time during the 2021 surveys in Kamehamenui. They are new species that have been recently described, and thus far, they have only been found in Kamehamenui FR (Doorenweerd et al. 2023).



*Figure 18. Native Yellow-Faced Bees (*Hylaeus *spp.), An Important Pollinator of Several Native Plants (Photo courtesy of Starr Environmental)*

Native spiders seen at Kamehamenui were limited to the subalpine shrublands. The carnivorous wolf spider lives under stones, while the crab spider and the long-jawed spider hunt for prey amongst the vegetation. Native yellow faced bees (Figure 18) are abundant in the subalpine shrubland of the Reserve. Haleakalā flightless moths are commonly seen on the cinder rocks in the summit region. The relatively undisturbed higher subalpine areas provide habitat for a variety of species of native tephritid or fruit flies. *Trupanea cratericola* which lay eggs in the flowers of kūpaoa (*Dubautis* spp.) and Haleakalā silversword are common in the higher elevations of the Reserve. *Trupanea limpidapex* lays eggs in the shoot tips of kūpaoa. Characteristic damage seen to kūpaoa by the fruit flies in the subalpine shrublands are indicative of the presence of these native fruit flies. The flowers of ʻahinahina kuahiwi (*Artemisia australis*) are utilized by *Trupanea artemisae*.

The koa butterfly (Figure 19) is locally abundant in forested areas as the larvae feed on koa, ʻaʻalii, and the non-native black wattle trees. A variety of native fancy-case caterpillars are common throughout the Reserve. Larvae with “burrito” shaped cases are found on stones and cliff faces in sheltered areas of the Reserve. While the larvae of the “burrito” type mostly feed on lichens and fungi, larvae with the “cigar” shaped case were also found (Starr Environmental 2021). These “cigar” shaped fancy case caterpillars (*H. desilvai*) are suspected to have carnivorous larvae but this would need to be confirmed by future field observations

(Doorenweerd et al. 2023). Native plant hoppers are host-plant specific and are found in all terrestrial native habitats in Hawai‘i; a few species also occur in the Reserve.

With regard to mollusks, the native tornatellid snails (*Tornatellides* sp.) (Gastropoda: Achatinellidae) are found in a variety of habitats in the Hawaiian Islands and are also present at Kamehamenui. The native ground snail (*Vitrina tenella*) was previously known to occur at Kamehamenui but was not seen during the 2021 surveys (Starr Environmental 2021). Native amber snails (*Succinea* spp.) that can inhabit both native and non-native dominated habitats were also not seen during the recent surveys but are expected to be present at Kamehamenui.



*Figure 19. Koa Butterfly (*Udara blackburni*) in the Koa/Wattle Forest of Kamehamenui Forest Reserve (Photo courtesy of Starr Environmental)*

3.7.3 Non-Native Wildlife

A wide variety of non-native mammal, bird, and insect species occur at Kamehamenui FR. Table 6 provides a list of non-native birds observed during the 2021 field survey of the Reserve (Starr Environmental 2021). Note, the abundance in Table 6 is relative to the property.

Eurasian skylarks (*Alauda arvensis*) were commonly seen in the vast open grassland/pasture habitat. Non-native passerines including red-billed Leiothrix (*Leiothrix lutea*), Japanese bush-warbler (*Cettia diphone*), warbling white-eye (*Zosterops japonicus*), house finch (*Haemorhous mexicanus*), common myna (*Acridotheres tristis*), northern mockingbird (*Mimus polyglottos*), and northern cardinal (*Cardinalis cardinalis*) were mostly seen or heard in the forested areas. Game birds and doves that were heard or visually observed include the ring-necked pheasant (*Phasianus colchicus*), chukar (*Alectoris chukar*), mourning dove (*Zenaida macroura*), zebra dove (*Geopelia striata*), and rock pigeon (*Columba livia*). A barn owl (*Tyto alba*) was seen flying out from a rock cave in a cliff in the pasture. Other species of birds such as chestnut munia (*Lonchura atricapilla*), house sparrow (*Passer domesticus*), and junglefowl (*Gallus gallus*) were only found in the lowest or western portion of the Reserve.

Table 6. Non-Native Birds Observed at Kamehamenui Forest Reserve During Field Surveys in June-August 2021

Scientific Name	Common Name	*Abundance in Forest Reserve
Acridotheres tristis	Common myna	Occasional
Alauda arvensis	Eurasian skylark	Common
Alectoris chukar	Chukar	Occasional
Cardinalis cardinalis	Northern cardinal	Occasional
Columba livia	Rock pigeon	Occasional
Gallus gallus	Red junglefowl	Rare
Geopelia striata	Zebra dove	Occasional
Haemorhous mexicanus	House finch	Common
Leiothrix lutea	Red-billed leiothrix	Common
Lonchura atricapilla	Chestnut munia	Rare
Mimus polyglottos	Northern mockingbird	Occasional
Passer domesticus	House sparrow	Occasional
Phasianus colchicus	Ring-necked pheasant	Common
Tyto alba	Barn owl	Rare
Zosterops japonicus	Warbling white-eye	Common

Source: Starr Environmental. 2021. Flora and Fauna Survey. Kamehamenui Forest Reserve, Maui. Prepared by Forest and Kim Starr. Prepared for Division of Forestry and Wildlife, Department of Land and Natural Resources.

*Abundance in Kamehamenui Forest Reserve

Common = A few flocks or well scattered individuals throughout the survey area.

Uncommon = Only one flock or several individuals seen within the survey area.

Rare = only one or two seen within the survey area.

Non-native mammals—axis deer (*Axis axis*), goats (*Capra hircus*) (Figure 20), pigs (*Sus scrofa*), and sheep (*Ovis aries*) are present at Kamehamenui FR but are less abundant in the harsh environmental conditions that occur in the uppermost elevations of the Reserve. In addition, domesticated cows (*Bos taurus*), goats, pigs, and sheep are kept on the leased ranch lands. Other mammals such as rats (*Rattus* spp.), mice (*Mus domesticus*), cats (*Felis domesticus*), dogs (*Canis lupus familiaris*), and mongooses (*Herpestes javanicus*) were not seen during the recent surveys conducted in 2021 and it is not clear which of these species occurs and/or is a problem in Kamehamenui FR.

There are two notable non-native insects that occur in the Reserve, including the Argentine ant (*Linepithema humile*) and the glaber ant (*Ochetellus glaber*). Both species are limited to the lower elevations of the Reserve. The lower incidence of invasive ants in the higher elevation habitats of the reserve may explain the relatively higher diversity of native insects (Starr Environmental 2021).



*Figure 20. Non-Native Goats (*Capra hircus*) at Kamehamenui Forest Reserve (Photo courtesy of Forest and Kim Starr)*

As for mollusks, non-native garlic snails (*Oxychilus alliarius*) that feed on smaller snails are present in the Forest Reserve. They have been observed on foliage and stones, and are a known prey species for native moths.

3.8 Critical Habitat

As outlined by the federal ESA, critical habitat is defined as, "*specific areas within the geographic area, occupied by the species at the time it was listed, that contain the physical or biological features that are essential to the conservation of endangered and threatened species and that may need special management or protection. Critical habitat may also include areas that were not occupied by the species at the time of listing but are essential to its conservation*" (USFWS 2017). About 1171 acres (474 hectares) of Kamehamenui FR overlaps critical habitat. Out of these 1171 acres, the uppermost 408 acres (165 hectares) overlaps critical habitat Ecosystem Unit – Alpine 01 for the Haleakalā silversword (Figure 21, Table 7). Just below this unit, the remaining 763 acres (309 hectares) overlaps critical habitat Ecosystem Unit – Subalpine 01 for eight plant species (Figure 21, Table 7). This subalpine ecosystem is also critical habitat (Bird Unit Subalpine 24) for two forest bird species, the 'ākohekohe, or crested honeycreeper and kiwikiu, or Maui parrotbill (Figure 21, Table 7).

Only Haleakalā silversword is known to be present in the Ecosystem Unit Subalpine 01 of Kamehamenui FR. Koʻokoʻlau (*Bidens micrantha* ssp. *kalealaha*) and nohoanu (*Geranium arboretum*) (Figure 22) are known to occur in the Subalpine Unit 01, but they have not yet been found during surveys in the Kamehamenui FR. The remaining plant species listed in Table 7 have not been documented to occur in the critical habitat units that overlap Kamehamenui FR; however, USFWS (2016) has determined that this area is essential for the conservation and recovery of these subalpine species because it provides the primary physical (e.g., rainfall, soil type etc.) or biological (e.g., pollinators, dispersal agents, roosting or nesting sites etc.) habitat requirements necessary to reestablish wild populations within their historical range.

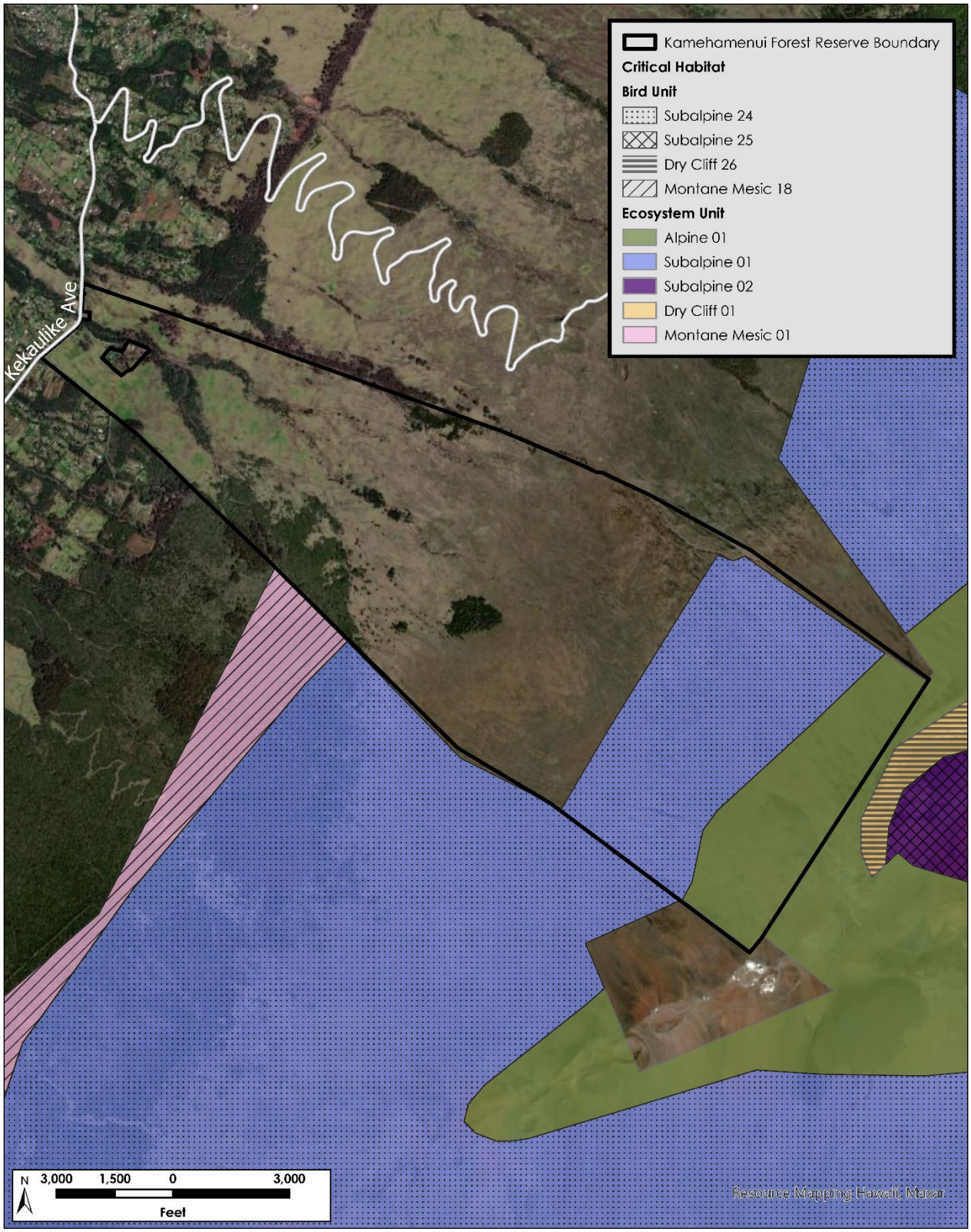


Figure 21. Critical Habitat Units (*Source: U.S. Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokaʻi, Lānaʻi, Maui, and Kahoʻolawe for 135 species. Final rule. Federal Register 81(61):17790–18110.*)

Table 7. Ecosystem Critical Habitat Designation in Kamehamenui Forest Reserve

Species	Critical Habitat Ecosystem Unit	
Plants	**Subalpine 01**	**Alpine 01**
Hinahina, Haleakalā silversword (*Argyroxiphium sandwicense* ssp. *macrocephalum*)	X	X
Asplenium peruvianum var. *insulare*	X	
Koʻokoʻlau (*Bidens micrantha* ssp. *Kalealaha*)^	X	
Hawaiian red-flowered geranium (*Geranium arboreum*) ^	X	
Nohoanu (*Geranium multiflorum*)	X	
*Phyllostegia bracteata**	X	
Schiedea haleakalensis	X	
Aʻe (*Zanthoxylum hawaiiense*)	X	
Birds	**Subalpine 24**	
'Ākohekohe, or crested honeycreeper (*Palmeria dolei*)	X	
Kiwikiu, or Maui parrotbill (*Pseudonestor xanthophrys*)	X	

Source: U.S. Fish and Wildlife Service. 2016. Endangered and threatened wildlife and plants; designation and nondesignation of critical habitat on Molokaʻi, Lānaʻi, Maui, and Kahoʻolawe for 135 species. Final Rule. Federal Register 81(61):17790–18110.

* This species may no longer occur in the wild on Molokaʻi, Lānaʻi, Maui, or Kahoʻolawe.

^ This species may occupy Subalpine Unit 01 but it is not clear if it is present in Kamehamenui Forest Reserve portion of the unit.

As of 2016, the crested honeycreeper,'ākohekohe, is found on Haleakalā at elevations between 5,000 and 6,500 ft (1,500 to 1,970 m) at Manawainui, Kīpahulu Valley, and the upper Hāna rainforest, and not in Kamehamenui. As of 2016, the Maui parrotbill, kiwikiu, was limited in its distribution to Haleakalā between 4,500 and 6,500 ft (1,360 and 1,970 m). USFWS (2016) has likely included Kamehamenui FR as part of these designated critical habitat units because they believe that the area is essential for their conservation.



Figure 22. Endangered Geranium Arboreum at Haleakalā National Park (Photo courtesy of Starr Environmental)

3.9 Archaeology and Historical Sites

Archaeological investigations were conducted in three separate locations of Kamehamenui FR. In 2021, the International Archaeological Research Institute, Inc. conducted a reconnaissance level survey along the southeastern fence line for the Kamehamenui Forest Protective Fence Project (Moore 2022). In 2023, ASM Affiliates (2024) conducted an Archaeological Inventory Survey (AIS) of approximately 320 acres in the lower westernmost portion of the Reserve overlapping the

ranch, and a reconnaissance survey of 25 miles of proposed linear trail routes in the upper/ eastern half of the Reserve.

Scattered throughout the 320 acres in the lower part of Kamehamenui, the AIS identified 82 cultural and archaeological features associated with the operation of the Erehwon Cattle Ranch from the mid-19th century through 1990. Ranch activities likely disturbed any evidence of Precontact and early historic agriculture or habitation in the Reserve. Nonetheless, historic ranching created the landscape as it is today. The physical landscape of the Reserve tells the story of ranching and other historic activities that once occurred within the boundaries of the lower 320 acres of Kamehamenui. Detailed descriptions of these 82 features can be found in the AIS report (Appendix F). The descriptions meet the standards of HAR §13-276, therefore the 320 acres are considered to be a cultural landscape. The area also meets the description of a Historic Vernacular Landscape according to the U.S. National Park Service.[1]

The 82 cultural and archaeological features found within the Reserve include: 25 features related to water management within Keāhuaiwi Gulch and other gulches (e.g., check dams and weirs to retain and direct water, rock piles to prevent erosion, and a Composite Reinforced Mortar [CRM] wall); four water features associated with the Kula water pipeline (e.g., remnants of rock foundation and wooden pump houses); 10 features related to agriculture in open pasture (e.g., terraces and berms for retaining soil and defining field boundaries for potato farming); 17 features related to livestock management along drainages and in pasture land (e.g., dry-stacked wall which likely served as a fence line [Figure 23]); four features associated with previous habitation south of Keāhuaiwi Gulch (e.g., a retaining wall and a "U" shaped enclosure, ceramic shreds, and glass fragments); eight features related to Erehwon Ranch dairy farm operations (e.g., a concrete feature that served as a silo, wooden trough, barn, and watering hole); and 14 features with undetermined functions (e.g., ten rock piles and two enclosures).



Figure 23. A Dry-Stacked Retaining Wall, an Archaeological Feature in Kamehamenui Forest Reserve Likely Related to Potato Cultivation (Photo courtesy of ASM Affiliates)

Three archaeological features were identified during the reconnaissance survey of the proposed trails in the upper/ eastern portion of the Reserve. These include a modified outcrop, a cairn/rock mound, and a cairn in the central portion of the Reserve. The function of these features is unclear. In addition, three previously recorded sites (Moore 2022) consisting of two rock walls and a rock pile overlap the trail along the southwestern border of

[1] "a landscape whose use, construction, or physical layout reflects endemic traditions, customs, beliefs, or values; expresses cultural values, social behavior, and individual actions over time; is manifested in physical features and materials and their interrelationships, including patterns of spatial organization, land use, circulation, vegetation, structures, and objects"

the Reserve. One rock wall is interpreted as a temporary habitation and the other as an informal windbreak. The rock pile is interpreted as a marker.

All identified archaeological sites and features will be avoided during the proposed infrastructure improvements and protected by fencing and/or archaeological monitoring during construction work. In the event that additional surface and/or subsurface historic properties or artifacts—including cultural deposits or features, human remains, lava tubes, structural remnants or concentrations of artifacts—are identified during any management activities, work will cease immediately in the area of the discovery. The discovery will be protected from further disturbance, and the State Historic Preservation Division (SHPD) will be consulted regarding appropriate documentation. If historical properties are present which require mitigation, SHPD will request that a detailed mitigation plan (e.g., an archaeological monitoring plan or a preservation plan) be submitted to SHPD for review and acceptance prior to initiation/ continuation of project work, along with written and photographic documentation providing verification that appropriate interim protection measures have been implemented.

3.10 Access

Kekaulike Avenue runs along the western border of Kamehamenui FR. However, at present, there is no public access to the Forest Reserve from this highway (Figure 24). There are three roads that ascend into the Forest Reserve from Kekaulike Avenue; two are dirt roads currently used by DOFAW as service roads. The third road is in the middle and is a separate private easement leading to the residential units located in the lower western portion of the Reserve (Figure 24). There is no legal public access to the Reserve through the adjacent private lands of the Haleakalā Ranch Company to the north or through the federal lands of the Haleakalā National Park to the east. The mauka fenced portions of Kamehamenui FR can be accessed from the adjacent Kula FR at the southern boundary. DOFAW plans to create access to Kamehamenui FR from Kekaulike Avenue (see Section 5 for details), which in turn, will also facilitate access to Kula FR, a popular recreational area.

There are a few existing trails in the upper eastern portion of Kamehamenui FR, but they are not connected to any public access points at this time. DOFAW plans to add trails in the upper eastern portion of the Reserve to connect to existing trails in the neighboring Kula FR in the near future (see Section 5). The main trail access points from Kekaulike Highway traverse through the currently leased portion of the Reserve. Access to these trails from Kekaulike Avenue will not be available until the lease expires, or a public access agreement is negotiated with the current lessee. Proposed plans for trails and access options are further discussed in Section 5 of this management plan, and the timing of these activities depend on the completion of previous phases.



Figure 24. Existing Access and Infrastructure

3.11 Infrastructure

Infrastructure in Kamehamenui is mostly associated with the historic and current land use of ranching. There are four main structures on the leased lands: two sheds, one built in 1947 and one built in 1952; and two redwood water tanks, one built in 1952 and one built in 1980 (Figure 25). The existing (leased) cattle ranch also has multiple small water pump sheds, water tanks, an old historic silo which was built in 1926, and two corral structures. There are three above ground storage tanks located in the central and eastern portion of the Reserve (Figure 24).



Figure 25. Water Trough, Old Dairy Barn, and Silo Associated with the Historic von Tempsky (Later "Erehwon") Ranch in the Lower Western Portion of Kamehamenui Forest Reserve (Photo courtesy of ASM Affiliates)

DOFAW recently completed building an ungulate-proof fence that encloses the upper 2210 acres of the Reserve (Figure 26).



Figure 26. Aerial View of the New Corral Area in the Southwestern Portion of the Reserve (Left Image) and the Ungulate-Proof Fence in the Upper Southeastern Portion of the Reserve (Right Image) (Photo courtesy of Maui Forest Bird Recovery Project)

There are two private residential properties in the western portion of Kamehamenui FR including the historic von Tempsky residence. The residences and their associated infrastructure are not part of the FR (Figure 27).

3.12 Public Use Opportunities

At present there are no public use opportunities at Kamehamenui. One objective of this plan is to map out future public use opportunities such as hiking, camping, biking, horseback riding and hunting. There are currently no campsites and no trails for biking or horseback riding. No portions of the Reserve are designated public hunting units.

3.12.1 Hunting



Figure 27. Aerial View of Two Residential Properties in the Western Portion that are not Part of Kamehamenui Forest Reserve (Photo courtesy of Ford & Associates)

Game mammals found in the Reserve include axis deer, feral pigs, goats, and sheep. Game birds (Figure 28) include: ring-necked pheasant (*Phasianus colchicus*), black francolin (*Francolinus francolin*), chukar, and gray francolin (*Francolinus pondicerianus*). Currently only the lease holder is authorized to hunt game animals within the area encumbered by the existing grazing and hunting lease. In the future (see Sections 5.3.3 and 5.4), hunting at Kamehamenui FR will only be allowed if it does not interfere with priority conservation actions as defined by the DOFAW Management Guidelines. Additionally, the area would need to be included as a public hunting area in the hunting regulations enforced by the Division of Conservation and Resources Enforcement. This includes Chapter 121 – HAR Rules Regulating the Hunting of Wildlife on Public Lands and Other Lands, Chapter 122 – HAR Rules Regulating Game Bird Hunting, and Chapter 123 – HAR Rules Regulating Game Mammal Hunting. A copy of current hunting rules and regulations can be obtained from https://dlnr.hawaii.gov/dofaw/rules/.



*Figure 28. Game Birds such as Chukar (*Alectoris chukar*) and Ring-Necked Pheasant (*Phasianus colchicus*) Occur at Kamehamenui Forest Reserve (Photo courtesy of ASM Affiliates)*

3.12.2 Forest Product Collection

Non-timber forest products such as flowers, ferns, fruits, and greenery may be gathered from the Forest Reserve System. Gathering of material from plant species that are not listed as a federal or state T&E species is permitted and regulated by DOFAW through standard Forest Reserve System permit procedures as described in Chapter 13-104, HAR. Gathering of non-listed species or common materials requested in quantities that are determined by DLNR as representing personal use is regulated through issuance of a Collection Permit (free of charge). If

quantities are determined to represent commercial use, a Commercial Harvest Permit may be issued for a fee. The Forest Product Price List on the DOFAW website can be consulted for information on personal versus commercial use quantities, as well as current commercial use pricing: https://dlnr.hawaii.gov/forestry/files/2013/09/2018-12-11_DLNR_Forest-Products-Price-List.pdf.

Collecting the following without a permit is prohibited under state laws Chapter 183D and 195D, HRS and subject to regulation under applicable HAR.

- Listed threatened, endangered, or other rare species
- Common invertebrate species
- Any migratory bird species

Applications for permits for such activities may be submitted to the "Administrator," at the DOFAW Honolulu office. In these cases, a separate Access Permit may be required which is obtained through the district manager at the DOFAW Maui office. Addresses for these offices are:

Administrator
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, Hawai'i 96813
Phone (808) 587-0166

Maui District Manager
Division of Forestry and Wildlife
685 Haleakalā Hwy
Kahului, Hawai'i 96732
Phone (808) 984-8100

The collection of any federally listed or migratory bird species is also subject to federal permits. Contact USFWS for additional information. For more information on how to apply for permits for the Forest Reserve System visit the DOFAW permitting webpage: https://dlnr.hawaii.gov/dofaw/permits/.

3.13 Traditional and Customary Rights

Traditional and customary rights of the Native Hawaiian people are protected under Hawai'i State law. In the Constitution of the State of Hawai'i, Article XII, Section 7 states that "*The State reaffirms and shall protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by ahupua'a tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778, subject to the right of the State to regulate such rights.*"

As described in Section 3.9 of this management plan, three cultural features were found during the reconnaissance-level archaeological survey along a 25-mile stretch in the upper eastern portion of Kamehamenui FR, above the active ranch. These features are all crudely constructed and indicative of short-term or recurrent habitation activities, and travel through the area during an indeterminant period. Previous nearby surveys in the upper portion of the FR have identified similar features, suggesting that additional features may lie outside the surveyed routes. Kamehamenui FR was probably an important place for cultural and religious activities and a source of natural resources for subsistence, ceremony, and for the making of implements of

varied purposes. Forest resources that were gathered likely included, but are not limited to: construction materials, foliage, natural fibers, dyes, medicinal plants, and feathers from native forest birds. The management activities outlined in this plan are not expected to impact or diminish these protected traditional and customary rights. However, without a permit, the collection of listed threatened, endangered, or otherwise rare species, common invertebrate species, or any migratory bird species, are prohibited under state laws Chapter 183D and 195D, HRS, and subject to regulation under applicable HAR. See section 3.11.2 for more information.

Anyone seeking to engage in an activity or collect any forest product from a State Forest Reserve that is normally prohibited by the forest reserve rules (Chapter 13-104, HAR) but are engaging in traditional and customary native Hawaiian cultural activities that are defined in, and protected pursuant to Sections 1-1, 7-1, HRS; article XII, section 7 of the Hawai'i State Constitution; and rulings of Hawai'i case law, can apply for a permit. The Hawaiian traditional and customary practices permit application is available on the DOFAW Permits & Guideline webpage (https://dlnr.hawaii.gov/dofaw/permits/) under the State Forest Reserve Section. Completed applications should be submitted to the branch office that services the district that the forest reserve is located in.

For any inquiries regarding traditional and customary rights for the Kamehamenui FR, please contact the Forestry Manager at the DOFAW Maui Office:

Forestry Manager
Division of Forestry and Wildlife
685 Haleakalā Hwy
Kahului, Hawai'i 96732
Phone (808) 984-8100

3.14 Revenue

According to Section 183-1.5, HRS, DLNR shall: *"Devise and carry into operation, ways and means by which forests and forest reserves can, with due regard to the main objectives of title 12, be made self-supporting in whole or in part."*

Commercial permits for non-timber forest products and small-scale salvaging of dead or down timber can be issued for Kamehamenui FR. Proximity to a major road make this Reserve a somewhat desirable location for this activity (scales are defined in Appendix G). Each application for a commercial salvage permit shall be considered on its own merits, including its effect on the premises, natural resources, and the public's use and enjoyment of the Reserve. Per the current rule (HAR 13-104-22) the raw material value of any commercial salvage permit issued for Kamehamenui FR cannot exceed $10,000 USD.

DOFAW is exploring options for new revenue streams, including those associated with ecosystem services to supplement funding of natural resource management activities of forests and other natural areas under its jurisdiction. Carbon sequestration—the capture and long-term storage of atmospheric carbon dioxide to mitigate global climate change—is an ecosystem

service for which a market for both compliance and voluntary carbon offsets already exists. DOFAW might consider undertaking a certification process for Kamehamenui as a reforestation/ afforestation carbon project under a voluntary carbon standard.

Section 4.0 THREATS

4.1 Invasive Plants

Invasive plants are non-native species whose introduction causes or is likely to cause economic or environmental harm, or are a threat to human health (HDOA 2016). The most direct impact of invasive plants in Hawai'i's forests is the loss of habitat for native plants and animals. Invasive plants can invade natural areas, grow and reproduce rapidly, reduce native biodiversity and alter ecosystem functions. Invasive plant species that are present in Kamehamenui FR and have the potential to disrupt the ecosystem are listed below in Table 8. For a brief description of each species, their statewide distribution and impacts, see Appendix H.

DOFAW, in coordination with its partners like the Maui Invasive Species Committee (MISC), conducts surveys to detect the presence of incipient invasive plants. Such early detection surveys are critical for DOFAW to respond rapidly and remove incipient invasive plant populations before they spread to an extent where their eradication becomes cost prohibitive. For example, *Cortaderia jubata* (Figure 29) are being actively controlled by MISC in upcountry Maui. This species also occurs in Kamehamenui FR and DOFAW would contribute towards its eradication from the Reserve as well.



Figure 29. Cortaderia jubata — *Monitored for Early Detection and Rapid Response* *(Photo courtesy of MISC)*

DOFAW's overall approach to the management of invasive plants at Kamehamenui FR depends on the specie(s)' potential impacts and distribution in the FR as well as available methods, such as control, containment, and eradication. Early detection and rapid response are also a critical part of DOFAW's management objectives:

- *Control*—Reduce populations and/or vigor of invasive plant species through mechanical, chemical, as well as biocontrol approaches.
- *Containmen*t—Stop or minimize growth and/or geographic spread if impacts are beyond the point of eradication.
- *Eradicatio*n—Complete removal of the population of invasive plant species threatening high-value resources (e.g., endemic trees) within a geographic area.

- *Early Detection and Rapid Response*—Periodic surveys to detect, assess, and rapidly respond are a critical defense against the establishment of invasive plant populations that are not yet present in the area but pose a serious threat to watershed function and/or native ecosystems if they become established.

Table 8. Invasive Plants Species Documented in Kamehamenui Forest Reserve

Species*	Common Name	Division of Forestry and Wildlife Objective	Regulatory Status
Acacia mearnsii	Black wattle	Control	Hawai'i Noxious Weed List
Banksia integrifolia	Coast banksia	Eradication	None
Bocconia frutescens	Tree poppy	Containment	Hawai'i Noxious Weed List
Buddleja davidii	Butterfly bush	Eradication	None
Buddleja madagascariensis	Smoke bush	Eradication	None
Cestrum nocturnum	Night blooming jasmine	Containment	None
Cortaderia jubata	Pampas grass	Containment	Hawai'i Noxious Weed List
Cotoneaster pannosus	Cotoneaster	Containment	None
Eucalyptus globulus	Blue gum	Control	None
Eucalyptus robusta	Swamp mahogany	Containment	None
Hypericum canariense	Canary Island St. John's Wort	Containment	None
Lonicera japonica	Japanese honeysuckle	Eradication	None
Morella faya	Fire tree	Control	Hawai'i Noxious Weed List
Passiflora tarminiana	Banana poka	Containment	Hawai'i Noxious Weed List
Pittosporum undulatum	*Mock orange*	Eradication	Hawai'i Noxious Weed List
Pinus radiata	Monterey pine	Control	None
Pyracantha angustifolia	Firethorn	Containment	None
Pyracantha koidzumii	Formosa firethorn	Containment	None

*Data from Starr Environmental. 2021. Flora and Fauna Survey. Kamehamenui Forest Reserve, Maui. Prepared by Forest and Kim Starr. Prepared for Division of Forestry and Wildlife, Department of Land and Natural Resources.

Some non-native plant species are also designated as a noxious weed by the Hawai'i Department of Agriculture. A 'noxious weed' is defined as a plant species which is, or may be likely to become, injurious, harmful, or deleterious to the agricultural industry or natural resources of the State. Selling or transporting noxious weeds, their seeds or vegetative reproductive parts is prohibited under State Law Chapter 152, HRS and subject to regulation under Chapter 4-68, HAR.

4.2 Invasive Animals—Vertebrates

Most of the lands of Kamehamenui have been under ranching since the late 1800s. Present ecosystem-level impacts such as loss of native vegetative cover, soil erosion and compaction, and reduction in groundwater recharge at Kamehamenui can be attributed to long-term impacts associated with the roaming and grazing of hoofed domesticated ranch animals such as cows, horses, goats, and sheep. Degradation of native ecosystems and watershed health in Kamehamenui is further exasperated by current browsing by feral pigs, goats, sheep, and more recently, by introduced axis deer. Smaller introduced mammals such as rats and mongoose also directly impact native plant and animals by eating fruits and seeds, and predating on native birds and their eggs. The impacts from introduced mammals vary across landscapes, depending on ecosystem type, what animal species are present and their population levels, and the type and intensity of any control measures being used. Table 9 below summarizes some of these impacts.

Table 9. Invasive Vertebrate Species that Occur in Kamehamenui Forest Reserve and their Potential Impacts

Species	Common Name	Potential Impacts
Axis axis	Axis deer	Vegetation damage and death from browsing and bark stripping, soil erosion, deforestation, and decrease in groundwater recharge.
Capra hircus	Feral goats	Limit the reproduction of most native species, resulting in deforestation, erosion, and watershed deterioration (impacts to groundwater recharge).
Sus scrofa scrofa	Feral pigs	Disturb vegetative ground cover by browsing, trampling, rooting and wallowing. In extreme cases this can negatively impact groundwater recharge. They also facilitate the invasion and establishment of weedy plant species and create breeding habitat for mosquitos that are vectors for human and avian diseases.
Felis catus	Feral cats	Predators of native and game birds; vectors of toxoplasmosis, a zoonotic disease.
Herpestes javanicus	Mongoose	Predators of native and game birds.
Rattus spp.	Rats	Predators of native plant fruits/seeds as well as native and game birds.
Canis familiaris	Feral dogs	While not invasive, there is a small population of wild dogs that are a safety concern to humans.

Damage from both domesticated and feral ungulates is so severe that large areas of the Reserve are completely denuded of vegetation and stripped down to dirt and stone (Figure 30). Even large trees in the subalpine shrubland and the mesic forest at Kamehamenui are damaged by ungulates (Figure 31). As mentioned in Section 3.6, most of the native plants are limited to the gulch slopes that are difficult for animals to access.



Figure 30. Large Areas of Kamehamenui Forest Reserve Have Been Grazed and Grubbed Down to Dirt and Stone by Non-Native Ungulates (Photo courtesy of Starr Environmental)



Figure 31. Damage to the Trunk of an ʻŌhiʻa Tree that was Used as a Rubbing Post by Non-Native Sheep (Photo courtesy of Starr Environmental)

The lower portion of Kamehamenui FR will continue to be leased for grazing in the near term (see details in Sections 2 and 5) and has several ranch animals, including cows, sheep, pigs, and goats. DOFAW plans to simultaneously work toward phasing out ranch operations and feral ungulates and the in Kamehamenui FR. To remove feral ungulates, DOFAW installed an ungulate-proof fence in the upper 2,200 acres of the Reserve, where public hunting will be initially employed to remove feral ungulates from the fenced enclosure. To remove all ungulates from Kamehamenui FR, DOFAW plans to gradually extend the ungulate-proof fence to lower elevations in future management phases. Eventually, the entire Reserve will be enclosed by ungulate-proof fences.

4.3 Insects and Disease

Approximately 20 non-native insect species become established in Hawai'i every year due to globalization and the State's increased dependence on imports (Coordinating Group on Alien Pest Species 2014). This combined with the high rates of endemism among Hawai'i's native plants and animals, makes our forests highly vulnerable to threats posed by introduced insects and diseases. Of particular concern are the introduced insects and pathogens that could cause widespread dieback of predominant forest canopy species such as koa and ʻōhiʻa.

Introduced pathogens that have caused significant damage to Hawai'i's forests include rapid ʻōhiʻa death and koa wilt (*Fusarium oxysporum* f.sp *koae*; Foxy-koae). Introduced insects that are of concern at Kamehamenui FR are mosquitoes (*Culex* spp.) and two-line spittlebug (*Prosapia bicincta*).

4.3.1 Rapid ʻŌhiʻa Death

Rapid ʻŌhiʻa Death (ROD; Figure 32) has been found on Hawai'i Island, Kaua'i, Maui and O'ahu and is caused by two pathogenic fungi, *Ceratocystis lukuohia* and *C. huliohia*. The highly aggressive *C. lukuohia* has been detected on Hawai'i Island and Kaua'i and the less aggressive *C. huliohia* has been found on all four islands. Hundreds of thousands of ʻōhiʻa trees have been killed by this disease and over 135,000 acres of ʻōhiʻa forest have been affected.

Through various ROD surveys and monitoring efforts, managers have recognized a few strong patterns of disease occurrence in the landscape. Storm and wind events that wound ʻōhiʻa trees can lead to infection by the fungus. Typically, after a storm event there is a spike in tree mortality, followed by a decreased but steady mortality rate. Anecdotally, trees with crowns emerging from the canopy or on the edge of a forest appear to be more prone to ROD.

Ambrosia beetles that bore into ʻōhiʻa trees are responsible for releasing frass that contains fungal spores into the environment. Entomologists have conducted controlled studies demonstrating that beetles can carry the fungus on their bodies and directly infect living ʻōhiʻa seedlings (Cannon et al. 2022). However, beetles normally attack dead and dying trees, therefore it is unlikely that beetles serve as the main disease vector.



Figure 32. Typical Symptom of Rapid ʻŌhiʻa Death—The Leaves Appear Burned but are Still Intact on the Tree (Note: Rapid ʻōhiʻa Death is not known to occur at Kamehamenui Forest Reserve and is not widespread on Maui yet. Photo courtesy of J. B. Friday.)

Another pattern is the higher incidence of *C. lukuohia* detections in areas where hoofed animals are present in comparison to adjacent areas where animals have been removed (Perroy et al. 2021). In a previously ungulate-free area, managers observed a sharp uptick in both symptomatic trees and positive detections for *C. lukuohia* when damaged fences allowed for animal ingress. The mechanisms are not fully understood, but it is thought that by wounding trees, animals might cause infection if spores are present. It is also possible that animals are transporting fungal spores contained in soil. Consequently, research on animals directly spreading ROD is underway.

The relationship between ROD and feral animals offers potential management tools for preventing wounding and possible spread of the disease by removing animals from the landscape. It is not currently clear which animals are responsible, but the pattern has been seen in forests with high populations of cattle and pigs. Cows strip bark from ʻōhiʻa trees while pigs damage roots when digging for food. To protect important ʻōhiʻa stands and forests, managers can utilize ungulate management (exclusion fences, hunting, or animal removal) to reduce the incidence of ROD. This may be the most effective tool we have for managing ROD, but this only removes one potential vector and cannot prevent storm damage that leads to wounds and consequently ROD. Areas that are animal free are still likely to have ROD occur, however the rate of infection over time is likely to be reduced.

DOFAW conducts statewide aerial surveys for ROD symptomatic trees, and surveys on Maui started in 2016. During these surveys, field staff collect samples from accessible symptomatic trees, and samples are sent to a lab to confirm the presence of *Ceratocystis*. In July 2019, *C. huliohia* was detected on Maui in a single tree located 53 miles east of Wailuku. Response was quick and the tree was destroyed. Aerial surveys for east Maui and leeward Haleakalā are conducted quarterly, and thus far there have not been any new detections of ROD on the island. As of December 2023, no additional ROD infected ʻōhiʻa trees have been detected on Maui. For

more information on what can be done to help prevent the spread of ROD, visit http://www.rapidohiadeath.org.

4.3.2 Koa Wilt

Koa wilt is a soil borne fungal disease that causes the dieback and death of endemic koa trees. The fungus that causes koa wilt is thought to have been introduced through the planting of ornamental acacia (possibly *Formosa koa* or *Acacia confusa*) and is now widely present in Hawaiian soils. *Fusarium oxysporum* (Foxy) is a common pathogen on many plant species worldwide, although the origin of Foxy-koae strains that are virulent to koa in Hawai'i is currently unknown (Dudley et al. 2017, Dobbs et al. 2019).

The wilt disease is mostly seen in younger koa trees (less than 15 years old) and in trees at elevations below 2500 ft. Koa trees are initially infected through the root, and the fungus migrates up through the stem and branches where it blocks vascular tissue and cuts off water supply to the leaves, causing them to wilt and turn brown. Small, infected trees gradually lose their crown and eventually die. Older and larger trees sometimes can wall off or "compartmentalize" the infection and retain a portion of their canopy. Some koa trees have been found to be resistant to the disease.

Koa wilt has not been observed at Kamehamenui FR probably due to the high elevation and relatively cooler ambient and soil temperatures. Nonetheless, koa trees in Kamehamenui will need to be monitored in the face of climate change and potential accompanying increases in soil temperatures. Applying fungicide to forest trees to control this disease is impractical and cost prohibitive. To minimize spread into the Reserve, DOFAW will need to avoid bringing in infected soil or plant parts. Shoes and truck tires will need to be thoroughly cleaned after use in infected areas and tools such as axes, chainsaws, and machetes will need to be sterilized after being used on infected trees.

4.3.3 Mosquitos

Mosquitos (especially *Culex quinquefasciatus*) are vectors for avian malaria. Since European contact in 1776, Hawai'i has lost nearly half of its native birds due to diseases, particularly avian malaria. Many native birds are limited to higher elevations where temperatures are too cold for the malaria parasite and its principal mosquito vector *C. quinquefasciatus*.

4.3.4 Two-Line Spittle Bug

Two-line spittle bug has caused heavy damage and loss of pasture in parts of Kona on the island of Hawai'i. Approximately 142,468 acres of kikuyu/pangola grass pastures have been impacted as of late 2018, and in some areas, pasture plant species are dying and being replaced with pamakani, fireweed, hilo grass and other weeds. The two-line spittle bug has not been detected on the island of Maui but is still a concern since large tracts of Kamehamenui FR are covered in kikuyu grass and spittle bugs feed on/are associated with this type of grass. Kikuyu is an aggressive non-native grass that forms dense, monotypic mats that can suppress the

establishment of native and non-native plant species alike. That said, kikuyu does provide some benefits in that it suppresses the growth of a more diverse, weedy vegetative cover that could be more difficult to control. Large scale dieback of kikuyu, which could be driven by the presence of the two-line spittle bug, could be problematic for Kamehamenui FR.

DOFAW's approach to the management of insects depends on potential impacts, distribution in the FR, and available control methods. Strategies include (Table 10):

- *Prevention*—Avoid or minimize the spread of disease (e.g., disinfect tools before using in the FR).
- *Control*—Reduce populations and/or vigor of pests and diseases.
- *Containmen*t—Stop or minimize growth and/or geographic spread.
- *Eradicatio*n—Eliminate population of a pest or disease within a geographic area.
- *Early Detection Rapid Response*—A species is not yet established in the area but is a serious threat to watershed function and/or native ecosystems. Early detection, rapid assessment, and rapid response is critical defense against the establishment of invasive pests and diseases.

Table 10. Division of Forestry and Wildlife's Management Objectives for Insects and Diseases in Kamehamenui Forest Reserve

Species	Common Name	Division of Forestry and Wildlife Objective
Ceratocystis lukuohia and *C. huliohia*	Rapid ʻōhiʻa death	Prevention, early detection, and rapid response
Fusarium oxysporum f.sp *koae*	Koa wilt disease	Prevention
Culex quinquefasciatus	Mosquitos	Control
Prosapia bicincta	Two-lined spittle bug	Early detection and rapid response

4.4 Fire

Wildfires are a threat to human safety, property, native plants and animals, and watersheds. Approximately 25% of the total land mass in Hawaiʻi is covered by fire-prone grasses and shrubs (Trauernicht 2014). This combined with an increase in human-caused ignition has resulted in a fourfold increase in the area burned by wildfires in Hawaiʻi annually (Trauernicht and Pickett 2016). Burned forested areas are readily invaded by fire-adapted invasive grasses. Dry and dense biomass of these grasses increase fuel loads, ignite easily, and carry fire over large areas, thereby increasing the intensity and frequency of wildfires, and proliferating the displacement of native vegetation by fire-prone grasses.

Overall fire risk at Kamehamenui FR can be described as moderate at lower elevations and low at higher elevations. The Hawaiʻi Wildfire Management Organization and partners have developed generalized hazard ratings for developed areas by identifying environmental conditions, land use characteristics, fuel types, hazards, and other general wildfire issues (Hawaiʻi Wildfire Management Organization 2016). Their Communities at Risk from Wildfires (CARW) map of hazard levels for developed areas of Maui was updated in 2013 and further revised in 2016 for

Upcountry Maui (Hawai‘i Wildfire Management Organization 2016, Figure 33). This map shows the lower one-third of Kamehamenui FR next to Kekaulike Avenue as having a "moderate" rating of fire risk (Hawai‘i Wildfire Management Organization 2016, Figure 33). Characteristics that contributed to this moderate rating include moderate fuel loads (31–70% vegetated), fuel structure that is contiguous with 6–12-inch grasses and light brush with few ladder fuels, and a moderate ignition risk due to proximity to roads and residential units. In comparison, based on these same set of characteristics, the fire risk for the remaining upper two-thirds of Kamehamenui (which is not on the CARW map) is likely lower. Vegetative fuel becomes sparser and is patchily distributed at higher elevations, and ignition risk decreases at farther distances from roads and the residential areas. Prevailing winds in the area also make it difficult for wildfires to move upslope. Nonetheless, uncertain future weather conditions, increased human presence, and consequently, increased ignition risk, could increase overall fire risk in the upper elevations of Kamehamenui FR. There have been fires in the neighboring Kula Forest Reserve in 1954, 1984, and 2007 that burned significant portions of the forest there.

4.5 Climate Change

Climate change is a major threat to the State of Hawai‘i. An assessment of major weather trends in the islands indicates disturbing shifts in Hawai‘i’s climate (Keener et al. 2012). Overall, Hawai‘i has become drier which will likely cause regional water shortages and significant decreases in groundwater resources. Average air temperatures have also risen, notably accelerating over the past 30 years. A hotter drier climate means an increase in the risk of wildfires which, when followed by heavy rain, contributes to severe flooding and erosion. There has been an increase in the intensity and frequency of extreme weather events in Hawai‘i. For example, in March 2021, Maui County issued a drought disaster for parts of the County and also experienced life-threatening floods in that same week (State of Hawai‘i 2021).

Native forest bird populations at Kamehamenui FR could be directly impacted because of climate change. Avian malaria, which is transmitted by the mosquito *C. quinquefasciatus*, limits the distribution of many threatened and endangered forest bird species to high elevations where temperatures are too cold for both the malaria parasite and the mosquito vector (Atkinson et al. 2014). Under this disease-driven distribution scenario, Fortini et al. (2014) have shown that increased mean annual temperatures could further restrict available suitable habitats for many Hawaiian forest birds, leading to possible extirpation of some species by the year 2100.

Climate change in Hawai‘i is predicted to impact forest ecosystems by altering resource availability and causing shifts in the abundance and distribution of species. For example, the population of the Haleakalā silversword (which is only found in high elevations of Haleakalā volcano, including the upper elevations of Kamehamenui FR; Figure 34), has severely declined since 1982. Small to medium sized plants are dying without flowering, causing a decrease in recruitment. This decline could not be attributed to apparent impacts such as disease or invasive species but does coincide with increased temperatures and decreased precipitation rates in its habitat (Krushelnycky et al. 2011, as cited by Keener et al. 2012).

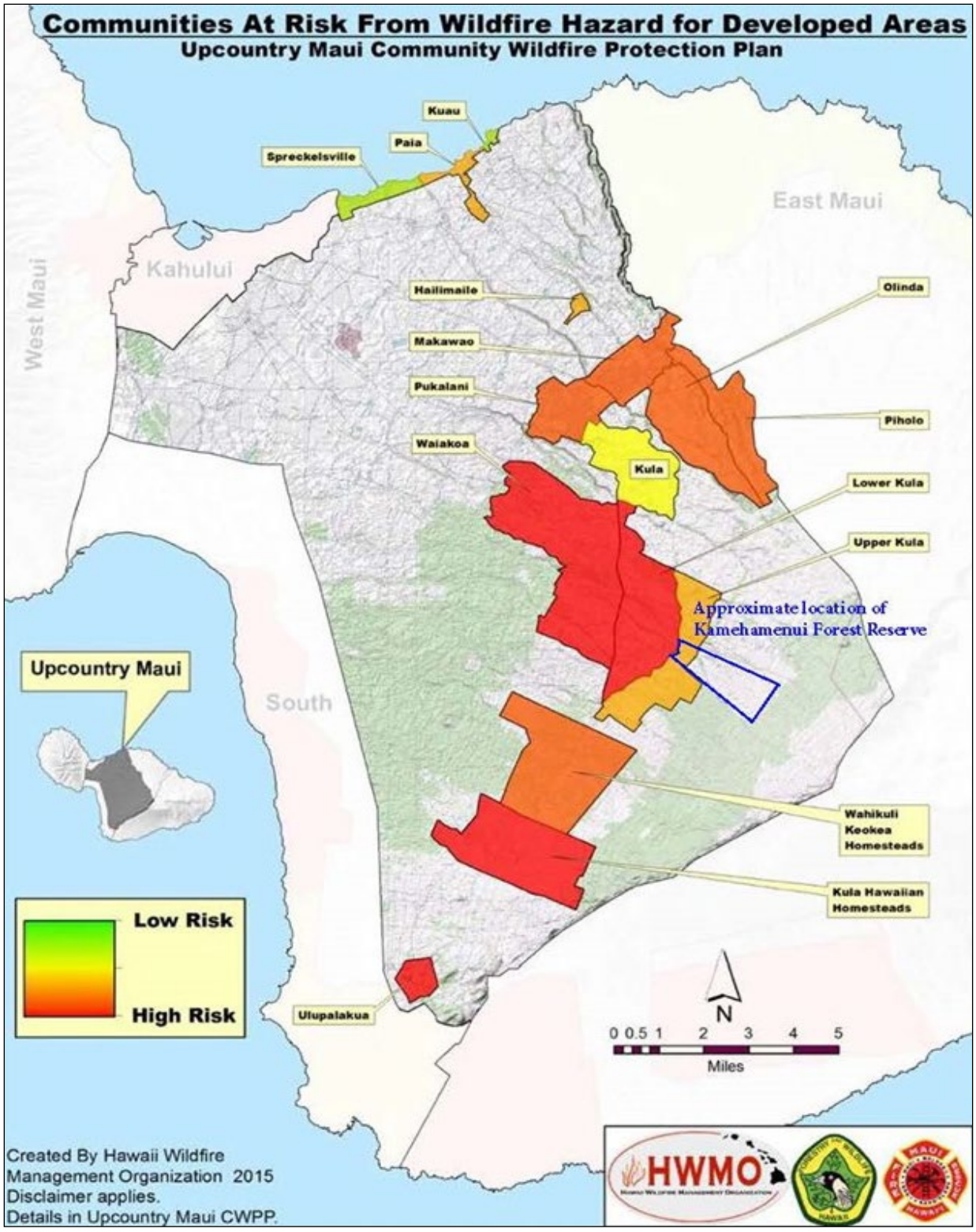


Figure 33. Upcountry Maui Communities at Risk from Wildfires Map—Hazard Ratings for Developed Areas (Source: Hawai'i Wildfire Management Organization. 2016. Upcountry Maui Community Wildfire Protection Plan. <https://www.hawaiiwildfire.org/fire-resource-library-blog/upcountry-maui-cwpp>.)



*Figure 34. Haleakalā Silversword (*Argyroxiphium sandwicense *subsp.* macrocephalum*) (Note: Decline of this species since 1982 overlaps with high elevation climate change trends and appears unrelated to disease or invasive species. Photo courtesy of Starr Environmental.)*

Climate change is also projected to exasperate the impacts of existing biological stressors such as invasive plants, animals, and diseases. The harsh environment of high elevation alpine and subalpine ecosystems, such as those found in Kamehamenui FR, to some extent has been spared from non-native species invasions (Denslow 2003). However, the warming of these habitat zones could facilitate the upward movement of invasive species into these otherwise harsh and resilient native ecosystems (Eiben and Rubinoff 2010).

The primary mitigation for climate change is the reduction of emissions and enhancement of carbon sinks. Through the State's Hawai'i Climate Change Mitigation and Adaptation Commission, and its partners like the Greenhouse Gas Sequestration Taskforce, Hawai'i aims to achieve 100 percent renewable energy and carbon neutrality by 2045. A large part of the mitigation effort is also maintaining and increasing carbon storage within our forests in order to help remove atmospheric carbon. The Pacific Island Climate Change Cooperative and EcoAdapt published the Hawaiian Islands Climate Vulnerability and Adaptation Synthesis (Keener et al. 2012). Through literature reviews, expert elicitation, vulnerability mapping, and workshops with resource managers and conservation planners, the synthesis provides information to improve understanding of climate change impacts, to increase capacity to reduce impacts, and to facilitate decision-making by land managers (Gregg 2018). This climate synthesis contains summaries of adaptation strategies and actions for habitat types and ecosystem services in Hawai'i, excerpts of which are included in Appendix I of this management plan. Habitat types relevant for Kamehamenui FR include subalpine shrubland, mesic forest, grassland/pasture, and native plants. To anticipate and mitigate climate change impacts, all strategies and action items were reviewed and if applicable, incorporated into management objectives for Kamehamenui FR.

Section 5.0 MANAGEMENT

5.1 Past Planning

This is the first Management Plan for Kamehamenui FR. Other existing plans that contain relevant information on the resources and management strategies pertinent to the management of Kamehamenui are listed below.

- Hawai‘i’s State Wildlife Action Plan
- Hawai‘i Forest Action Plan
- DOFAW Draft Management Guidelines
- Leeward Haleakalā Watershed Restoration Partnership Management Plan
- Kula Forest Reserve Management Plan
- MISC Strategic Plan
- USFWS Endangered Species Recovery Plans
- Kaheawa Wind Power II Wind Energy Generation Facility HCP
- Auwahi Wind Farm HCP
- Kaheawa I Wind Farm HCP
- Kaheawa II Wind Farm HCP

5.2 Current Planning

DLNR DOFAW acquired the lands of Kamehamenui in September of 2020 with the goal of integrating them into the State’s Forest Reserve System. As detailed in Section 2, prior to acquisition there had been little development on these lands. The native forests on Kamehamenui were lost over time to subsistence farming, logging for timber, ranching and agriculture, and grazing by feral ungulates up until acquisition. The goals and objectives for the Kamehamenui FR management plan discussed in this section were developed to align with DOFAW’s management priorities and guidelines (described below). In addition to natural resource protection and restoration, DOFAW recognizes the potential of Kamehamenui FR for public use opportunities. As such, DOFAW organized multiple public scoping meetings in 2022 (see Appendix A) to gather input from various stakeholders (e.g., partners, interest groups, general public) on how to further define the management activities proposed in this section.

5.3 DOFAW’s General Management Guidelines

Appendix G details a set of draft Management Guidelines developed by DOFAW to assist in evaluating and balancing human activities with resource management objectives for lands under DOFAW jurisdiction. The purpose of the guidelines is to provide administrative policy direction and prioritize resource management activities based on the integrity of existing natural resources and social needs in four principal classifications: Conservation Resources, Forest Products Management, Recreation Management, and Hunting Management. This section identifies the areas at Kamehamenui FR that fall under these guidelines. Section 5.4 below details the specific management approach and the associated proposed management activities in the Reserve.

5.3.1 Conservation Resource Guidelines

DOFAW's Management Guidelines separate conservation resources into four classifications: High Conservation Resources (C1), Medium Conservation Resources (C2), Low Conservation Resources (C3), and Little to No Conservations Resources (C4). Detailed definitions of these classifications and their associated management strategies can be found in Appendix G. As depicted in Figure 35, resource management in Kamehamenui FR will follow the C1 – High Conservation Resources and the C2 – Low Conservation Resources guidelines. The upper eastern half of Kamehamenui FR includes critical habitat for plants and animals, and has the highest diversity and abundance of native species in the Reserve. Therefore, this area will be designated as C1 – High Conservation Resources. Management strategies in this portion of the FR will revolve around preserving and protecting existing native habitat for rare, threatened, and endangered plants and animals. Strategies will include ungulate exclusion fencing, recovery of T&E species, predator control, weed control, outplanting of native vegetation and reintroduction of native wildlife. The remaining lower half of Kamehamenui FR is composed of pasture/ grassland with limited native biological resources. These lands have been designated as C2 – Medium Conservation Resources because they have a high potential for reforestation, watershed restoration, and habitat restoration for native plants and animal species. Management strategies here will include ungulate exclusion fencing, outplanting native vegetation, reintroduction of native wildlife, small scale timber production, and limited low impact recreation activities.

5.3.2 Forest Products Management Guidelines

DOFAW's Management Guidelines separate forest products management into four classifications: Large Scale Commercial (F1), Small Scale Commercial (F2), Personal Use (F3), and Restricted (F4) (see Appendix G for detailed definitions of these classifications and their associated management strategies). Forest products management will be restricted (F4) in the upper half of Kamehamenui FR (Figure 36). The F4 management area overlaps areas of high conservation value (C1), consequently forest production activity will only be allowed if it also improves watershed and conservation of native resources. Forest products in the remaining lower half of Kamehamenui FR will follow the guidelines for Small Scale Commercial (F2) management (Figure 36). Activities here could include sustainable forest production, small-scale timber harvesting, and harvesting of non-timber forest products.

5.3.3 Hunting Management Guidelines

DOFAW's Management Guidelines separate hunting management into four classifications: Active Hunting Management (H1), Moderate Hunting Management (H2), Low Intensity Hunting Management (H3), and No Hunting Management (H4). Kamehamenui FR has been identified by DOFAW as a zero-tolerance area for habitat degradation caused by ungulates due to the high priority goals of native forest and species restoration. Therefore, there will be no ongoing public hunting program (H4) for game mammals at Kamehamenui FR (Figure 37). Activities related to game mammals at the Reserve will include ungulate-proof fencing, ungulate control by DOFAW

staff, and limited use of public hunting for ungulate control with permission and guidance from DOFAW staff.

Opportunities for game bird hunting in Kamehamenui FR may be considered for areas not designated as critical habitat for endangered species (Figure 38), and to the extent that these activities are compatible with other management goals, especially T&E species recovery for species like the nēnē. Kamehamenui contains habitat available for nēnē on Maui (DLNR 2015). Nēnē have an extended breeding season, and nesting may occur in all months except May, June, and July, with the majority of birds nesting between October and March, and most clutches laid between October and December (DLNR 2015). If bird game hunting is established in the Reserve, DOFAW will need to employ several strategies to avoid and minimize impacts to nēnē. These include: 1) a survey of the Reserve before bird hunting season to determine if there are any nēnē in the area and if there is any nesting activity, 2) if nēnē are sighted in the area, DOFAW will post their locations at the hunter check-in station and may restrict this area from hunting, and 3) if found, nēnē nests will be flagged and the location will be posted at the check-in station, and an appropriate buffer will be established around the nests by staff biologists to prevent entry and disturbance by humans. Like the Kipuka ʻĀinahou Nēnē Sanctuary on Hawaiʻi Island, DOFAW may need to issue special use permits for bird hunting at Kamehamenui if nēnē are present in the Reserve during bird hunting season.

5.3.4 Recreation Management Guidelines

DOFAW's Management Guidelines separate recreation management into four classifications: R1 (High Recreation Management), R2 (Medium Recreation Management), R-3 (Low Recreation Management), and R4 (Restricted Access). Given that Kamehamenui FR in the future will be easily accessed by the general public and it has potential for recreation, the vast majority will be managed for medium (R3) to low (R2) recreation (Figure 39). Medium to low level recreation activities may include maintained trails for hiking, non-motorized biking, equestrian use, and remote camping. The uppermost part of the Reserve that overlaps federally designated critical habitat will be restricted for recreational use (R4) (Figure 39). Any opportunity for recreational use in the R4 area will be limited to hiking on designated trails only, and there will likely be little to no recreational amenities available in this area.

5.4 Management Approach and Proposed Activities at Kamehamenui Forest Reserve

Watershed protection and enhancement of forests, recovery of T&E species, and public recreation and benefits are some of the main purposes for DOFAW acquiring and integrating Kamehamenui into the State's Forest Reserve System. The management objectives for Kamehamenui will ensure long-term restoration, sustainability and protection of the forest resources and other conservation and public values for which it was acquired. As discussed in Section 2.4 the lower approximately 1,234 acres (~500 hectares) of land is currently leased by DOFAW for grazing and cattle ranching. Under the lease, which expires in 2030, DOFAW retains the right to withdraw portions or all of this area from the lease at its discretion for any purpose.

DOFAW has already initiated management actions to conserve and restore the 2,200 acres that were withdrawn from the lease. For the remaining approximately 1,234 acres, DOFAW will continue to withdraw limited areas from the grazing lease over the next five years.

Management of Kamehamenui is being done in a phased approach. This involves withdrawing portions of the leased land and enclosing the area with an ungulate-proof fence. Once the fence is built, all domestic and feral ungulates will be removed. Other management activities aligned with DOFAW's Management Guidelines (see Section 5.3) will then be implemented for each phase.

Once all the domestic animals have been removed and the enclosure is built, the procedure for removing the feral ungulates will be as follows. DOFAW will first utilize public hunting to remove feral ungulates. Public hunting for mammals will be allowed until DOFAW determines that all ungulates have been removed, or that aerial capture, eradication, and tagging of animals (ACETA) is needed to remove the remaining animals. Per DOFAW's Management Guidelines for Kamehamenui (see Section 5.3.3), there will be zero tolerance for the presence of feral ungulates across all management phases.

Figure 40 and Sections 5.4.1 to 5.4.5 below describe the details of DOFAW's phased management approach and the associated proposed activities at Kamehamenui FR. Regardless of the Phase, the following management approaches apply to the entire Kamehamenui FR.

1) The goal for reforestation efforts at Kamehamenui is to re-establish forests across 75% (~2,576 acres) of the FR by 2030, that is, within 10 years of acquisition or as soon as silvicultural practices allow. Re-establishing forest cover at Kamehamenui FR will include both active (planting and seeding) and passive (natural) restoration, and will also be conducted using a phased approach.
    a. Phase I: ~1% active and ~42% passive restoration of native forest cover
    b. Phase II: ~13% active and ~8% passive restoration of native forest cover
    c. Phase III: ~9% active and ~2% passive restoration of native forest cover

    As fencing and ungulate removal are completed, natural recovery and active reforestation efforts will be implemented in each phase to achieve the goal of 75% forest cover by 2030 (details in Sections 5.4.1 to 5.4.3).
2) Feral ungulate removal will occur per the general approach described above (in this section). Public hunting will be utilized first followed by ACETA, if needed, to remove feral ungulates. There will be zero tolerance for ungulates in the Phase III Area.
3) Outside of the controlled hunts to remove feral ungulates, there will be no recreational hunting for game mammals in any of the Phase areas at Kamehamenui. Game bird hunting may be considered outside of the critical habitat if compatible with conservation goals.
4) There will be no commercial hunting in Kamehamenui FR.
5) Paragliding and hang gliding are prohibited in Kamehamenui FR.

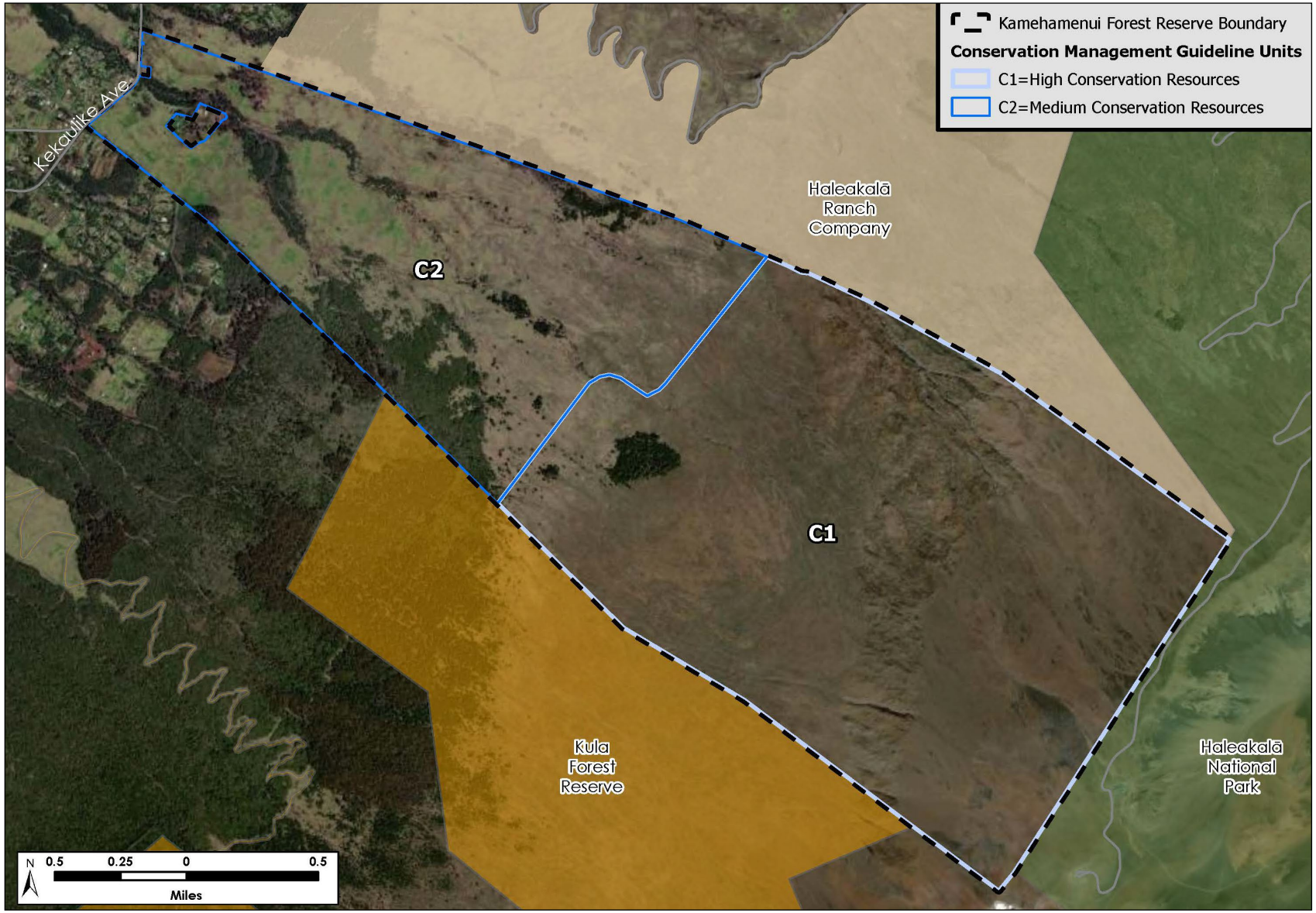


Figure 35. Kamehamenui Parcel—Division of Forestry and Wildlife Conservation Management Guideline Units

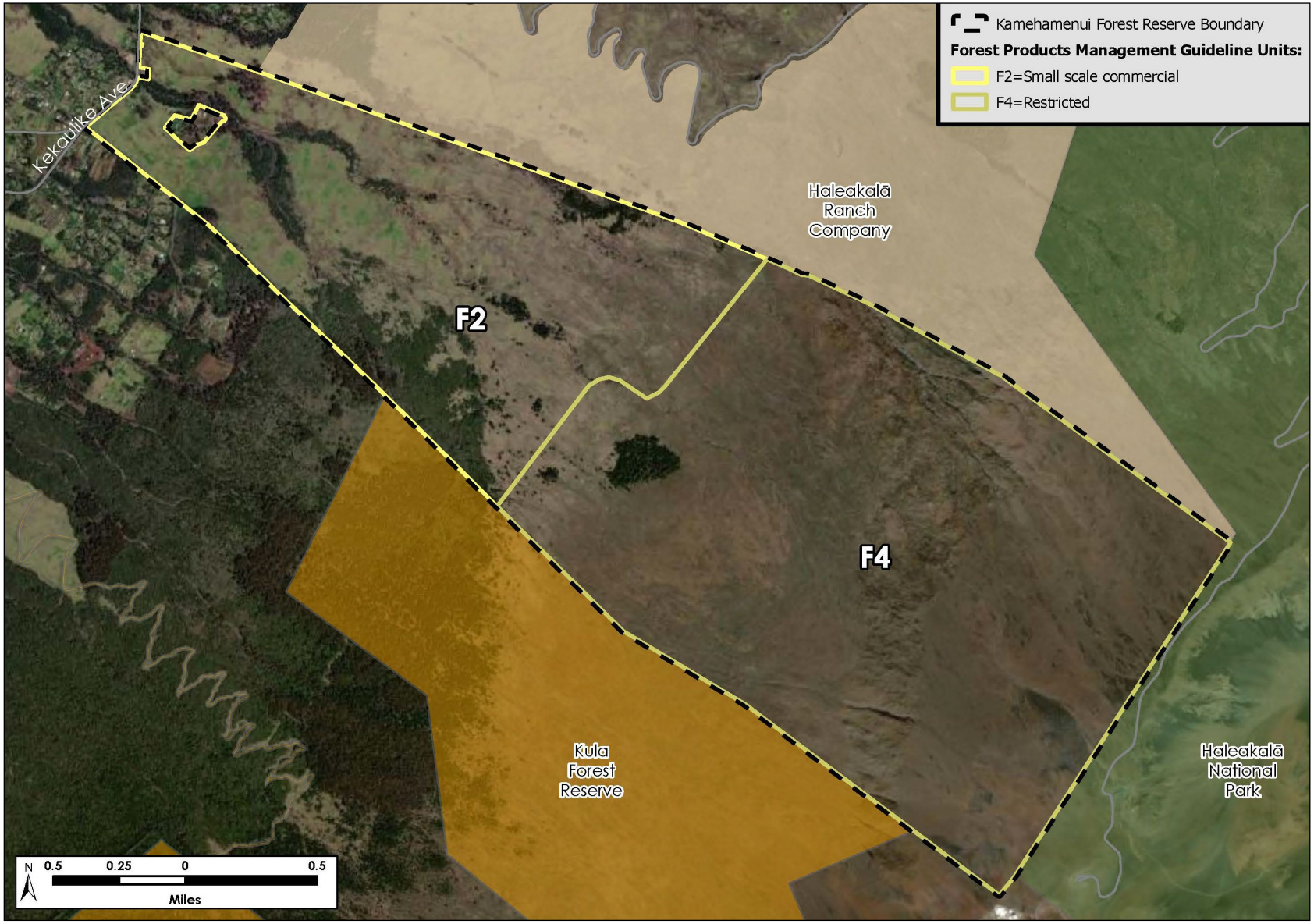


Figure 36. Kamehamenui Parcel—Division of Forestry and Wildlife Forest Products Management Guideline Units

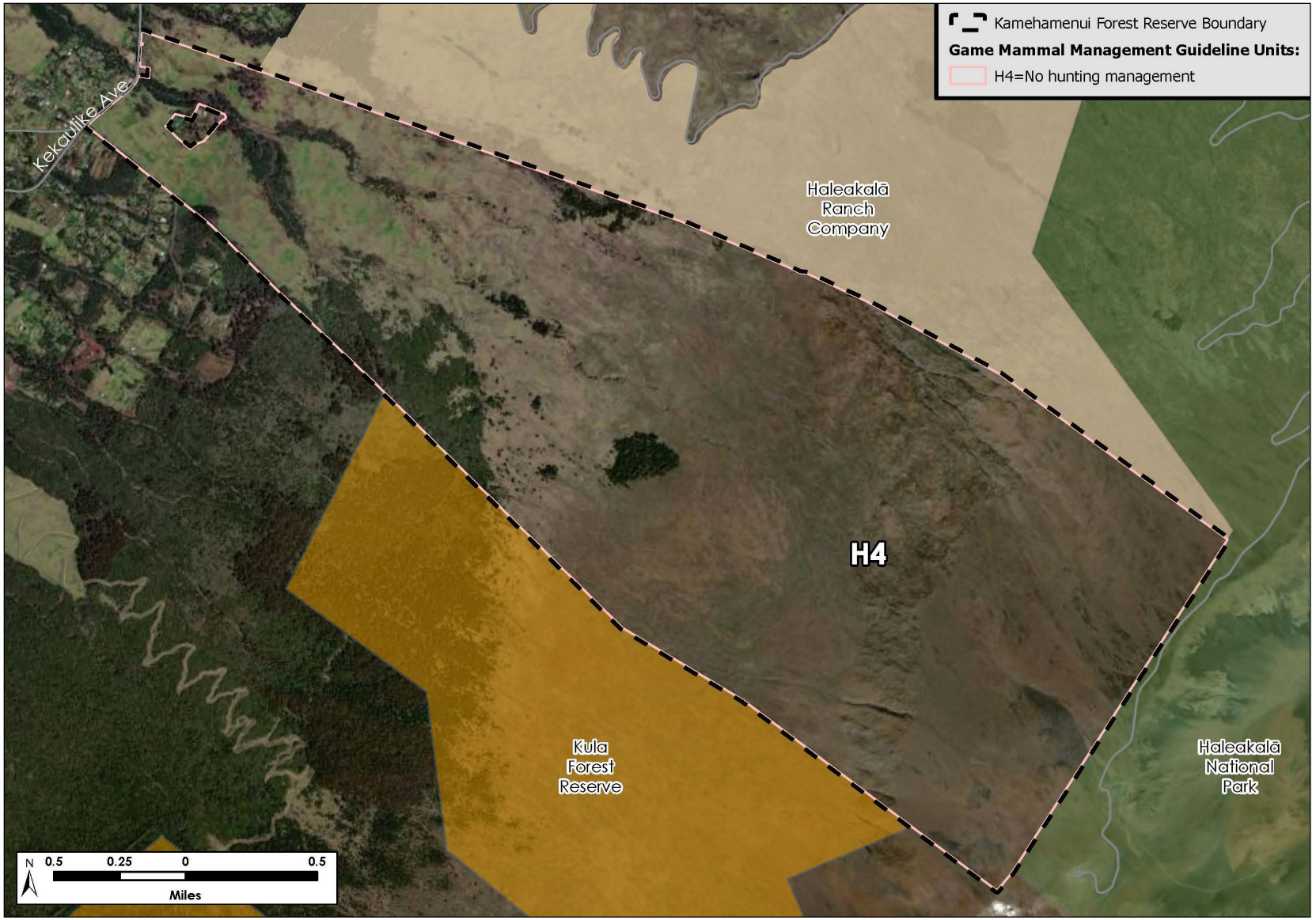


Figure 37. Kamehamenui Parcel—Division of Forestry and Wildlife Game Mammal Hunting Management Guideline Units

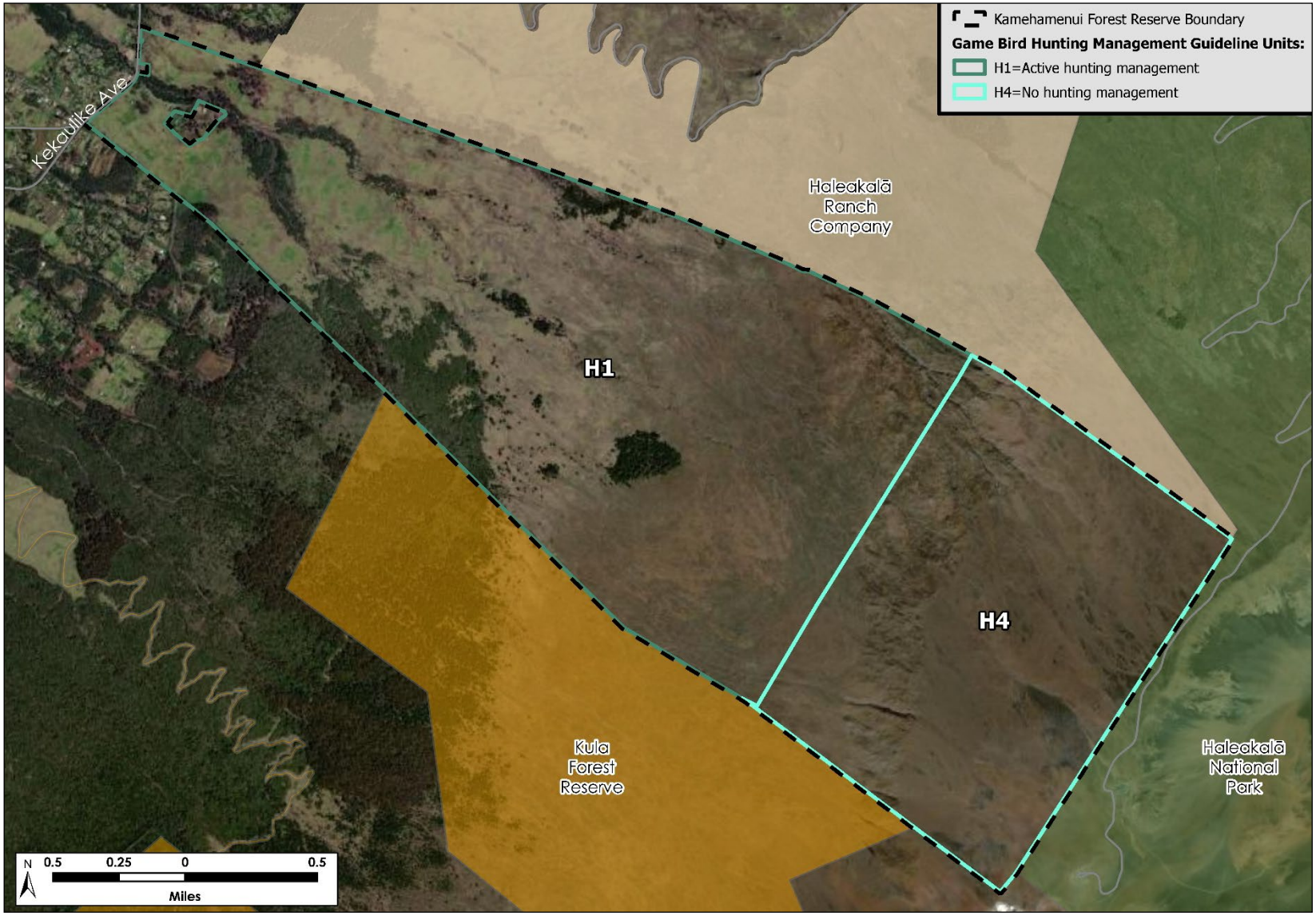


Figure 38. Kamehamenui Parcel—Division of Forestry and Wildlife Game Bird Hunting Management Guideline Units

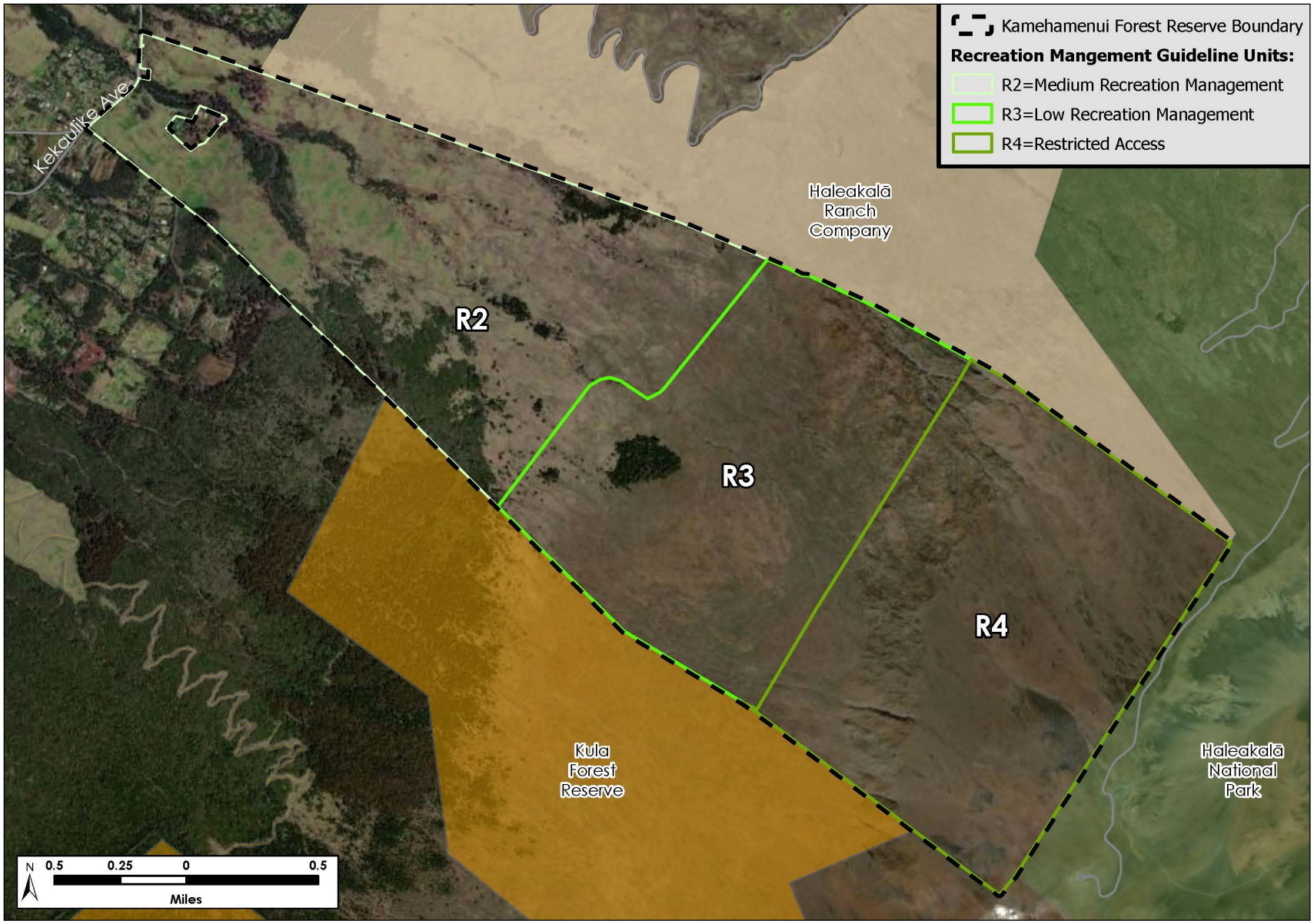


Figure 39. Kamehamenui Parcel—Division of Forestry and Wildlife Recreation Management Guideline Units

5.4.1 Phase I

Phase I is already underway; DOFAW has withdrawn the upper approximately 2,210 acres (about 64% of the Reserve) from the grazing lease and construction of an ungulate-proof fence along the Phase I border of the Reserve is complete (Figure 40). The priority in Phase I will be habitat protection and recovery of T&E species, followed by active restoration efforts. Building toward its goal of obtaining 75% forest cover at Kamehamenui FR, DOFAW is proposing passive restoration of about 42% and active restoration of about 1% of the Reserve during Phase I. DOFAW will focus on management activities in Phase I over the next few years until the Division has the funding and staff capacity to manage additional lands withdrawn from the lease. Specific natural resource management activities as well as other public use activities proposed in this Phase I Area are discussed below. Access and parking to the Reserve are discussed in Section 5.4.4.

Natural Resource Conservation and Management

- *Habitat Protection*—Native plant species diversity and abundance are highest in Phase I of Kamehamenui FR. About 42% (~1454 acres) of the Reserve that falls within Phase I is composed of native dry and mesic shrublands (Figures 10 and 38). DOFAW plans to restore forest cover in these high elevation, harsh environment, native-dominated habitats through passive restoration activities such as fencing, ungulate removal, and invasive species control.
- *Habitat Restoration*—Habitat restoration will be lower in priority to habitat protection in Phase I. About 21% (~724 acres) of the Reserve within Phase I is composed of sparsely vegetated to unvegetated areas. Only about 1% (~36 acres) of the Reserve is covered by non-native mesic grasslands and mesic forests. DOFAW plans to gradually restore areas covered by non-native vegetation over time with native forest cover. Habitat restoration efforts will involve seeding and outplanting with native shrubland species as well as ecologically and economically valuable native tree species such as koa and `iliahi, or Hawaiian sandalwood. These forests will also help enhance restoration efforts by providing seeds for propagation.
- *Recovery and Management of T&E Plants*—Protection of existing T&E plants, collection of propagation material/propagation and outplanting of T&E plant species will be prioritized to facilitate their recovery. Emphasis will be on recovering the federally designated critical habitat for these eight taxa in the uppermost portion of the Phase I Area.
- *Recovery of T&E Animal Species*—The uppermost portion of the Phase I Area overlaps with critical habitat for crested honeycreeper and the Maui parrot bill. In addition to management efforts for the recovery of these species, conservation activities in Phase I will include efforts for research and management of the endangered Hawaiian hoary bat, nēnē, Hawaiian petrel, and Blackburn's sphinx moth. DOFAW will also implement habitat restoration at Kamehamenui for endangered species impacted by the Auwahi wind farm by:

    - Outplanting food plants for nēnē such as the favored native species kukaenēnē and pūkiawe.
    - Adding additional firebreaks to provide protection to surrounding areas from fire.
    - Outplanting native host plant species of the Blackburn's sphinx moth to enhance population recovery.
    - Improve forest habitat that provides transitory corridors contiguous with Kula Forest Reserve, Haleakalā National Park and other protected areas to benefit Hawaiian hoary bat, Hawaiian petrel, Blackburn's sphinx moth, and nēnē.
- *Control of Invasive Plants, Pathogens, and Insects*—Mechanical, chemical, or biological means, as appropriate, will be employed to control invasive plants, pathogens, and insects, particularly for the protection of T&E taxa and their habitat. The list of invasive plants planned for control at Kamehamenui, their descriptions, and strategies for control are in Appendix H. The exact distribution of invasive flora (and fauna) and specific strategies to manage them will be identified as part of the management objectives as well as through more comprehensive survey efforts. The priority invasive plant species to control include the black wattle, Monterey pine, and eucalyptus (Table 8) and the general distribution of these three species are known to DOFAW managers.
- *Small Predator Control*—Baits and traps specifically for the control of predators such as rats, cats, and mongoose will be deployed as needed for the protection and recovery of native species.
- *Fire Mitigation*—The southern portion of Phase I will be managed to keep fuel loads down and mitigate fire risk. As needed, 'pulse grazing' will be employed with local livestock owners to control fuel loads in designated areas.

Hunting

- DOFAW will utilize public hunters for a specified period of time to remove ungulates from the Phase I Area prior to staff control operations.
- High-powered rifles will be allowed in Phase I Area only during staff control operations.

Recreation

- There will be no development of improved trails and amenities for recreational activities in the uppermost area of the FR that is fenced off to protect habitat for endangered seabirds.
- There are a total of three locations for camping in the Phase I Area. About 4–5 single campsites (one person tents) will be allowed at each location. Each location will also have a comfort station located within 50–75 yards of the campsite. At two of the three locations, group camping will also be allowed with a proposed limit of 7–10 people per group (Figure 40).
- Camping at Kamehamenui FR will be through a reservation system with fees. A maximum duration of three nights will be permitted for camping with two days per week allocated as campsite rest or services days. Additionally, DOFAW proposes to

implement a 30-day reuse rule for camping wherein applicants cannot make more than one reservation within a 30-day period.

- Hiking will be allowed in the Phase I Area on designated trails only (Figure 40). These trails will be connected with the Waiakoa Loop Trail in the Kula FR (#5 Forest Access Road) and can be accessed from the Kula FR prior to completion of public access trails in the Phase I and II Areas.
- Non-motorized biking will be allowed in Phase I outside of the federally designated critical habitat on designated trails only (Figure 40).
- Equestrian use will be allowed in Phase I outside of the federally designated critical habitat on designated trails only (Figure 40).

5.4.2 Phase II

Phase II will begin when DOFAW has accomplished major tasks defined for Phase I such as removal of ungulates and/or until the Division has funding and personnel to manage additional lands withdrawn from the lease. The Phase II Area is about 714 acres (26% of the Reserve) below the ungulate fence at Kamehamenui FR (Figure 40). The management priority in Phase II will be habitat restoration, with the goal to extend the "mauna lei" or the band of native forest trees that once encompassed the mid-elevations of Haleakalā. Details of natural resource management and public use activities proposed in the Phase II Area are discussed below. Access and parking to the Reserve are discussed in Section 5.4.4.

Natural Resource Conservation and Management

- *Habitat Restoration*—Out of the 714 acres in the Phase II Area, about 433 acres (13% of the Reserve) is composed of non-native grassland and shrubland. The priority for Phase II will be habitat restoration. DOFAW plans to convert 13% of non-native vegetation to native forest cover. Removal of non-native vegetation will be followed by out planting and revegetating with ecologically suitable native plant species as well as economically valuable species such as koa and `iliahi, or Hawaiian sandalwood. Habitat restoration efforts here will contribute significantly toward achieving the goal of restoring 75% of the Reserve with forest cover. Like in Phase I, the native trees could also serve as seed orchards to enhance the overall population of these tree species.
- *Habitat Protection*—Out of the 714 acres in the Phase II Area, about 266 acres (8% of the Reserve) is composed of native mesic shrubland mostly limited to gulches and areas not easily accessible by ungulates. With passive restoration efforts such as ungulate removal, fencing, and invasive species removal, DOFAW expects to further enhance recruitment and regeneration of native forest cover in these native shrublands.
- *Invasive Species Control*—Similar to Phase I, mechanical, chemical, or biological means, as appropriate, will be employed to control invasive plants, pathogens, and insects, particularly for the protection and habitat enhancement of T&E taxa. The list of invasive plants planned for control at Kamehamenui, their descriptions, and strategies for control are in Appendix H. The exact distribution of invasive flora (and fauna) in the Phase II Area and specific strategies to manage them will be identified as part of the

management objectives and through more comprehensive survey efforts. The priority invasive plant species to control include black wattle, Monterey pine, and eucalyptus (Table 8) and the general distribution of these three species are known to DOFAW managers.

- *Volunteer Opportunities*—The mid-elevations of the Phase II Area will be more accessible to the public and organized volunteer opportunities will be available for conservation efforts such as outplanting native trees.
- *Fire Mitigation*—The southern portion of the Phase II Area will be managed to keep fuel loads down and mitigate fire risk. DOFAW has been removing invasive fire-prone black wattle trees to mitigate fire risk in this area. As needed, 'pulse grazing' will also be employed with local livestock owners to control fuel loads in designated areas.

Hunting

- DOFAW will utilize public hunters for a limited period of time to remove ungulates from the fenced Phase II Area prior to staff control operations.
- High-powered rifles will only be allowed during staff control operations in Phase II Area.

Recreation

- Camping will be permitted at two locations in the Phase II Area. Each location will provide for single (not group) campsites with a centralized comfort station.
- Camping at Kamehamenui FR will be through a reservation system with fees. Additionally, DOFAW proposes to implement a 30-day reuse rule for the campsites.
- A maximum duration of three nights will be permitted for camping, with two days per week designated as campsite rest or services days.
- Hiking will be allowed in the Phase II Area on designated trails only.
- Non-motorized biking will be allowed in the Phase II Area on designated trails only.
- Equestrian use will be allowed in the Phase II Area on designated trails only.

5.4.3 Phase III

About 510 acres (10% of the Reserve) in the westernmost portion of Kamehamenui FR is the Phase III Area (Figure 40). Management activities in the Phase III Area of Kamehamenui will begin when DOFAW has funding and personnel to assume conservation management activities. The management priorities for the Phase III Area are to manage for native species reforestation and maintain public recreation access. Specific natural resource management and public use activities proposed for the Phase III Area are discussed below. Access and parking to the Reserve are discussed in Section 5.4.4.

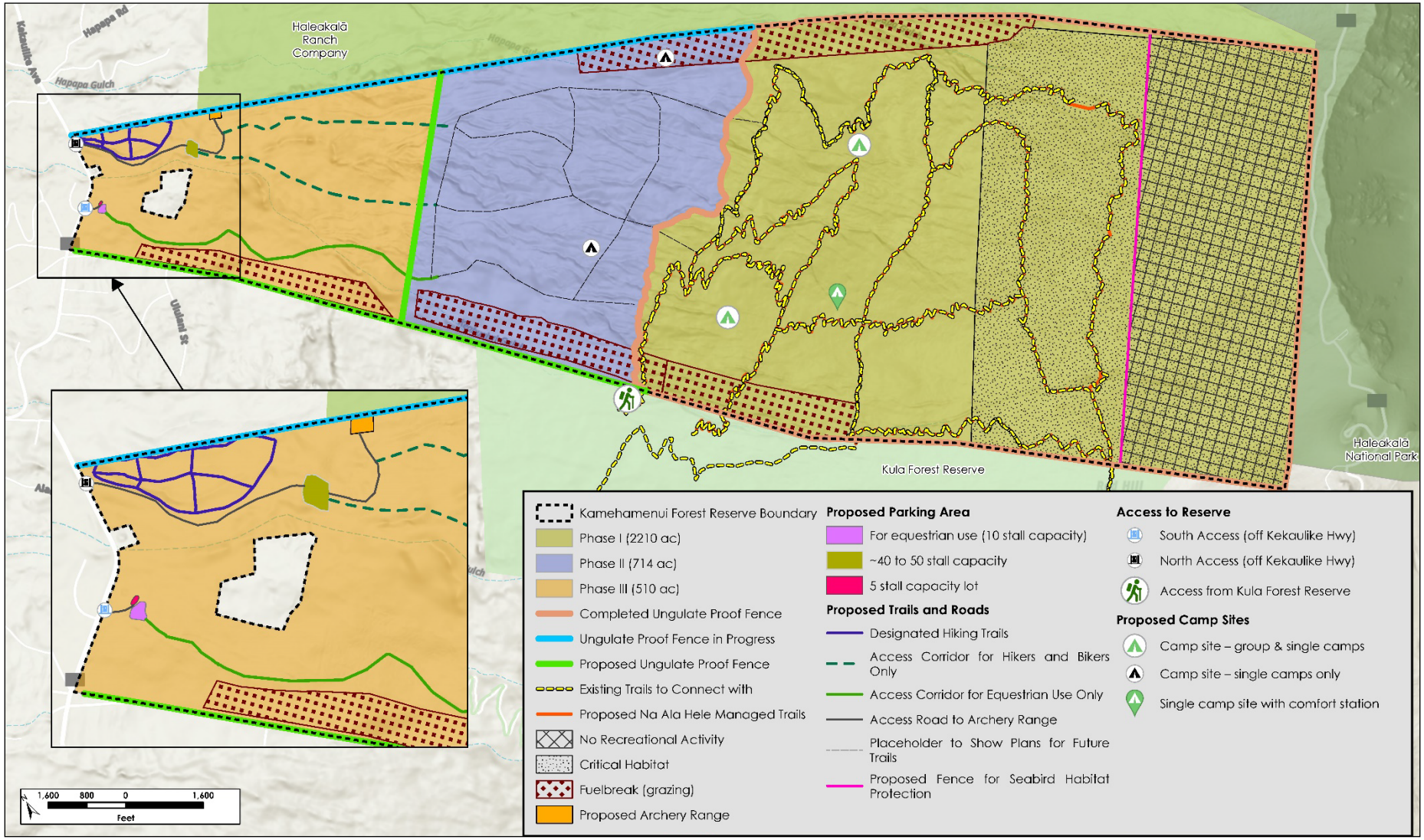


Figure 40. Proposed Management Activities and Amenities at Kamehamenui Forest Reserve

Natural Resource Conservation and Management

- *Habitat Restoration*—Almost all of the Phase III Area is pastureland with barely any native vegetation. Management of the area includes sustainable recreational activities (see below), which includes parking infrastructure for the FR. Nonetheless, restoring habitat through outplanting with native plant species will be a priority in the Phase III Area. About 343 acres (9% of the 75% forest cover goal for the FR) is planned for revegetation with native trees, shrubs, and ground cover to improve watershed functions and habitat for native species.
- *Habitat Protection*—About 52 acres (2% of the Reserve) of the Phase III Area is composed of native mesic shrubland mostly limited to gulches and areas not easily accessible by ungulates. With passive restoration efforts such as ungulate removal, fencing, and invasive species removal, DOFAW expects to further enhance recruitment and regeneration of native forest cover in these patchy habitats dominated with native vegetation.
- *Invasive Species Control*—Mechanical, chemical, or biological means, as appropriate, will be employed to control invasive plants and animals.
- *Volunteer Opportunities*—The Phase III Area will be accessible to the public and organized volunteer opportunities will be available for conservation efforts such as outplanting native trees.
- *Fire Mitigation*—The southern portion of the Phase III Area will be managed to keep fuel loads down and mitigate fire risk. As needed, 'pulse grazing' will be employed with local livestock owners to control fuel loads in designated areas.

Hunting

- DOFAW will utilize public hunters for a limited period of time to remove feral ungulates from fenced units prior to staff control operations.
- High-powered rifles will not be allowed during ungulate control hunts in the Phase III Area.

Recreation

- Camping will not be allowed in the Phase III Area.
- Hiking will be allowed in the Phase III Area on designated trails.
- Biking will not be allowed in the Phase III Area except for a corridor that will provide access from Kekaulike Avenue to the Phase I and II areas.
- Equestrian use will not be allowed in the Phase III Area except for a corridor that will provide for equestrian access from Kekaulike Avenue to the Phase I and II areas.
- A small (75 yards x 50 yards) archery range is proposed for the Phase III Area. A reservation system may be used to manage use of the range. Hunter Safety Program funds may be used to manage the archery range.

5.4.4 Access and Parking

Based on the various proposed public use activities, the Kamehamenui FR is expected to be in demand for public recreation. The Reserve is estimated to be able to support 180 visitors per day, and the level of visitor use will be managed according to this estimate. To manage use, visitor numbers will be limited by the number of parking stalls available, as described below, and by the implementation of a reservation system as needed. The reservation system will be structured to ensure ample opportunities for Hawai‘i residents, consistent with current reservation systems for other DLNR lands. Described below are the proposed access points and parking options for Kamehamenui FR.

1) Kekaulike Avenue—Northern Access Point:
    a. Includes a 40–50-stall parking area that provides access to the archery range and a stacked loop trail (Figure 40).
    b. The parking lot will be strategically positioned farther inland from the highway so that it will not be visible from neighboring residences.
    c. A separate, unimproved parking area for 5 cars will also be provided for the archery range in the Phase III Area.
    d. If needed, DOFAW plans to implement a reservation and fee system to manage parking in the 40–50 car capacity parking area.
2) Kekaulike Avenue—Southern Access Point:
    a. Will Include a 5–10-stall parking area and an equestrian parking area with up to 10 stalls in the southwestern portion of the Phase III Area, off Kekaulike Avenue where there is a corral (Figure 40).
    b. DOFAW plans to implement a reservation and fee system to manage capacity issues in the southern access point parking areas.
3) Kula State Forest Reserve
    a. The #5 Forest Access Road gate near the boundary between Kamehamenui and Kula FRs will be left open, and the public will be allowed to park along the road’s shoulder area as long as vehicles do not block access. This road will provide direct access to the upper Phase I and the mid-elevation Phase II areas of the Reserve.

In addition to the three proposed access points, access to the Reserve from the Haleakalā summit through the top eastern portion of the Phase I Area will be open. Public access in this area will be allowed as long as it does not impact habitat and endangered species recovery efforts. Access to this area may be considered later when opportunities and concerns about impacts on endangered species can be assessed and mitigated. DOFAW will work with neighboring landowners and explore potential locations where DOFAW’s staff management can access the FR and park. Finally, DOFAW also plans to work with Hawai‘i Department of Transportation to develop parking restrictions, place signage along Kekaulike Avenue in the vicinity of the Reserve, and explore other means to deter unwanted parking along the highway.

5.4.5 Fire/Fuel Management

Kamehamenui FR is situated in a dry region with a moderate to low fire risk. Unlike the northern border which is adjacent to a working private ranch covered with low growing and grazed grassland, the southern border is next to forested land in Kula Forest Reserve and surrounding area. DOFAW plans to create fuel breaks along the southern boundary overlapping the Phase I and Phase II areas. Work is already underway to remove fire-prone invasive black wattle trees along the Reserve's southern border to mitigate fire risk. DOFAW will also utilize the services of local livestock owners to implement 'pulse grazing' to keep fuel loads down in these designated areas.

5.5 Management Goals and Objectives, and Implementation Tasks for Kamehamenui Forest Reserve

Broad management categories for each forest reserve are derived from the mandates that regulate DOFAW activities, including the Draft Management Guidelines and Administrative Rules, as well as input from district staff. The following nine management categories (listed below in no particular order) are used to guide management activities, including goals and objectives, within state forest reserves.

- *Watershed Values*—Maintain or increase the quantity and/or quality of aquifer recharge and soil erosion control.
- *Native Ecosystems*—Maintain and restore native ecosystems by establishing viable populations of native species in natural patterns of abundance and distribution. Restore ecological functions, ecosystem services, evolutionary processes, and foster adaptation to climate change.
- *Natural Resource Protection*—Protect forest ecosystems from wildfire, insects, and disease.
- *Cultural Resource Protection*—Protect cultural resources and traditional customary practices.
- *Invasive Species Control*—Monitor and control incipient and established invasive plants and animals that negatively impact ecosystems.
- *T&E Species Management*—Protect federally and state listed, or otherwise rare plants and animal species.
- *Access, Trails, and other Public Uses*—Support non-commercial uses, such as recreation, cultural activities, personal gathering, educational or research activities, and events among others.
- *Game Animal Management*—Manage public hunting areas and game animals.
- *Commercial Activity*—Promote sustainable income generating activities such as timber, ecotourism, etc.

5.5.1 Management Goals and Objectives

Table 11 expands on DOFAW's management categories defined above and details the overarching goals for each category along with associated objectives, implementation actions and estimated costs for Kamehamenui FR.

5.6 Overall Measures of Success

Measures of success for individual forest reserve management plans can be derived from the State of Hawai'i annual variance reports. Initial measures of success that may be applicable to Kamehamenui include:

- 75% of the Reserve is restored to native forest
- Acres and numbers of invasive plants controlled
- Number of invasive animals removed by species
- Miles of fence built and/or maintained
- Number of native plants planted
- High survivorship of outplantings
- Number of species as well as number of individuals of rare, threatened, or endangered plant/animal species protected
- Identify, document, catalog, and protect cultural resources
- Miles of trails constructed and maintained
- Number of volunteer service hours
- Metric tons of carbon sequestered
- Revenue generated from sale of sustainably cultivated/harvested forest products (timber, non-timber and ecosystem products)
- Amount of funds leveraged through competitive grant writing

Table 11. Goals, Objectives, and Action Items for Management Categories at Kamehamenui Forest Reserve

Goals	Objectives	Implementation Actions	Estimated Cost (USD)
Watershed Values			
Kamehamenui Forest Reserve (FR) has minimal soil erosion impacts on the Leeward Haleakalā Watershed.	Increase and maintain forest cover on watershed lands to protect water quality and enhance watershed recharge for communities of Maui.	Re-establish appropriate forest cover on 75% (~1300 acres through passive restoration and ~1250 acres through seeding and outplanting) of Kamehamenui FR.	$3,000,000 (1250 acres x 436 trees per acre x $5/seedling)
	Transition domestic cattle and sheep out of the FR.	Determine timing of the withdrawal of lands from the lease, and the removal of cattle and sheep as per the phased process.	(N/A: Staff time)
		Maintenance of existing ungulate-proof fences.	$30,000 annually
		Work with lease holder to systematically remove cattle and sheep as land is withdrawn from the lease, and ensure these animals are all removed before the area is fully fenced.	N/A: Staff time
	Control all other ungulate populations at levels consistent with watershed protection needs.	In the phased fencing approach, assess locations for strategic fence placement options to best enhance water quality and ensure that the area is completely fenced.	N/A: Staff time
		Utilize public hunting as a first step to remove ungulates from fenced area.	$2,500/phase
		Monitor and continue to control ungulates and aim for zero tolerance within fenced area.	$10,000/year
		Draft aerial capture, eradication, and tagging of ungulates plan and implement, as needed, to achieve watershed restoration goal (to reduce erosion impacts from ungulates).	N/A: Staff time
		Install 8’ high ungulate-proof fencing in a phased-in approach to completely enclose all phase units.	$2,400,000 (~32,800 ft of fencing)
There is a program that effectively	Develop comprehensive monitoring protocols.	Set up photo points and monitor established reforestation plots for species survival.	$20,000 (initial setup); followed by $10,000/year

Goals	Objectives	Implementation Actions	Estimated Cost (USD)
monitors forest composition and assess landscape level needs over time at Kamehamenui FR.		Continue to assess the effectiveness of monitoring techniques and establish new protocols as needed.	N/A: Staff time
There is effective collaboration with Watershed Partnership members.	Maintain DOFAW's partner role with either the Leeward Haleakalā Watershed Restoration Partnership or East Maui Watershed Partnership.	Improve communication and coordination between state, federal and county agencies regarding watershed protection.	N/A: Staff time
		Participate in Watershed Partnerships' quarterly meetings, and establish regular communications, schedules, and protocols.	N/A: Staff time
		Issues and then annually renews Kamehamenui FR Special Use Permits (for various management actions otherwise prohibited by HAR).	N/A: Staff time
There are several strategies in place to adapt to changing climate.	Monitor latest publications and available information for climate change, vulnerability, modeling, and adaptation.	Participate in climate change seminars, meetings, and workshops.	N/A: Staff time
	Increase collaborative efforts to conserve streams and watersheds.	Expand watershed conservation to lower elevations by restoring ranchland back to forest.	N/A: Staff time
	Protect forests to increase recharge and water retention.	Support heathy forests through planting native trees and controlling invasive species.	N/A: Staff time
Natural Resource Protection			
Kamehamenui FR has a robust fire presuppression and mitigation program.	Implement fire prevention/ presuppression/suppression activities.	Develop fire management plans.	$60,000
		Scope sites for potential water storage tanks, dip tanks, and water hydrants.	N/A: Staff time
		Install water storage and dip tanks for use during wildfire suppression activities.	$90,000 (per unit)
		Scope for a potential water dip tank site.	N/A: Staff time

Goals	Objectives	Implementation Actions	Estimated Cost (USD)
		Implement fuel break/firebreak installation and maintenance projects around common ignition sites (e.g. road), proposed access points, and other potential high use areas.	To be determined (TBD)
		Explore the feasibility of managed grazing and fuel treatments throughout the parcels to limit the spread and severity of fires.	N/A: Staff time
		Remove fire-prone invasive trees and plant native species strategically in fuel break areas.	$50,000 annually
		Identify potential sites for fuel grazing treatments/prescriptions.	N/A: Staff time
	Conduct public education and outreach.	Participate in outreach activities as appropriate based on fire preparedness levels.	N/A: Staff time
		Post 'Smokey the Bear' fire prevention signs at entrances/access points during periods of high fire risk.	N/A: Staff time
	Prepare for and implement post- fire mitigation strategies.	Collect and store seed stock for various native plant species to be used for post-fire mitigation work.	$20,000/year
		Following fires, employ appropriate mitigation strategies such as seed scatter, aerial broadcast of seeds, weed control, soil conditioning and reforestation.	TBD
		Build fire-resilient native communities to stabilize soils following fires to prevent post-burn erosion.	TBD
There is an efficient system to monitor weather conditions in a timely manner.	Install and utilize Remote Automated Weather Station (RAWS) for resource protection.	Seek out funds to purchase and install RAWS unit (1 unit).	$30,000 (for 1 unit)
		Conduct annual maintenance of RAWS.	$2,500/year
		Use data to determine district fire preparedness levels.	N/A: Staff time
		Implement fire preparedness activities (readiness levels calculated and based on Keetch-Byram Drought Index and fuel moisture content).	N/A: Staff time

Goals	Objectives	Implementation Actions	Estimated Cost (USD)
		Use RAWS data to monitor environmental conditions relating to forest health.	N/A: Staff time
Forests at Kamehamenui are protected and healthy.	Monitor forest health and implement sound forest management practices.	Conduct bi-annual forest health surveys, including aerial surveys as needed. Compose and submit annual survey report to Forest Health Coordinator.	N/A: Staff time
		Based on the results of bi-annual aerial surveys and periodic ground surveys, notify landowners and request access and/or work with landowners to collect samples to test for diseases such as rapid ʻōhiʻa death (ROD).	N/A: Staff time
		Implement biosecurity measures for early detection of pests and diseases.	N/A: Staff time
		Implement biosecurity measures for rapid response to new pests and diseases.	N/A: Staff time
		Collaborate with partners to secure essential technical information and understanding of the mode of transmission of incipient pests and diseases.	N/A: Staff time
		Adopt appropriate sanitation procedures proven to be effective against the spread of an incipient pest or disease.	N/A: Staff time
		Adopt sanitation procedures proven to be effective against the spread of ROD and include prevention protocols in all issued permits for the Kamehamenui FR.	N/A: Staff time
	Increase public awareness about forest health.	Continue to participate in outreach activities targeting pests and diseases (e.g., ROD).	$15,000/year
Cultural Resource Protection			
Cultural resources at Kamehamenui are well protected.	Increase understanding of cultural resources in need of protection.	Collect data from the community and consultants in order to better protect cultural resources.	N/A: Staff time
	Increase biocultural landscape-based planning and management practices.	Revise planning documents based on climate change data.	N/A: Staff time
		Articulate the value of culturally significant habitats (especially for cultural resource improvement).	N/A: Staff time

Goals	Objectives	Implementation Actions	Estimated Cost (USD)
	Prioritize and pair habitat restoration with cultural resource management.	Restore culturally significant habitats from mauka to makai (e.g., loʻi, forests) where practicable and compatible.	TBD
	Protect traditional and customary practices (e.g., gathering, farming, fiber collection and processing, stargazing).	Identify or create designated spaces in Kamehamenui FR specifically for cultural practices.	N/A: Staff time
	Maintain permit and application process for protected cultural activities that require a forest reserve permit.	Maintain and update cultural application process.	N/A: Staff time
		Review applications and issue applicable forest reserve permit(s) if approved.	N/A: Staff time
Game Animal Management			
Public hunting for game birds may only be considered to the extent that it is compatible with management goals for endangered species recovery and reforestation.	Periodically assess if game bird hunting is a sustainable option for Kamehamenui FR.	Open or close Reserve for game bird hunting per conservation needs.	N/A: Staff time
Game mammal hunting program will be managed with the goal to eventually remove ungulates.	Provide and maintain hunter access for initial removal of ungulates from fenced phase areas.	Use hunters to initially control and remove ungulates in the upper two-thirds (~2200 acres), fenced area of the FR.	$2,500
		Communicate with hunters about the limited opportunity for game mammal hunting and DOFAW's long term objective of zero tolerance for ungulates.	N/A: Staff time
		As the fence is progressively built in the lower one-third of the parcel, continue to use hunting to remove feral ungulates from the FR.	$2,500/phase

Goals	Objectives	Implementation Actions	Estimated Cost (USD)
Threatened and Endangered Species Management			
T&E species and rare plants and animals are protected and on a path to population recovery.	Implement the management and recovery of T&E species consistent with management guidelines, and applicable recovery and management plans in cooperation with the Plant Extinction Program and USFWS.	Plant Extinction Prevention Program staff, state botanists, and consultants to conduct botanical surveys, for inventory and status of T&E plants.	TBD
		Hire a district botanist and invertebrate specialist to conduct biological surveys to collect and document baseline assessment for T&E and common species within all Maui Nui State Forest Reserves.	$75,000/year
		Use baseline data obtained from biological surveys to determine specific areas to protect species of interest.	N/A: Staff time
		Before the construction of the larger FR boundary fence and subsequent ungulate removal is completed, build and maintain temporary fenced areas where needed to protect and outplant T&E plants.	TBD
		Conduct predator and ungulate control as needed to protect T&E plants.	TBD
	Prioritize T&E wildlife species protection with assistance from Maui Forest Bird Recovery Project, Maui Nui Seabird Recovery Project, Snail Extinction Prevention Program, USFWS, and other agencies.	Before the larger FR boundary fence is completed, build and maintain temporary fences around wild populations of rare animal species.	TBD
		Inspect and maintain existing fences twice per year or as needed to protect T&E wildlife species.	TBD
		Continue ongoing monitoring and surveys for presence, location, and population estimates of rare birds, including seabirds and nēnē.	N/A: Staff time
		Conduct acoustic monitoring of ʻōpeʻapeʻa 5, 10, 15, and 20 years after the start of habitat restoration activities.	TBD
		Devise and implement predator control strategy. Install predator control traps, and monitor and maintain traps.	TBD

Goals	Objectives	Implementation Actions	Estimated Cost (USD)
	Implement various strategies to restore populations of rare plant and wildlife species.	Identify and prioritize restoration of suitable habitat for release of rare wildlife species. Incorporate climate change scenarios into the decision-making process.	N/A: Staff time
		Protect and prepare habitat for rare plant species introduction by increasing habitat quality and reducing threats (e.g., predators, invasive species, human disturbance).	TBD
		Release rare wildlife species into suitable habitats, and monitor survival, dispersal, reproductive success, abundance, and genetic diversity.	TBD
Native Ecosystems			
About 75% of Kamehamenui FR is composed of native forest.	Identify areas that will be managed primarily through active and/or passive restoration efforts.	Protect and enhance native plant populations in areas identified for habitat protection.	TBD
		Outplant common native plant species in areas identified for restoration from pasture to native habitat.	$3,000,000
		Outplant surrogate species that may be tolerant of future climate conditions.	TBD
		Identify a good existing seed bank and allow for natural regeneration of native vegetation.	N/A: Staff time
		Collect seeds to stock Maui District's seed bank inventory.	$25,000/year
		Direct/broadcast native plant seeds in suitable areas to enhance natural regeneration.	N/A: Staff time
There is zero tolerance for ungulates in the Reserve, particularly in native habitats.	Used a phased management approach to remove ungulates from the FR.	Utilize public hunting to initially remove ungulates from the fenced areas of the Reserve (also see Game Management and Watershed Management categories in this table).	$2,500/phased-in unit
		Use aerial control (aerial capture, eradication, and tagging of animals), as needed to remove ungulates from fenced areas (after area is closed to public hunting).	TBD
		Conduct periodic aerial and ground surveys to check for damages and possible breaches to ungulate-proof fences.	$10,000 per year*

Goals	Objectives	Implementation Actions	Estimated Cost (USD)
		Conduct periodic aerial and ground surveys for ungulate presence within the fenced units.	*Same flight time will be used for fence line checks
Management strategies that are adaptive to climate change.	Anticipate and facilitate habitat migration.	Conduct a cost-benefit analysis for a range of management alternatives based on climate change vulnerability assessments and prioritization processes.	TBD
		Use common garden experiments (planting along elevational/moisture gradient) to identify species applicability under changing climatic conditions.	TBD
		Prioritize the planting of native species that thrive in a wide variety of conditions (e.g., generalists, resilient native/endemic species).	N/A: Staff time
		Outplant native species to create habitat and facilitate a biome shift.	$3,000,000
		Monitor abundance of native and invasive species as temperatures rise and precipitation rates change.	N/A: Staff time
		Map transitional areas between different habitats (i.e., mesic to dry) to identify and prioritize protection for areas that may transition to a drier habitat.	TBD
	Improve silvicultural practices for priority species.	Improve seed storage capacity, seed propagation methods, and silvicultural planting methods (i.e., seed collection, composition, spacing).	$25,000
		Consider climate projections in the timing and seasonality of planting to promote natural recruitment.	N/A: Staff time
There is an effective program to monitor the status and distribution of native species over time.	Establish native species population baselines and track long term trends.	Use ground and aerial methods to monitor and document the abundance and richness of native animals.	TBD
		Monitor and document native plant species abundance and richness in the reserve.	N/A: Staff time

Goals	Objectives	Implementation Actions	Estimated Cost (USD)
Invasive Species Control			
There is strong support and cooperation with conservation organizations and partner agencies with regard to invasive species management.	Continue to work with cooperating agencies, including MISC, The Nature Conservancy, Natural Resource Conservation Service, Hawai'i Department of Agriculture, University of Hawai`i-College of Tropical Agriculture and Human Resources, East Maui Watershed Partnership, Leeward Haleakalā Watershed Restoration Partnership, USFWS, and other entities.	Invasive species technician and support staff to work with agencies on early detection and control of invasive species in the FR.	$150,000/year
		Improve data sharing within and between agencies.	N/A: Staff time
		Plan, coordinate, and implement multi-agency work trips to control invasive species in the FR.	$10,000/year
		Support applied research for potential biocontrol agents, including labor and helicopter time.	$25,000/year
	Conduct research to support adaptive policies and technology that increase landscape-level protection and restoration.	Research and develop new/improved methods of small predator control.	$25,000/year
Introduction of new invasive species and spread of incipient invasive species populations in the reserve is minimal.	Adopt biosecurity measures to prevent the introduction and spread of invasive species.	Research and develop new/improved methods of weed control.	$25,000/year
		Conduct periodic surveys to detect the presence of new invasive species, including new diseases and pathogens in the Reserve. Implement early detection, early response measures.	$15,000/year
		Implement quarantines, intra-island policies, departmental and division policies and protocols, optional vs. mandatory restrictions to minimize the introduction and spread of invasive species.	N/A: Staff time
Effective control strategies continue to lower the impact of existing invasive	Monitor and control established invasive species.	Write a comprehensive weed control plan.	$60,000
		Prioritize invasive plant removal, focusing on areas with high diversity of native species, e.g., pine, eucalyptus, and black wattle.	N/A: Staff time

Goals	Objectives	Implementation Actions	Estimated Cost (USD)
species on native species and habitat.		Adopt appropriate manual, chemical, biological, and mechanical methods to control established invasive species, prioritizing areas with high diversity of native species.	N/A: Staff time
		Conduct aerial and ground control work to remove invasive species from FR and prevent further spread.	$50,000/year
		Conduct periodic surveys to monitor and map invasive species populations within the FR. Surveys will also be used to validate the effectiveness of each control method.	$15,000/year
		Conduct small predator control work based on proven and cost-effective methods.	$25,000/year
Access Trails and Other Public Uses			
There is adequate public access to Kamehamenui FR.	Create new access as needed, while maintaining and updating historical access agreements with adjacent landowners, as needed.	Meet with neighboring landowners to scope, identify, and formalize agreements of possible secondary and tertiary access points as appropriate for public access to the FR.	N/A: Staff time
		Work with lease holder of state land for public access.	N/A: Staff time
		Build and maintain public vehicle access road from the lower (western) end of the FR.	$75,000 (install); $25,000/year (maintenance)
		Build and maintain public parking areas in the lower (western) end of the FR by Kekaulike Avenue.	TBD
		Build additional public access trails to connect with Kula FR (above the fenced area).	$2,000,000
Manage and construct infrastructure for public use.	Build and maintain trails in accordance with Nā Ala Hele Trails program standards and plans, as proposed in the Kamehamenui Forest Restoration Environmental Assessment.	Determine location of trails for hiking, mountain biking, and equestrian trails.	N/A: Staff time
		Maintain and repair trails as needed.	$50,000/year
		Conduct risk assessment for all trails to determine mitigation needs.	TBD

Goals	Objectives	Implementation Actions	Estimated Cost (USD)
	Build and maintain recreational infrastructure (in addition to trails above) in accordance with Nā Ala Hele trails program standards and plans, as proposed in the Kamehamenui Forest Restoration Environmental Assessment.	Identify locations to build campsites and cabins, and complete necessary environmental compliance for construction.	$25,000 (flight time)
		Establish camping reservation and permit and fee system.	$20,000
		Provide public with parking and covered rest areas or weather shelters for day and extended overnight trips.	TBD
		Construct and maintain an archery range in the FR.	$25,000 (construct); $15,000/year (maintenance)
	Manage recreation and public access to prevent harm to natural resources, infrastructure, and not disturb the neighborhood.	Connect remote trails to public access paths.	TBD
		Build and maintain the public vehicle access road to parking areas.	$10,000/year
		Establish a public parking reservation and fee system, as needed.	N/A: Staff time
		Evaluate and, if needed, provide porta-potties in areas where they can be easily serviced.	TBD
		Hire a consultant to evaluate the carrying capacity of the FR for additional recreational opportunities.	TBD
	Increase enforcement of Forest Reserve Rules and applicable Hawai`i Administrative Rules to protect DOFAW infrastructure.	Secure funding for additional nighttime surveys and patrols.	$50,000/year
		Periodically evaluate the parking situation and modify or enforce rules to prevent disruption to neighboring community.	N/A: Staff time
	Adopt measures to adapt to climate change.	Adjust the timing of actions (e.g., open/close dates, road or trail closures, special use permits) to accommodate changing climate conditions (e.g., drought, increased fire risk).	N/A: Staff time
	Increase public information and awareness.	Install information signs as needed.	$10,000/year

Goals	Objectives	Implementation Actions	Estimated Cost (USD)
Commercial Activity			
Funds generated from sustainable forestry activities (excluding ecotourism) supplement funding of natural resource management activities.	Explore ecosystem services as revenue streams.	Identify future small-scale outplanting sites, and initiate outplanting of sandalwood and koa seedlings.	N/A: Staff time
		Carbon sequestration: Certified carbon offset market. Certification of Kamehamenui FR reforestation projects under a Voluntary Carbon Standard. Establish inventory plots for future certifications.	TBD
	Determine future income possibilities from fee services such as parking and user fees.	Generate income from fee services to supplement funding for natural resource management activities and infrastructure maintenance and upgrades.	TBD
	Determine future income possibilities from donation and various social media platforms.	Generate income from donation programs and social media platforms.	N/A: Staff time

Section 6.0 FUTURE RECOMMENDATIONS

6.1 Desired Outcome for the Forest Reserves

- Protection and enhancement of watershed quality and quantity
- Continued maintenance of existing ungulate-proof fencing and forest restoration areas
- Extend ungulate-proof fencing and restorations efforts downslope to revegetate and decrease soil erosion
- Stable to increasing populations of T&E species
- Healthy native ecosystems
- Protection of cultural resources
- Negotiate cooperative agreements with neighboring landowners to secure management and public access in perpetuity
- Sustainable harvest level of game birds
- Development of alternative revenue opportunities to support the management needs of the forest reserves

6.2 Future Recommendations

- Continue to pursue land acquisitions to increase area for watershed protection, natural resource conservation, and public hunting
- Long-term funding sources are needed to support fire mitigation projects such as the installation of water/dip tanks to support aerial fire suppression, fuel mitigation along access corridors, and the development of landscape fuel reduction projects
- Develop alternative funding opportunities that support forest management and sustainable use, such as carbon offset credits or other ecosystem services markets
- Enhance DOFAW's capacity for successful implementation of management plans by increasing personnel and equipment resources
- Develop and implement spatially-explicit management plans for endangered species and recovery efforts in Kamehamenui FR forest reserves
- Develop and implement monitoring methods to establish a baseline and track trends of species richness and diversity

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APPENDIX A. PUBLIC SCOPING FOR DEVELOPMENT OF KAMEHAMENUI MANAGEMENT PLAN

The Department of Land and Natural Resource (DLNR) Division of Forestry and Wildlife (DOFAW) – Maui Branch, conducted an extensive scoping process to gather input for the development of the first management plan for the Kamehamenui Forest Reserve. This appendix provides details of the four information gathering or scoping meetings that were conducted during the year 2022. This appendix consists of five parts.

Appendix A. Parts 1-3 provide relevant details and documentation on the scoping meetings

Appendix A. Part 4 is a compilation of all verbal and written comments received during the scoping meetings. Written comments consist of comments received during the course of the public meetings, comments solicited by DOFAW via email between October 12, 2022 and November 18, 2022, as well as hard copies of comments and petitions submitted to DOFAW during the public scoping meetings. About 400 verbal and written comments are documented.

Appendix A. Part 5 is an analysis of all verbal and written comments to guide the development and management of public use opportunities at Kamehamenui Forest Reserve

Appendix A1.
Internal Scoping Meeting with Maui DOFAW Forest Management Staff

Purpose:	Maui's Divisions' DOFAW staff are the stewards of conservation lands on Maui who best know the resources at Kamehamenui and are tasked with the challenges of the managing it in perpetuity. This purpose of this first internal scoping meeting for the management plan was to gather first hand information from them on what they think should be included in the management plan.
When:	February 23, 2022.
Where:	Virtual Microsoft Teams Meeting
Attendees:	Maui DOFAW Branch: Lance DeSilva, Jan Pali, John Mederios, Shane DeMattos, Stephanie Franklin, and Tanya Rubenstein. H. T. Harvey & Associates (Project consulting team): Shahin Ansari, Paul Conry, Greg Spencer, Scott Terrill, and Phillip Matsunaga.
Meeting Structure:	The 3-hour virtual meeting focused on systematically gathering and documenting input on goals, objectives and action items on DOFAW's eight major management categories: • Resource Protection • Watershed Values • Invasive Species Control • Threatened and Endangered Species Management • Native Ecosystems • Game Animal Management • Commercial Activity • Access, Trail, and Other Public Uses



Kamehamenui Forest Reserve Management Plan

1st Internal Information Gathering Meeting with Maui DOFAW

February 23, 2022

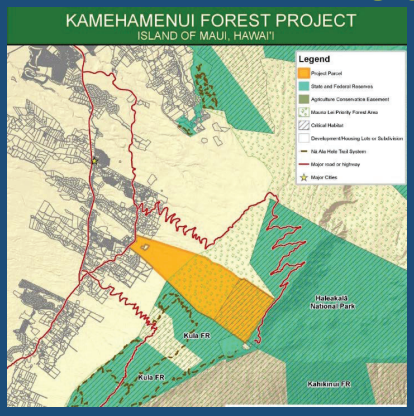
Meeting Objective

- To gather first-hand information from Maui DOFAW staff on their vision for Kamehamenui Forest Reserve and what they think should be included in this management plan.

- To gather specific input on goals, objectives, and action items with regard to DOFAW's eight management categories
  - Resource Protection
  - Watershed Values
  - Invasive Species Control
  - Threatened and Endangered Species Management
  - Native Ecosystems
  - Game Animal Management
  - Commercial Activity
  - Access, Trail, and Other Public Uses



Stakeholder Scoping Meetings



Internal DOFAW Information Gathering Meeting

Partner Agency Meeting

Federal | State | County

Neighboring Landowner Meeting

Community Meeting (Virtual)

Community Meeting (In-person)

Gather input from multiple stakeholders to develop draft framework for the management plan.

1st Draft of Kamehamenui Management Plan (Internal Review)

2nd Draft of Kamehamenui Management Plan (Public Review)

Board Approval (DOFAW)

Final Management Plan

Meeting Structure (2.5 hours)

- Introductions
- Discuss four resource management categories (60 minutes, 15 mins/topic)
  Resource Protection, Watershed values, Invasive species control, T&E Species management
- *Break (10 minutes)*
- Discuss four resource management categories (60 minutes, 15 mins/topic)
  Native ecosystems, Game animal management, Commercial activity, Access, Trails, and other public uses
- Additional thoughts and future recommendations for inclusion in management plan

Housekeeping

- Meeting is being recorded
- You can put comments in the chat box as well
  - Comments in the chat box cannot be recorded
  - Copy-paste comments from the screen
- Taking notes on shared screen

Appendix A2 - Scoping Meeting with Landowners whose Properties are Adjacent to Kamehamenui Forest Reserve

Purpose:	To gather input from landowners adjacent to Kamehamanui on the State's potential plans and management activities for the newly formed Kamehamenui Forest Reserve.
When:	August 10. 2023; 5:30 to 7:30 pm
Where:	Kula Elementary School, 5000 Kula Hwy, Kula, HI 96790
Attendees:	• 31 landowners invited. • 36 signed the meeting sign-in sheet • About 75 people attended the meeting – many of them were not adjacent landowners.
Meeting Structure:	The meeting started with a brief introduction to Kamehamenui and its potential for conservation and public use. The meeting was then opened up to the neighboring stakeholders to provide comments. DOFAW staff addressed questions throughout the meeting.

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

ROBERT K. MASUDA
FIRST DEPUTY

KALEO L. MANUEL
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
BUREAU OF CONVEYANCES
COMMISSION ON WATER RESOURCE MANAGEMENT
CONSERVATION AND COASTAL LANDS
CONSERVATION AND RESOURCES ENFORCEMENT
ENGINEERING
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
KAHOOLAWE ISLAND RESERVE COMMISSION
LAND
STATE PARKS

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF FORESTRY AND WILDLIFE
685 HALEAKALA HWY
KAHULUI, HI 96732

July 7, 2022

Subject: Invitation to Attend a Neighborhood Meeting with Division of Forestry and Wildlife to Provide Input on Developing the Draft Management Plan for Kamehamenui Forest Reserve

Aloha!

In September 2020, the State Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) acquired 3,433 acres of Kamehamenui land along the northwestern slopes of Haleakala, in Kula, Maui (see attached map). DOFAW seeks to integrate Kamehamenui into the State's Forest Reserve System. DOFAW has a mandate to protect, manage, restore, and monitor natural resources within the Forest Reserve System. To effectively do this, DOFAW, works with the community to develop a comprehensive management plan that addresses the issues, goals, and objectives of the Forest Reserve System for each individual Forest Reserve which, in part, also reflects the Division's management guidelines specific to that area.

The Maui DOFAW Branch is beginning to develop a management plan for the Kamehamenui Forest Reserve. We invite you to attend the first scoping meeting being organized with neighboring landowners to learn about DOFAW's vision and management guidelines for Kamehamenui Forest Reserve and more importantly, to gather your input and ideas and address any questions or concerns you might have.

Meeting with neighboring landowners will be an in-person gathering
Wednesday, August 10, 2022
Kula Elementary School Cafeteria
5:30 to 7:30 pm

Topics of discussion during this meeting could include DOFAW's following management categories:

- access, trails, and other public uses
- commercial activities
- game management
- resource protection
- watershed management
- invasive species control
- threatened and endangered species management
- native ecosystem management

Discussion will also include other topics that you as a landowner might want addressed, for example, traffic, noise issues, parking, visitor use capacity etc.

DOFAW wants the preparation of this management plan to be a transparent process. Therefore, after meeting with neighboring landowners, we will also be organizing subsequent meetings to gather input from our federal, state, and county partners as well as from the community at large. The comments provided by you as a neighboring landowner during this first information gathering meeting will lay the foundational framework to gather additional input in subsequent meetings from other stakeholders. Your participation is critical to developing an effective and adaptive management plan for Kamehamenui Forest Reserve. Please take the time to share your thoughts with us about the existing conditions at Kamehamenui and actions that you think will be needed to protect, manage, restore, and monitor the natural resources in this new Forest Reserve on Maui.

Sincerely,



Scott Fretz, Manager
Maui District, Division of Forestry and Wildlife

Attachment: Map of Kamehamenui Forest Reserve with Neighboring Landowner Parcels

Czar Family Trust
PO Box 1248
Kula, HI 96790

Bailey, John V Exemption Trust
266 Kekaulike Ave
Kula, HI 96790

Inouye, Ralph K and Sachiko TRS
1860 Kekaulike Ave
Kula, HI 96790

Pieter Nicolas Denhartog
11 Ululani Rd
Kula, HI 96790

Gail Ann Simmons
11 Ululani Rd
Kula, HI 96790

Bailey, John V Exemption Trust
266 Kekaulike Ave
Kula, HI 96790

Ditmar Hoerl
10 Ululani St
Kula, HI 96790

RBLA LLC
7100 Alvern St, Apt 412
Los Angeles, CA 90045

Von Tempsky, Kimball Trust
6 Puu Hale St
Lahaina, HI 96761

Yang Wu
528 Moaniala St
Honolulu, HI 96821

Nancy Zhao Wu
528 Moaniala St
Honolulu, HI 96821

Haleakala Ranch Company
529 Kealaloa Ave
Makawao, HI 96768

RBLA LLC
7100 Alvern St, Apt 412
Los Angeles, CA 90045

Von Tempsky, Kimball Trust
6 Puu Hale St
Lahaina, HI 96761

Christopher C Monroe
PO Box 1208
Kula, HI 96790

Karsten Mendel Dueck
2277 Kekaulike Ave
Kula, HI 96790

Deponte, Franklin E Trust
102 Ioio Pl
Kula, HI 96790

Ching, Arnold S C Revoc Living Trust
2115 Kekaulike Ave
Kula, HI 96790

Lum, Carole J Y Revoc Living Trust
2115 Kekaulike Ave
Kula, HI 96790

John Ivan Yannell
46 Ihe Pl
Kula, HI 96790

Lum, Carole J Y Revoc Living Trust
2115 Kekaulike Ave
Kula, HI 96790

Stanford Shigeo Carr
4753 Farmers Rd
Honolulu, HI 96816

Kathy Siu Pung Carr
4753 Farmers Rd
Honolulu, HI 96816

Doe, Harold W/Fujii, Diane Trust
106 Ioio Pl
Kula, HI 96790

Trevor K Pechin
PO Box 663
Kula, HI 96790

Nicholas H Pechin
PO Box 663
Kula, HI 96790

Maui Electric Co Ltd
Attn: Land Division, Engineering
PO Box 398
Kahului, HI 96733

Richard David Jr Tramontin
2176 Kekaulike Ave
Kula, HI 96790

Christina Karin Tramontin
2176 Kekaulike Ave
Kula, HI 96790

Nowhere LLC
90 Aleiki Pl
Paia, HI 96779

Haleakala National Park
PO Box 369
Makawao, HI 96768

Kamehamenui Forest Reserve Management Plan
Scoping Meeting for Adjacent Landowners organized by Division of Forestry and Wildlife
Kula Elementary School Cafeteria
August 10, 2022 5:30 to 7:30 pm

	Name	Phone #	Email	Property address	Did you receive a letter from DOFAW requesting attendance at this meeting? (Yes/No)
1	Gerri Mishida	[redacted]			No
2	Lee Monroe				Yes
3	Jean Fiddes				No
4	Lea Voss				No
5	Ditmar Hoerl				Yes
6	Dave Gleason				Yes
7	Mary Anna Grimes				Yes
8	Koko Wolbe				A copy
9	Miles Wolbe				A copy
10	Christina Tramontin				Yes
11	Betty Peschke				No
12	Bruce Cary				No
13	Aaron Hughes				No
14	Kathleen Baldwin				No
15	Geri Baar				No
16	Matt Larga				Yes
17	Martin Heaene				No
18	Gordean Bailey				Yes
19	Jeff Bagshaw				
20	Russ Taft				No
21	Steve Robertson				No
22	Godwin Pelissero				No
23	Trevor Pechin				Yes
24	Frank DePonte				Yes
25	Kainoa DePonte				Yes
26	Priscilla DePonte				Yes
27	Greg and Stephanie Czar				Yes
28	Karsten and Molly Dueck				Yes
29	Michael Sarona				No
30	Darrell Williams				No
31	John B Dug				No
32	Jordan Jokel				Yes
33	Nate Holmes				No
34	Lauren Knobel				Yes
35	Timmy Bailey				Yes, Gordean Bailey did
36	Pieter Denhartg				No mother
37	Gail Simmons				Yes
38	Lance DeSilva				DLNR-DOFAW
39	Greg Spencer				HTH
40	Terrell Erickson				HTH
41	Doug Sheehan				No
42	Whitney Fujiidoe				Yes
43	Armel Chin				Yes
44	Leilani Magee				No
45	Jeff Bettendorf				No
46	Rick Tramontin				Yes
47	Carolelum Chin				Yes
48	Annamarie Sheehan				

Kamehamenui Forest Reserve Management Plan

Stakeholder Meeting with Adjacent Landowners
August 10, 2022
Kula Elementary School Cafeteria

Department of Land and Natural Resources
Division of Forestry and Wildlife
Maui Branch

Meeting Objectives

To gather input from landowners *adjacent* to Kamehamenui on the State's potential plans and management activities for the newly formed Kamehamenui Forest Reserve.

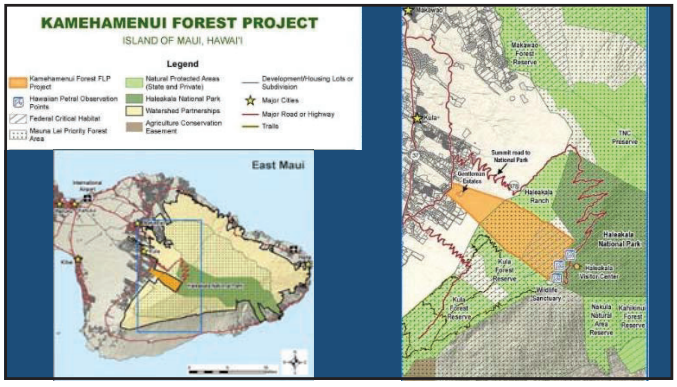


Housekeeping and Meeting Structure

- Two-hour meeting 5:30 – 7:30 pm
- Meeting is being recorded so we can capture your ideas, suggestions, and concerns accurately
- First provide background about DOFAW and Kamehamenui Forest Program followed by open discussion

Hawaii's Forest Reserve System

- Forest Reserve System created in 1903 by the Territorial Government of Hawaii
- Hawaii Revised Statute (HRS) Chapter 183 and associated Hawaii Administrative Rules (HAR) Chapter 104
- Department of Land and Natural Resources' (DLNR) Division of Forestry and Wildlife (DOFAW) mandated to protect, manage, restore, and monitor the natural resources within the FR System
- The state's largest public forest lands, offering benefits that include watershed restoration, native habitat management, recreation and hunting

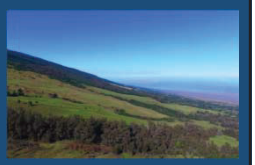


Kamehamenui Forest Reserve Management Plan

DOFAW Organized Stakeholder Scoping Meetings

Gather input from multiple stakeholders to develop draft framework for the management plan.

- Internal DOFAW Information Gathering Meeting
- Adjacent Landowners Meeting
- Community Meeting (Virtual)
- Community Meeting (In-person)
- 1st Draft of Kamehamenui Management Plan (Internal Review)
- 2nd Draft of Kamehamenui Management Plan (Public Review)
- Board Approval (DOFAW)
- Final Management Plan

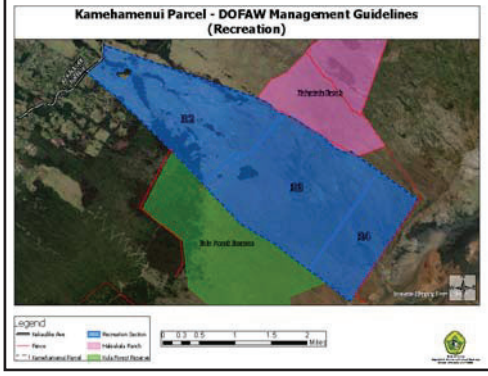


Kamehamenui Forest Reserve Management Plan

- Serve to guide future field operations, assist with budgeting, and help secure funding for Kamehamenui Forest Reserve
- Multiuse management plant that explores full potential of Kamehamenui:
  - access, trails, and other public uses
  - game management
  - commercial activities
  - resource protection
  - watershed management
  - invasive species control
  - threatened and endangered species management
  - native ecosystem management







Proposed Recreation Guidelines

R1 = High Recreation Management

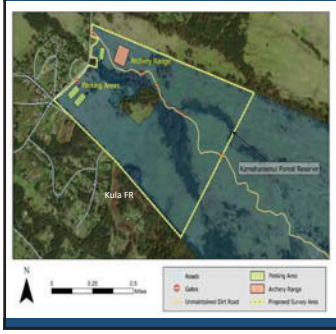
R2 = Medium Recreation Management

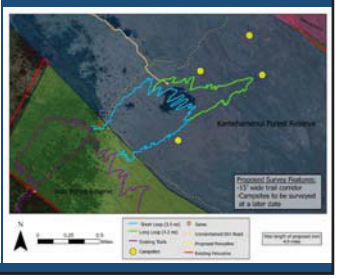
R3 = Low Recreation Management

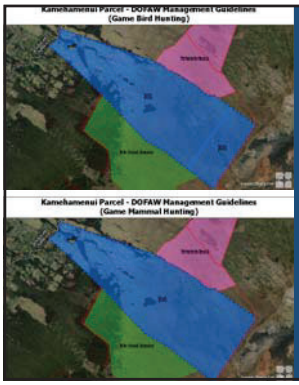
R4 = Restricted Access

Proposed Infrastructure to Support Recreation

Access, Trails, Parking, Campsites







Proposed Game Management Guidelines

- Provide and maintain hunter access for game bird hunting.
- Develop and manage a game mammal hunting program to eventually phase out ungulates.

H1 = Active Hunting Management

H2 = Moderate Hunting Management

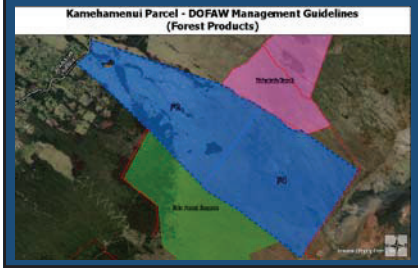
H3 = Low Intensity Hunting Management

H-4 = No Hunting Management

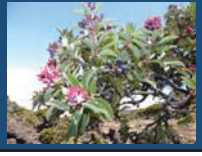
Proposed Forest Products Management Guidelines

F1 = Provide Large Scale Commercial, F2 = Small Scale Commercial,

F3 = Personal Use, F4 = Restricted

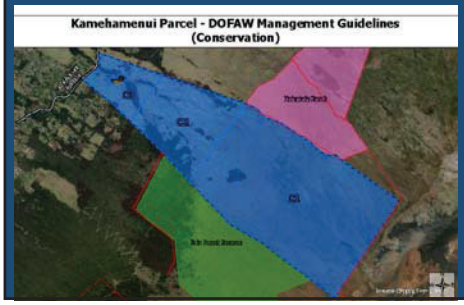






Proposed Conservation Management Guidelines

(watershed protection, resource protection invasive species control, threatened and endangered species management, native ecosystem management)



C-1 = High Conservation Resources

C-2 = Medium Conservation Resources

C-3 = Low Conservation Resources

C-4 = Little to No Conservations Resources

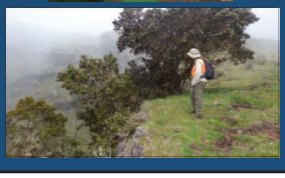
Proposed Conservation Management Watershed Protection





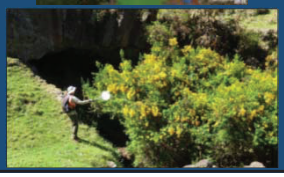
- Increase forest cover
- Upper areas more habitat protection
- Lower section more reforestation
- Phased approach over time to remove cattle and restore ranch land with forest

Proposed Conservation Management Guidelines Resource Protection

- Fire suppression and mitigation
- Protect and maintain healthy forests
- Protect cultural resources

Proposed Conservation Management Invasive Species Control

- Work with federal, county, non-profit, and private sector partners to control established invasive species
- Includes aerial and ground control work

Proposed Conservation Management Guidelines Threatened and Endangered Species Management





- Protect and recover listed rare plant and animal species
  - Haleakala silversword
  - Seabirds
  - Nene
  - Hawaiian hoary bat (ʻōpeʻapeʻa)
  - Maui parrotbill (kiwikiu)
  - Crested honeycreeper (ʻākohekohe)

Proposed Conservation Management Guidelines Native Ecosystem Management





- Protect and enhance native habitat in areas identified for protection
- Outplant with native species in areas identified for restoration

Kamehamenui Forest Reserve Management Plan

Shahin Ansari
sansari@harveyecology.com

Upcoming Community Meetings in August - September 2022

Appendix A3 – Public Scoping Meetings

Purpose:	To gather input from the community on potential activities that the State should consider when developing the management plan for Kamehamenui Forest Reserve.
When:	October 12, 2023; 5:30 to 7:30 pm
Where:	Kula Community Center, E. Lower Kula Rd, Kula, Maui, HI 96790
Attendees:	• 54 people signed the meeting sign-in sheet • It is estimated that about 100 people attended
Meeting Structure:	The meeting started with a brief introduction to the resources at Kamehamenui and its potential for conservation and public use. The organizers then split up the meeting into four separate stations in the room to allow people to provide focused input on four major topics: 1) Public Access 2) Trails and Recreation 3) Hunting 4) Conservation Needs Relevant information materials were posted and available at each station. DOFAW staff assisted by members from the consulting team were present at each station to gather input from the people and address their questions. Written comments were also solicited and gathered from the public.

Purpose:	To gather input from the community on potential activities that the State should consider when developing the management plan for Kamehamenui Forest Reserve.
When:	October 19, 2022; 5:30 to 7:30 pm
Where:	Virtual Microsoft Teams Meeting. The purpose of the virtual platform was to provide outer island residents to provide their input as well.
Attendees:	About 20 people attended
Meeting Structure:	The meeting started with a brief introduction to the resources at Kamehamenui and its potential for conservation and public use. The organizers then split up the meeting into four separate “virtual rooms” where the discussion was focused on the following four major topics: 1) Public Access 2) Trails and Recreation 3) Hunting 4) Conservation Needs

	DOFAW staff assisted by members from the consulting team were present in each “virtual room” to gather input from the people and address their questions. In addition the main link to the meeting was also live during the meeting to welcome people throughout the duration of the meeting and direct them to either of the four “virtual rooms” of their preference. People could also enter and leave the discussion going on in any room at any time during the meeting.

Making Hawai`i a Great Place to Live!

Department of Land and Natural Resources

Ka ʻOihana Kumuwaiwai ʻĀina

10/11/22 – INPUT SOUGHT FOR MANAGEMENT OF KAMEHAMENUI FOREST RESERVE ON MAUI

Posted on Oct 11, 2022 in Forestry & Wildlife, News Releases, slider

DAVID Y. IGE GOVERNOR	**SUZANNE D. CASE** CHAIRPERSON

For Immediate Release: October 11, 2022

INPUT SOUGHT FOR MANAGEMENT OF KAMEHAMENUI FOREST RESERVE ON MAUI



To view video please click on photo or view at this link: https://vimeo.com/454915182

(KAHULUI) – Adding a new parcel to public lands is a rare event and opportunity on an island. In September 2020, DLNR acquired 3,433 acres of land known as Kamehamenui on the northwestern slopes of Haleakalā in Kula on Maui. Upper portions of the parcel include native shrubland ecosystems and provides habitat for nesting endangered seabirds and other wildlife. The reserve will join other lands managed by the DLNR Division of Forestry and Wildlife (DOFAW), which is mandated to protect, restore and monitor natural resources within forest reserves.

To effectively manage reserves, DOFAW works with the community and stakeholders to develop comprehensive management plans that address the issues, goals, and objectives for each individual forest reserve.

To begin developing a management plan, DLNR invites interested people to attend a public scoping meeting to gather input and ideas and address any questions or concerns.

Topics of discussion during this meeting could include resource protection, access, trails, game management, and other public uses.

There will be an informational meeting tomorrow (Wednesday, October 12), at the Kula Community Center on Lower Kula Rd in Kula, from 5:30 to 7:30 pm.

A virtual information meeting will be held next Wednesday (October 19) from 5:30 to 7:30 p.m.

Written comments can also be sent via email close of business on November 18, 2022 to Shahin Ansari, a contractor with H.T. Harvey and Associates, at sansari@harveyecology.com.

# # #

RESOURCES

(All images/video courtesy: DLNR)

HD video – Kamehamenui Forest Reserve (Sept. 4, 2020):

https://vimeo.com/454915182

Photographs – Kamehamenui Forest Reserve (Sept. 4, 2020):

https://www.dropbox.com/sh/99dqd748614eykc/AADDkOAfU6f2oztkwe2xwrXZa?dl=0

October 19 meeting link: Click here to join the meeting

- Meeting ID: 260 058 709 649
  Passcode: bTBXSS
- Download Teams | Join on the web
- Or call in (audio only): +1 628-215-0177,,279033498# United States, San Francisco,
  Phone Conference ID: 279 033 498#

Media Contact:

Dan Dennison

Senior Communications Manager

dlnr.comms@hawaii.gov

MAUI

Maui News

56

Input sought for management of Kamehamenui Forest Reserve on Maui

October 12, 2022 · 4:47 AM HST



KAMEHAMENUI FOREST ACQUIRED FOR CONSERVATION. 3,433 acres of mountain watershed lands protected in perpetuity for the people of Hawai‘i. Courtesy of Island Sotheby’s International Realty.



Kamehamenui Forest Reserve (Sept. 4, 2020). VC: DLNR Hawai‘i

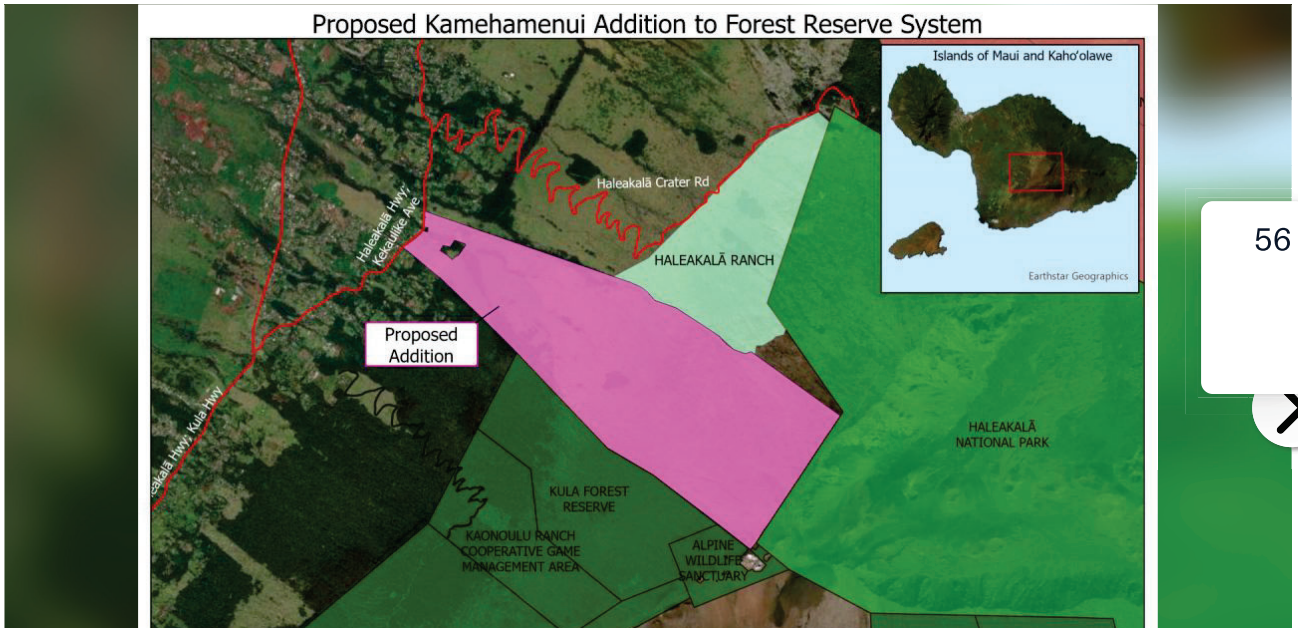
A recent land acquisition protects the Kula water aquifer, habitat for endangered species, and community-based forest restoration opportunities. These lands are now protected in perpetuity thanks to federal, state and nonprofit partners.

The Trust for Public Land purchased 3,433 acres of property in upland Kula from the Shizuka Asakawa Revocable Trust in July 2020 and conveyed the property to the DLNR Division of Forestry and Wildlife in 2020.

Now the department is developing a management plan and is inviting the public to attend a public scoping meeting to gather input and ideas, and address any questions or concerns.

- There will be an in-person informational meeting today, Wednesday, Oct. 12, at the Kula Community Center on Lower Kula Rd in Kula, from 5:30 to 7:30 p.m.
- A virtual information meeting will be held next Wednesday, Oct. 19, from 5:30 to 7:30 p.m.
- Written comments can also be sent via email close of business on Nov. 18, 2022 to Shahin Ansari, a contractor with H.T. Harvey and Associates, at sansari@harveyecology.com.

Topics of discussion during this meeting could include resource protection, access, trails, game management, and other public uses.



Kamehamenui, Maui. PC: DLNR/DOFAW



MAUI JOBS

View All Jobs >

Hale Makua
Certified Nursing Assistant
Central Maui · 3 weeks ago

Rimfire Imports, Inc.
Drivers and Warehouse Associates
Central Maui · 1 week ago

Community Clinic of Maui, Inc. dba Malama I Ke Ola Health Center
Dental Assistants and Dental Hygienist
Central Maui · 1 week ago

Looking for locally based talent? Post a Job Listing

Sponsored Content

Kamehamenui Forest Reserve Management Plan
Scoping Meeting for Adjacent Landowners organized by Division of Forestry and Wildlife
Kula Elementary School Cafeteria
October 12, 2022 5:30 to 7:30 pm

	Name	Phone #	Email	Address
1	Frank DePonte			
2	Aimee Szabo			
3	Marty Hearne			
4	Gabriel Manibog			
5	Rebecca Taylor			
6	Alisi Cannon			
7	Grant Wilson			
8	Doug Duncan			
9	Clay Taylor			
10	Warren A.			
11	Melissa Meier			
12	John Meier			
13	Leilani Magee			
14	Betty Peschke			
15	Miles Wolbe			
16	Koko Wolbe			
17	Aaron R. Moose			
18	Cliffon and Rebecca P.			
19	Bobbie and Jack P.			
20	Patri McLaughlin			
21	Warren Watanabe			
22	Maile Darris			
23	James Klask			
24	Theresa Thompson			
25	Roy Glanser			
26	Marc Ratte			
27	Mark Fillazar			
28	Peter Fay			
29	Heidi Wirtz			
30	Petar Kovacic			
31	Robert Cole			
32	Karen Cole			
33	Wayne L.			
34	Kathleen McNamara			
35	Aller Atkinson			
36	Lucia Maya			
37	Doug Sheeha			
38	Francine Hughes			
39	Jean Fiddes			
40	Martin Malley			
41	Richard Donovan			
42	Matthew Redmond			
43	Path Welton			
44	Seth W.			
45	Whitney F. D.			
46	Diane F.			
47	Herald D.			
48	Lyman K.			
49	Brenda K.			
50	David Voss			
51	Ryan Worcester			
52	Bert Ratte			
53	Lea Voss			
54	Troy and Chocolate Helmer			
55	Lou Szabo			
56	Russell R.			
57	Rick Tramontin			

Kamehamenui Forest Reserve Management Plan

Public Meeting
October 12, 2022
Kula Community Center, Kula, Maui

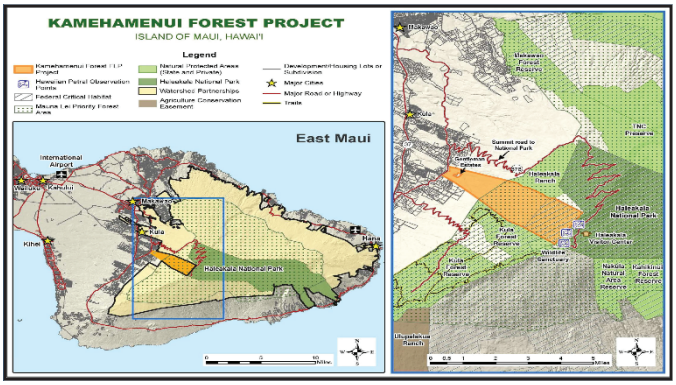
Department of Land and Natural Resources
Division of Forestry and Wildlife
Maui Branch

Public Scoping Meeting Objective

To gather input from the community on potential activities that the State should consider when developing the management plan for Kamehamenui Forest Reserve.

Hawaii's Forest Reserve System

- Forest Reserve System created in 1903 by the Territorial Government of Hawaii
- Hawaii Revised Statute (HRS) Chapter 183 and associated Hawaii Administrative Rules (HAR) Chapter 104
- Department of Land and Natural Resources' (DLNR) Division of Forestry and Wildlife (DOFAW) mandated to protect, manage, restore, and monitor the natural resources within the FR System
- The state's largest public forest lands, offering benefits that include watershed restoration, native habitat management, and recreation



Kamehamenui

Home to the Historic Von Tempsky Erehwon Ranch





Photos courtesy of von Tempsky family collection

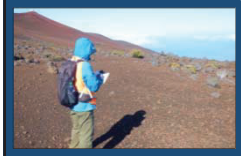
Kamehamenui Forest Reserve

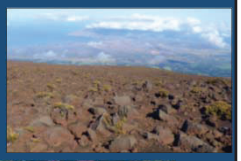


- About 3433 acres
- Elevational range: 3,650 to 9,700 feet above mean sea level
- Annual air temperature ~ 44-61 degrees Fahrenheit
- Annual rainfall ~ 27-40 inches

Kamehamenui Forest Reserve

Upper Elevations Above 6500



Hawaiian petrel


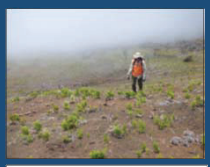
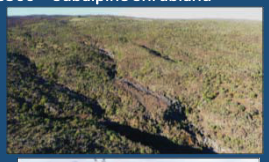
Haleakala Silversword

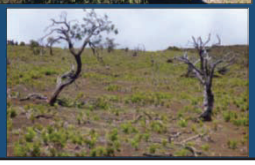
Pukiawe

Photos by Kim and Forest Starr

Kamehamenui Forest Reserve

Upper Elevations Above 6500 – Subalpine Shrubland

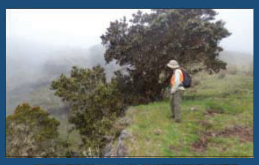
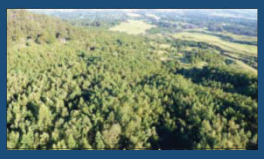



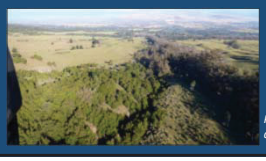


Photos by Kim and Forest Starr

Kamehamenui Forest Reserve

Upper Elevations 5000 to 6000 feet – Mesic Forest

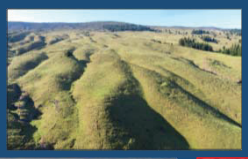





Photos by Kim and Forest Starr

Kamehamenui Forest Reserve

Elevations Below 6500 feet – Pasture



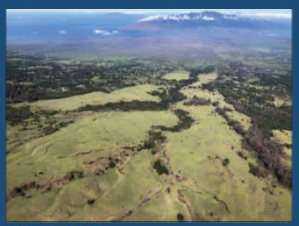


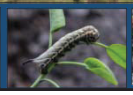

Photos by Kim and Forest Starr and Ford & Associates

Kamehamenui Forest Reserve

Potential for Conservation and Recreation

- Conservation (watershed management, invasive species control, threatened and endangered species management, native ecosystem management)
- Trails and Recreation (e.g. hiking, camping, archery range)
- Access (connect with Kula Forest Reserve, parking?)
- Hunting and game management






Kamehamenui Forest Reserve Management Plan

DOFAW Organized Stakeholder Scoping Meetings

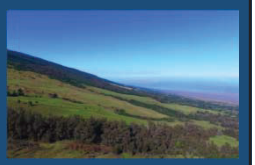
Gather input from multiple stakeholders to develop draft framework for the management plan.

✓ Internal DOFAW Information Gathering Meeting

✓ Adjacent Landowners Meeting

Public Meeting (In-Person) (Today)

Public Meeting (Virtual). Next week, Oct 19, 2022



1st Draft of Kamehamenui Management Plan (Internal Review)

2nd Draft of Kamehamenui Management Plan (Public Review)

Board Approval (DOFAW)

Final Management Plan

Today's Meeting Structure to Provide Input

Four Stations

1. Trails and Recreation
2. Public Access
3. Hunting
4. Conservation Needs

- Visit each station
- Speak with DOFAW staff
- Present your ideas, suggestions, questions, and concerns
- Provide written comments at each station

Project Timeline

Time	Actions and *Opportunities to Provide Comment
October 19, 2022 (next week)	*Virtual public meeting [See DLNR DOFAW website on details to logon]
November 18, 2022	Deadline to provide written input for development of management plan (sansari@harveyecology.com)
December 2022	Complete first draft of management plan
January 2023	*Launch public engagement platform on DLNR-DOFAW website with details on management plan
March 2023	*Release draft management plan and environmental assessment (EA) – 30 days public review and comment period
April-May 2023	Final management plan and EA



Appendix A4.

Compilation of All Verbal and Written Comments Received During Scoping Meetings with the Neighboring Landowners and the Public.

Kamehamenui Forest Reserve Management Plan

Compilation of All (Verbal and Written) Comments Received from Public Scoping Meetings

Comment [Black ink = email comment, Red ink = in-person mtg comment, Blue ink = submitted petitions and comments, Green ink = virtual mtg comments
I would like to voice my opinion in support of including horse trails on the Kamehamenui Parcel Master Plan. We only have one horse trail available on Maui State Land for recreational use. We are a large horse community and are under served. In addition, I am requesting horse trailer parking and easy access off Kekaulike Ave. in Kula to access the trail. The Von Tempsky land has always had horses on it and it only seems natural that you include horse trails so we have access to enjoy riding here in Kula. Makawao Forest is further away and this would be so convenient for many upcountry horse people. We are restricted with all the large parcels that are privately owned. Thank you for your consideration.
I would like to voice my opinion in support of including horse trails on the Kamehamenui Parcel. I would like horse trails to be included in the Master Plan. We only have one horse trail available on Maui State Land for recreational use. We are a large horse community and are under served. Also, I am requesting horse trailer parking and easy access off Kekaulike Ave. in Kula to access the trail. The Von Tempsky land has always had horses on it and It only seems natural that you include horse trails so we have access to enjoy riding here in Kula. Thank you for your consideration.
I would like to voice my opinion in support of including horse trails on the Kamehamenui Parcel. I would like horse trails to be included in the Master Plan. We only have one horse trail available on Maui State Land for recreational use. We are a large horse community and are under served. Also, I am requesting horse trailer parking and easy access off Kekaulike Ave. in Kula to access the trail. The Von Tempsky land has always had horses on it and It only seems natural that you include horse trails so we have access to enjoy riding here in Kula. Thank you for your consideration.
Sorry the following is a collection of notes rather than a well written proposal. Please see the attached map with possible bike trails in red. It would be great to have access from the hunter station from Poli Poli from the east, from Haleakala Highway from the west and the new access point from the north. That way there are several entry/exit points that could spread out users and provide variety. The bike trails would double as hiking trails although it would be great to have some downhill bike only sections. A more thorough study is needed. The bike trails would be highly dependent on the topography however it does look like there are some ravine crossings that the trails could utilize. I'd also love to see a public archery range near the entrance to practice bow shooting. There also may be rock and cliffs that would be great for rock climbing however since I've not been in the area I don't know of any exact spots. Cabins and tent camping would be great as well as viewpoints for sunset. I would also love to have a dog park or trails that are dog friendly. It would be great to continue the conservation efforts of reforesting with native plants to connect Poli Poli, Kamehamenui and around the rest of Haleakala to provide habitat for native birds to migrate along. Fencing to keep out ungulates from this area would be important.
I am writing in regards to the recent development by the Dept of Land and Natural Resources, Division of Forestry and Wildlife for the 3,400 acre Kamehamenui Parcel on Keakaulike Avenue in Kula, (The old von Tempsky "Erehwon Ranch") for the State Forest Reserve system. The Maui community looks forward to seeing the DLNR give the needed forest and habitat restoration to the native Maui forestry, as well as offer part of the land for public recreation. Knowing there are numerous public recreation activities being offered, I, along with many are requesting that horse trails be part of the public recreation plans. As a horse owner and advocate for education and support for all riders, I am one of the many hoping that this recently purchased State Land will permit horse trails, in addition to hikers, bikers, and hunters that are in consideration. Being part of the Maui community, I know it is a priority for DLNR to reestablish native forest habitat and protect it, so it is important to express that riders and horse owners in the community, are committed to respecting the habitat protection, and many of us will gladly offer assistance in developing appropriate trails and signs to ensure riders stay out of sensitive areas. Ideally with horse trails, only minimal milage of trails is needed, possibly just a 2- 5 mile loop in the forest, or several acres of flat open pasture land. If possible, it would be ideal to keep mountain bikers and horse trails separated, if there were enough space to offer separate activities. Space for trucks & trailers would also be needed, offered similar as the Kahakapao Trails, ideally at the main gate entrances off Keakulike Avenue. If an extra contact person to help represent the horse community for future collaboration with the DLNR is needed, I would gladly offer myself to be of assistance. I was born and raised in the islands and have called Maui my home since 2001, and have had horses my entire life. Having public trails here in the islands for the horse community has always been limited, and currently there is only one other public horse trail on Maui. Maui's horse community is a wonderful group of dedicated people, both to their equine partners, but also to the land and the community. The horse community is filled with hard working, dedicated, and genuine individuals. If access to this new state land included horse trails and space for trailer parking, I know all the individuals that would be able to enjoy time on these trails with their horses, would gladly step in to help maintain and improve the trails for generations to come. As a Board Member & Officer of The Maui Horse Show Association and the Hawaii State Dressage Society, I help promote a variety of Horse Shows, a range of equine educational events, the welfare of horses and

ponies, and scholarship programs for our young riders. I also have a background as a Therapeutic Riding Instructor for children and adults with special needs, as well as military veterans. I am an advocate for the horses and all they do for us, and I personally love being able to share this amazing world of horses with others, as horses give so much to our community.
Horses are a way of life for me and so many others, and the Maui equine community is an amazing group of individuals. We have such a diverse group of riders and disciplines (with both English and Western riding), but we all support one another. If part of this Kamehamenui Parcel land can become accessible for our riders and horses to enjoy, we would be supportive advocates for the respect and future well being of the land.
We hope you will consider allowing horse trails to be part of the future of this State Land. The horses of Maui and the riders that care for them will greatly thank you!
[*Joy added: school, Shahin added - conservation]*

My name is Joshua DeCambra from the island of Maui and have high interest in this newly acquired addition to the forest reserve system for hunting purposes. I have hunted the neighboring Kula Forest Reserve and around Hawaii all my life and have had great memories doing so. I also have a strong passion for hunting and firmly believe that this newly added Kamehamenui Forest Reserve is an attractive place for hunting to take place. One of the main reasons for hunting/hunting program to exist at Kamehamenui is because of the multiple access points that make access to this place easy. Access from Kula Forest Reserve, crater road and Kekaulike Avenue are all attractive options to access Kamehamenui. My second reason is because of the value that the Spanish goat, Polynesian boar, axis deer and game birds have to those that pursue them. These game mammals/birds have very high value for not only eating purposes, but for the experience and memories made while hunting. Recent laws have been passed by governor Ige expressing the value of game mammals/birds. My last reason is because hunters will actually use the game mammal/bird resources rather than it being wasted by fencing/aerial eradication. I have heard horror stories of hundreds of goats, pigs, and deer being shot down from a helicopter and being wasted. I completely understand the ideology of restoring native forests and wildlife, but also would love hunting to have more of a presence in areas across Hawaii rather than going straight to fencing/eradication of game mammals. I would also like to commend all to those who were involved in making the meetings happen and hope hunting will have a place in Kamehamenui forest reserve for generations to come.

Thank you for the opportunity to comment on the request for input for DLNR Division of Forestry and Wildlife (DOFAW) management of Kamehamenui Forest Reserve on Maui. Haleakalā National Park supports the DLNR DOFAW, and most management actions discussed during the virtual meeting on October 19.
Haleakalā National Park offers the following updates:
Haleakalā National Park supports the described predator control and management of ʻuaʻu described by DOFAW representative and implemented by Maui Nui Seabird Recovery Project. Proposed, ongoing, and completed fencing would serve to protect nesting seabirds and nēnē from feral ungulates and predators while also keeping the public away from these sensitive high elevation areas.
Controlling invasive pine (Pinus spp.), eucalyptus (Eucalyptus globulus), faya tree (Morella faya), and any other non-native species above 6500 feet is important to surounding ecological communities. Haleakalā National Park is supportive of and strongly encourages the control of these and other invasive plant species, and control throughout the management unit to reduce ongoing landscape invasion and ever-increasing fire hazard. Furthermore, the park recommends subsequent native plant restoration activities to stabilize the watershed and preserve rare and endangered species habitat.
Joy added: Conservation

Aloha my name is Joe hudson and I am an equestrian from kula. It would be wonderful to have a place to realize ride up country . Please allow for This to go through the process of becoming a treasure for many fellow equestrians.
Joy added: horse

TO: DEPT OF LAND AND NATURAL RESOURCES
FROM: DOUG AND KATHRYN SMITH
DATE: NOV 18, 2022

RE: Horse Trails on Kamehamenui Parcel

Regarding the trail development by the Dept of Land and Natural Resources of the 3000 acres in Kula recently acquired by the State and currently drafting a plan for the future recreational use of this land:
I would like to request horse trailer parking and easy access off Kekaulike Ave in Kula to access the trail.
We only have one horse trail available on Maui for recreational use and we are a large horse community and feel that we are underserved.
Again, we need horse trailer parking and entrance and exit off Kekaulike Avenue.
Thanks you very much for your consideration of this.

Aloha

Doug and Kathryn Smith

I am writing to request that horse trails be included on the Kamehamenui Parcel. There is currently only one horse trail for recreational use on Maui, and we need more. Ideally, I request that there be horse trailer parking and easy access from Kekaulike Ave in Kula to access the trail.

Kamehamenui Forest Reserve Management Plan

Compilation of All (Verbal and Written) Comments Received from Public Scoping Meetings

I am writing in support of including an equestrian trail in the proposed recreation plan for the Kamehamenui Parcel, formerly the Von Tempsky Ranch. I believe there is only one other equestrian trail on Maui and that is far away from where the majority of horses are found on our island, which is upcountry. I live upcountry and there are no places up here to ride my horse except in fenced arenas at private boarding facilities. The paniolo tradition is strong on Maui and I would hope that your work will honor our cultural traditions of horse-related activities here. An equestrian trail through the historic von Tempsky horse and cattle ranch would be an ideal location to ride through, enjoying the peaceful beauty of nature. I also hope that you do not allow concessions such as trail rides for visitors in your plan. At this time it would be good to preserve parts of our island for people who live here. Mahalo for your consideration of this testimony.
We write in support of having a horse trail and accessible trailer staging at the new project on the old Von Tempsky property. The robust horse community on Maui would be so grateful to have another designated area to safely and legally trail ride.
I am writing you asking that you please give horse trailer parking and easy access off Kekaulike Ave. in Kula to access the trail. We only have one horse trail available on Maui for recreational use. We are a large horse community and we are underserved. If we don't speak out, horse trails will be left out of the management plan. Horses are extremely important in mine and my teenage daughters lives . She's a strong , confident, kind young lady and it's her passion for horses that drives her and keeps us sane. Please help keep this energy alive and give us places to ride and share our joy and continue the Lio tradition in Maui. It is very important for all of us . Mostly the upcoming generations.
My name is Clifton Dodge, and I grew up on and next door to the old Vontempsky Ranch. I had the unique opportunity to explore the land, as my father was in business with Robbie Vontempsky, as well as I worked for the owners after. Both maintaining the old tudor house grounds, as well as doing hikes to the old Ohia forest at 5500 ft on Hanpapa Gulch to cut Maricaphia from around the old trees to try to help them out. (Labor of love) I have for 30 years been dreaming of doing restoration on horseback of these grounds, of restoring a native forest to this once rich and amazing area. I have watched as the waddle have taken over one of the few kipukas of Hapuu, amau and Palapalai ferns with U'ulei hanging off the side, and a strong Mamaki making for an amazing guild of Hawaiian plants hanging on a ledge over a gulch. I remember seeing one lone Lobelia clinging to the side of a rock face, and the wreckage of a WW2 plane high on the slopes. I am very excited about the prospect of this area becoming available for the public to enjoy. I hope that it's serenity and tranquility can be maintained, while allowing the public to enjoy it's majestic beauty. A well thought out access and rest station past the hunter check in, and accessing the proposed upper trails would be of little if any impact to the local community that lives in that area.. Not to mention the magic truly starts at 5000'. A trail allowing horse and hiker to access from the lower area (off upper Kula Hwy 37) would be ideal, but should be limited access (reservations) (not 100 parking stalls for every tourist coming down the mountain). This land will quickly become forest. It wants to be forest. All we need to do is work as a community to support that goal... I always wondered what the economics of Kula would look like if the old ranchers had planted Koa and Sandalwood, instead of waddle and Eucalyptus. They were doing what they thought was right at the time. Now we know better. I have attached my personal bio for your reference, as I personally hope to be involved in this process. *[Shahin added - conservation*]
I would like to stress the importance of adding equestrian trails to your planned park in Kula. We only have the Makawao state land forest and in the rainy months it is too slippery. Kula and Olinda offer different climates and it would be a nice addition to have equestrian access in Kula. The horses love the outings and it would make a difference to be able to access more nature and trails via horseback. Maui has become private property fences. In the old days you could ride for miles. Not any more. We are very limited. Thank you for considering making our horse community better! It would really make a difference.
Hello, I am emailing to suggest horse trails be included on the old Von Tempsky ranch being developed for trails in Kula. We only have one horse friendly state trail currently on island and need more with the growing equestrian population I also support the horse trails on Kamehamenui Parcel.

Kamehamenui Forest Reserve Management Plan

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As a local resident of Maui, I am intimately familiar with the new Kamehamenui Forest Reserve. More than twenty years ago, the Von Temptsky family gave me written permission to hike and hunt on the property. At the time, I lived in a homestead off Wahelani Street which directly abuts the Kamehamenui Forest Reserve, and hiked and subsistence-hunted all over the property for many years.

For nearly two decades, I have also volunteered with the Maui Na Ala Hele Advisory Council as the mountain bike representative. Because I also hike and bowhunt, I feel I represent a broad spectrum of the Maui community, and not just the interests of cyclists.

I was excited to hear of the State's acquisition of the former Erehwon Ranch (Nowhere spelled backwards.) Excited to both see it preserved, and to be opened for public access. The potential for recreation on the property is unmatched, and it is a welcome addition to the State's holdings. I can't wait for the land to be opened for public access!

As a longtime advocate for "Public access to Public lands," I can quickly suggest sorely needed improvements which would make the land more accessible, and provide for the protection of endangered species. First and foremost is hunter access. While the State of Hawaii claims to be only now developing a Master Plan, in reality, they have been planning since acquiring the property nearly three years ago. Many times, I have heard that the state is planning to fence and eradicate the goats, pigs, and deer on the property. Truth is, the fence is already under construction, as is the aerial eradication. Just this morning (11/17/22) I watched a helicopter eradicating on both the new Kamehamenui Forest Reserve and Haleakala Ranch's adjacent Pu'u Pahu Reserve. While I get that eradication is done to help preserve endangered species, I am very much against it as a land management policy. The fences mostly serve to fragment the landscape, as well as to concentrate the damage caused by ungulates. There is no reason why we can't determine the Sustainable Carrying Capacity of the land, and use local hunters to manage that population. The Maui community has voiced its feelings and opposition to aerial eradication many times, and still waits to be heard. In the face of rising food costs, we wish to have this renewable natural resource on our landscape. Furthermore, having hunted that area for over 2 decades, I can say with certainty that the goats migrate daily between the public hunting lands of Polipoli #5 and the Kamehamenui Forest Reserve. You can't eradicate the one without destroying the other. Eliminating the ungulates in Kamehamenui will also bring an end to public hunting in Polipoli.

Public access to the property means public trails, as well as the parking and facilities to support them. Parking should be provided both near the Polipoli Hunter Check Station, and at the lower end of the property, near Kekaulike Hwy at approximately 3800ft elevation. Na Ala Hele staff have already begun scouting potential trails. These trails should be multi-use….hiking, mountain biking, and equestrian trails should be provided. Some trails should be set aside for only cycling or equestrian use, so as to minimize user conflicts.

Because the property is vast, 3340 acres to exact, I'd like to suggest that camping be allowed, either at designated spots or dispersed. I'm sure a permit system could be readily implemented if needed. However, at this time, I'm against any commercial use of the property…no guided hikes or horseback rides, please!!! I'm also against allowing dirt bikes on the property. While I'm keenly aware of the need for additional places for the dirt bike community to ride, I'd prefer not here. That said, I am in favor of allowing disabled hunters to use ATVs to access the hunting area.

For many years I have advocated for an archery range on the island. To be an effective bowhunter requires frequent practice. Without a public range on the island, hunters have difficulty practicing and achieving the necessary skills to humanely hunt animals with a bow. This property is lage enough to safely accommodate an archery range. I suggest it be built in the lower section of the property for easy public access.

I could make many more suggestions, but there's a lot to what I've already said, and I leave it at that for now. Please feel free to contact me at any time.

Maui is one of the most beautiful places on earth and its natural beauty is what drove me to retire here 9 years ago. As an avid equestrian, I was also encouraged by the number of facilities which cater to residents and provide rental and lease horses for pleasure use. The disappointing factor was that there is only one designated horse trail on State/County land. But recently the County has obtained access to the property known as the Kamehamenui Parcel is Kula, and are in the process of developing a Master Plan for the property. As a centuries old horse and cattle ranch, it is a natural location for another horse trail, though it does need off street access for horse trailers. Several times a week, I am privledged to be able to ride. Primarily at the Haku Stables in Makewao under their Veterans program and at other locations as well. This period of time is most useful as a form of therapy and it would be wonderful to see the County be actively engaged in providing more horse trails to augment the available equestrian access.

I am writing to express my interest in the use of Kamehamenui Parcel.

I would like to add my voice to the Maui horse community and request that horse trails be considered for the use of this property.

There is one horse trail for recreational use on Maui and it is not enough to support the Maui horse community.

Please consider horse trailer parking and access off Kekaulike Ave. in Kula.

I have been on Maui my whole life. When I was a kid, there were unlocked pastures and miles and miles of open land to ride. I used to ride into Makawao for Komoda's doughnuts after school and hang out with Big Ed in his tack shop. I grew up with a whole bunch of kids, and it was a wholesome way to grow up. We also had rodeo and later, polo, but there is nothing like the feeling of riding freely over the open fields.

Today, I can no longer ride anywhere I used to. There are locked fences everywhere. The roads are deadly. I feel bad that I drive my horse and trailer so slowly, but not really because I am sad that I can't ride to these places like I used to.

Please help us to have a healthy, wholesome way for our keiki to grow up and for the rest of us to have some of the joy we used to when we were young.

Kamehamenui Forest Reserve Management Plan

Compilation of All (Verbal and Written) Comments Received from Public Scoping Meetings

I am writing to express my support in the creation of horse trails on the Kamehamenui Parcel, along with access and trailer parking off Kekaulike Ave. There is only one horse trail available on Maui for recreational use. Local ranches are no longer an option as they once had been many many years ago. This is a golden opportunity to expand equestrian's opportunities to get out on the trail. Please give this idea a fair chance.
I am writing to share my support of horse trails in the Kamehamenui acreage that will soon be open to the public in Kula.
I'm writing in support of horse use, specifically a horse trail, to be included in the recreational portion of the management use plan for the 3000-acre Kamehamenui Parcel in Kula, Maui. Additionally, I support including adequate horse trailer parking and turn around areas and easy, safe access off Kekaulike Avenue. Currently Maui has only one recreational use horse trail on State of Hawai'i land. Maui has a large equine community and we are currently underserved.
I fully support the addition of Kamehamenui into the State of Hawaii/DLNR-DOFAW Forest Reserve inventory. Additionally, I strongly SUPPORT HUNTING as a management tool in controlling the Game Mammals at the proposed Kamehamenui Forest Reserve! Despite Game Mammals being considered by some to be invasive and destructive, they are highly valued and prized by many. Game Mammals are very important subsistence, recreational, and cultural resources! I fully understand the importance and significance of native fauna and flora species, but I also believe that the Game Mammals at Kamehamenui should be managed rather than totally eradicated. With the application of careful management, a balance between Game Mammal populations and native flora can be achieved. In some cases, maintaining a population of Game Mammals can be highly beneficial. For example, it has become a recent concern that the absence of Game Mammals at the Mauna Kea Forest Reserve on Island of Hawaii has caused the overgrowth of grasses and other vegetation, which now poses a serious fire hazard which would threaten Mamane forest and Palila habitat. This could potentially become a similar situation and/or concern should Game Mammals be removed Kamehamenui. Although native forest restoration appears to be the primary goal at the Kamehamenui, I'm highly recommending that Game Mammal and Game Bird hunting be allowed, as there is adequate public access. From a hunting perspective, Kamehamenui is extremely attractive. Unlike Kamehamenui, several other Maui Forest Reserves/Public Hunting Areas (i.e. Hana Forest Reserve, Kipahulu Forest Reserve, portions of West Maui Forest Reserve, Kahikinui Forest Reserve-Nakula) are land locked and don't have public access. Due to the remoteness and inaccessibility of these other Forest Reserves/Public Hunting Areas, public interest and usage are very low and Game Mammal populations are high without the management that hunters would otherwise provide. High Game Mammal populations in these inaccessible Forest Reserves often require controversial aerial eradication as a Game Mammal population control measure. In complete contrast, Kamehamenui has great public access opportunities! Access could be achieved through Kekaulike Highway, the neighboring Kula Forest Reserve, and Haleakala Highway (near mile marker #7). Because of the great access potential at Kamehamenui, hunters would be able to effectively access the area and manage Game Mammal populations. I am very cognizant of the ideology that native forest restoration and game mammal management can be opposing concepts and cannot co-exist. If environmentally sensitive areas are fenced and Game Mammals need to be removed, please utilize hunting as a management tool in their removal. The lower elevation (approximately 7,000 feet elevation and lower) have been subjected to years of cattle ranching, in which the landscape is dominated by invasive pasture grasses and aggressive non-native trees (pine, black wattle, eucalyptus, etc.). I am proposing that sustainable Game Mammal populations be allowed to exist and managed in Kamehamenui's lower elevation for the purpose of public hunting. Due to Game Birds not having significant adverse impacts on native forests, I am also proposing that Game Bird hunting also be allowed at the proposed Kamehamenui Forest Reserve. To recapitulate, I fully understand that there can be conflict in allowing Game Mammal populations to exist for hunting in a designated and dedicated conservation area because of the potential for negative impacts, but I strongly believe management through hunting instead of eradication is the solution. If it is determined that managing the area's Game Mammal population for public hunting is ultimately deemed not feasible, please allow hunters to have the opportunity in harvesting the Game Mammals. Eradicating the Game Mammals would be wasting an invaluable resource. I am hoping that the State of Hawaii/DLNR-DOFAW will consider the aforementioned comments, proposals, and recommendations in the future creation and management of the Kamehamenui Forest Reserve. Thank you very much for the opportunity in providing input on the proposed Kamehamenui Forest Reserve.
I'm emailing you in regards to the Kamehamenui Parcel. It has come to my attention that there is a start of a trail development by the Dept of Land and Natural Resources of 3000 acres in Kula. That this piece of land was acquired by the State and currently a draft plan is being designed for the future recreational use of it. Word is saying that the particular parcel was the Von Tempsky ranch in Kula. That ranch has been a working cattle ranch since the 1800's! It has always had cattle and horses on it, so it is a natural for horse trails; not to mention one of only two on the entire island! Please, our equine community are in such dire need for more available places with truck and trailer access to be able to safely go out and travel and have trail rides with our equine family and friends. Trails are limited but to even get there safely due to lack of parking and safe room to unload and load our horses is slim to none. We are begging to be heard. Please include our Hawaii Paniolo in your new proposal. Hawaiians loose home land all the time and now our agricultural lands are also being taken away. Help to stop the list from growing. Let's start giving back!
We need to have more than one horse trail on state land and would appreciate you considering this when you develop those 3000 acres. I have lived on maui for the last 7 years and would. welcome that.

Kamehamenui Forest Reserve Management Plan

Compilation of All (Verbal and Written) Comments Received from Public Scoping Meetings

I am writing in regards to the recent development by the Dept of Land and Natural Resources for the Kamehamenui Parcel on Keakaulike Avenue in Kula. As a resident of Kula and a horse owner, I am one of many residents hoping that this recently purchased State Land will consider being open to allow horse trails and trailer parking. My understanding is that this land has been a working cattle ranch since the 1800's. Since it has had cattle and horses on it for many generations, it seems a natural for horse trails. Public horse trails on Maui are extremely limited for our vibrant horse community. I believe there is only one other public horse trail on state land on Maui. Maui's horse community is a wonderful group of dedicated and responsible residents. If access to this new state land included horse trails and space for trailer parking, I believe all the individuals that would be able to enjoy time on these trails with their horses, would gladly step in to help maintain the trails for generations to come. We very much hope you consider this opportunity to engage a wonderful community with this land.
As an avid member of the Maui horse community and resident of this island for over 43 years I want to voice my support and encouragement towards the establishment of a Public Horse trail system on the Kamehamenui Parcel. I have seen the changes on Maui that have closed previously accessible riding areas due to increased fencing of private lands, increased traffic and guardrails that prevent safe equestrian activities. The changes on losses ave greatly impacted our equine community. Maui is incredibly beautiful, the land and views unlike anywhere else in the world. The increasing population and unchecked tourism has impacted our horse community in a negative way, taking open areas and access away from part of the Maui culture and history that includes horses. The possibility of a Public horse trail system on the parcel under consideration would be an ideal area for our horse community. Kekaulike Ave., with enough area dedicated to trailer parking could provide easy and safe access to the number of Upcountry riders to access trails. Please consider the Equine community needs of this island! This is a perfect opportunity to preserve the life of Maui's equestrian community and culture.
Aloha, please see my attached letter to PLEASE include Horse trails in the master plan for recreational use of the Kula Kamehamenui recreation park. As part of the horse community, owning two horses, we are hugely underserved with currently only ONE Horse trail on state land
We desperately need horse trails here in Maui. I moved here in 2001 from Oahu because Maui was a place where we could have our horses and be able to trail ride with my children safely without having to cross highways or only be in an arena. When I first moved here there were trails over by the Pawela lighthouse, by Jaws and most of the pineapple fields and cane fields allowed access to riding. We respect the aina and often reported when we saw abandoned vehicles, suspicious activity and we stayed on the trails so as to not damage any of the foliage in the area. Now, the pineapple fields and cane fields are all fenced up, we have very few places to ride and enjoy the beautiful mountainside and ocean coast. Working full-time, this was the main stress reliever and source of enjoyment for me. Now it's a struggle to find a place to ride. Please consider the horse community here and allow access to riding on the Kamehamehanui Parcel. PLEASE create a place to park our truck and trailers so we can safely access that area. My children grew up riding the trails here on Maui and they learned so much from those experiences. It is important that we make these areas available for generations to come.[Shahin added -parking]
As a huge member of the maui horse community it has come to my attention that the kula 3000 trail was purchased by the state and we will lose access to a beloved trail we currently use. Our trails and equestrian options here on maui have significantly decresed over the years. Please consider keeping it available to us as a healthy source of exercise for both rider and equine of this island. It is tradition in our community to pass down to the next generation the stewarship of this island and care for our equine friends. We are praying this tradition is not snuffed out like so many traditions historically before. Thank you for reading my plea.
I recently heard about the plan for the Hawaii DLNR to create a trail on Maui on the Kamehamenui Parcel. As there is a long history of Paniolo and horses on Maui and currently only one trail on Maui where horses are allowed, I ask you to please include equestrian/horseback uses in the development of this trail. Of course, adequate turnaround and parking to accomodate trucks and trailers of all sizes will be needed as well. In this new age of uncertainty, the horses and their history in these islands is a common ground that brings many of us together. It is a unique history, not found anywhere else and the Von Tempsky ranch was a great part of it. This is an amazing opportunity to perpetuate not only horses, but the connection to Hawaiian culture as well. Please include me in any communications of future developments regarding this trail and the 3000 acres as well.
I am a horse owner living in Haiku. I would like to voice my desire to see a horse trail system, with ample horse trailer parking at Kekaulike Ave in Kula with trail access from there. There are very few options for trail riding with horses on Maui. This would be a wonderful addition for the Maui horse community.
My name is Alexa von Tempsky Dudoit. I am writing in SUPPORT of having access to these lands for the purpose of horse trails for the community. As it stands at this moment there is only one other trail on Maui that is accessible use for horse trails to the public. As a young girl growing up on my grandfather's Erewhon Ranch, I too was able to ride my horses on this beautiful mountain of Haleakala and there is no other feeling like it. I would like to believe that it would give our family pleasure to see others enjoy it as we did in the past. Please take all into consideration. I was not able to attend the public meeting so this will be my testimony.

Kamehamenui Forest Reserve Management Plan

Compilation of All (Verbal and Written) Comments Received from Public Scoping Meetings

I would like to submit my request to add horse trail access and parking to the Master Plan for the recently acquired property Kamehamenui & parking on Kekaulike Ave. I have been an active member of the Maui County horse community since 1973 in Molokai and since 1979 in Maui. I am a 43 year member of Kaupakalua Roping Club , and have been a rodeo competitor , a mounted parade Marshall , a rodeo and Makawao July 4th parade announcer. The KRC arena is dedicated to teaching the youth of Maui the joy of riding but to have somewhere to ride outside of an arena would be a great gift.
I've live on Maui since 1969. Never got into rodeo or showing my horses, I just love to ride. In the past, pastures were open and the roadways of Haiku were quiet and safe to ride. Nowadays, everything is locked.busy and not safe. We have one place for riders like me(and others) , which is Kahakapao, Makawao Forest reserve. A great place, once you figure out how to avoid all the cyclists and barking dogs. I appeal for your consideration to open the Kamehamenui parcel for the trail riding of horses with a safe lot for trailers as well. Thank you for your time. [Shahin added - parking]
I am writing in support of developing horseback riding trails on the Kamehamenui State Land Parcel in Kula, Maui. I have been riding horses on Maui since the early 1970's. We used to be able to ride all over upcountry and down to the beaches for a swim. Over the years access to the old trails through pastures and pineapple fields have been lost. The large upcountry horse community on Maui is underserved with only one horseback riding trail on state land. Please include plans for horseback riding trails, easy access off Kekauliki Ave., and ample horse trailer parking in the Master Plan for this Kamehamenui parcel. Preserve the upcountry paniolo tradition. Put horses back in Paniolo Country.
I am writing to support the horse trail proposal in Kula. I am a local resident and have been in the horse community on Oahu and Maui since 1960. I have watched the horse community grow while trails and facilities disappear. I have been a riding instructor for 50 years, currently teaching at Haku Baldwin Center and various private stables on Maui. Please put forth every possible effort to maintain our Paniolo heritage. We desperately need horse trails and riding areas, with safe trailer access and parking, for the large horse community on Maui today, and to preserve it for generations to come.
I am a member of the Kula horse community and wish to voice my support for horse access and trails on the Von Tempsky parcel. This is a singular opportunity to ensure recreational use of this land and to preserve open space for the future of all Maui residents and visitors. Access for horse trailer parking and easy access off Kekaulike Avenue is vital for the horse community as well. With population growth and development, the nature of Kula and its tradition of horse and ranch activities is diminished and compromised. Please respect the aina, encourage recreational use, and allow for open space now and in the future.
I am writing to urge you to consider adding horse trails on the Kamehamenui Parcel of land that is being considered for use by the general population of Maui. There is such a need for more places for trail riding on our island as we have such a large horse community in upcountry Maui. In addition, it would be wonderful if you would consider horse trailer parking and easy access off Kekaulike Ave. in Kula to access the trail for equestrians. We are an amazing bunch of Mauians who respect the aina, and adding the horse community into the plan would be beneficial for all. Thank you for your consideration of this request. Please, please, don't leave us out!
Please accept my testimony for our equestrian community to be represented in the Master Plan of the Kamehamejanui Property. Equestrians trailer their horses to trails of Maui. We have one Trail on Stateland that we can ride through. Since all the Bmx bikes are using the trails as well , it can be difficult to maintain a calm horse. We are in great need of these Super trails. We want to be counted in. Thank you for your work and most careful consideration.
I'm writing in support of including a horse trail in the master Kamehamenui Parcel plan. The Maui equestrian community is in need of another recreational trail since we only have one. Please include horse trailer parking that is easily assessable to Kekaulike Ave. The equestrian community has been eagerly waiting for new trails to be accessible to us. What a perfect opportunity to open up this trail for our horse community and what a great way for our young children to learn the history and be able to ride on such a historical piece of property.
My name is Ahni Francisco, I am so grateful to have been born and raised on the beautiful island of Maui. I was raised riding horses, and still am very involved in the horse community, and ride my four horses daily. I very much enjoy riding at Kahakapao trails, and to hear that there is another trail in motion thrills me. Kamehamenui sounds incredible, and you small Maui horse community would greatly appreciate your consideration. If I can be of any help, please reach out.
We are residents of Maui and would like to submit our input for the management plan for Kamehamenui. Overall, we strongly support this addition to the forest reserve. We support fencing of the area (8 foot deer fence with a 2 foot pig skirt) in sections and then removal of all ungulates (goats, sheep, deer, and pig) inside the fence. We have seen firsthand the damage caused by ungulates and believe fencing and removal are necessary parts of any attempt to restore native forest in the area. Once the fencing and ungulate removal is completed, then we recommend replanting of native plants inside the fence using DOFAW best practices. For recreation, we support the addition of trails used for hiking and biking. We would like the trails to connect to the Waiakoa Loop trail and Upper Waiohuli trails in the Kula forest reserve. We also would like trails to connect to the upper part of Skyline road near the Silversword enclosure.

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Our experience with Makawao forest reserve is that hikers and uphill bikers can safely coexist on trails. We have also learned that for safety reasons there should be separate downhill bike-only trails. For Waiakoa and Waiohuli trails, the access point is at the Kula forest reserve hunter checkin station on Waiopoli road. This area currently has a small number of informal roadside parking spots. We recommend that additional parking spots should be added at this location to accommodate people using both Kula forest reserve and Kamehamenui forest reserve. [Shahin added - conservation]
Re how to use the previous Von Tempski land now made public on the slopes of Haleakala: Have horse riding trails ! (not race tracks, arenas, etc)) A horse riding trail can be used by hikers too, we don't all want to gallop around. When I had a horse in Haiku, I had to ride on the side of Hana Hwy to reach some open land private owners would allow us to mosey around on. It was unsafe at times on the road, and slowed traffic as well (drivers didn't 't want to hurt us). I eventually had to sell my horse . We aren't all rodeo performers or competitive riders. And as the saying goes, "the outside of a horse is good for the inside of a man/woman/child". Being outside is good for physical and mental health and stress, and riding, hiking, jogging, etc can all co-exist together on Beautiful Maui. And having horse trailer turn-around and loading/unloading areas and parking space would help too. so please try to get some wider, flatter/smoother trails easier for horse riders and shareable with hikers (who can briefly step aside or go around if we meet up on the trails in the new public space on the mountainside.
I am writing to you to express my appreciation in advance for consideration of including horseback riding as a part of the old Von Tempsky Ranch that the DLNR purchased. It has been a cattle ranch historically so seems perfect to allow horseback riding to continue on the land. As you may or may not know there are fewer and fewer places on Maui for public horse enthusiast to enjoy these days. This property would be a perfect location for horseback riding. It could be well organized and set up to create minimal conflict with hikers or bike riders, hunters etc. A nice area for trailer parking off of Kekeaulike would help to keep it organized.
Aloha, I moved here full time two years ago and coming from southern Ca. and owning a horse with horse property and trails and acquiring a horse for trails here I had no idea how limited the riding is. I live in Makawao believing that such an old horse town surrounded with cattle and goats would have so many places to stage the truck and trailer but I was sadly very wrong. I have been made aware of this awesome purchase by DNLR and would be so happy to have designated horse trails here with a staging area and easy access off Kekaulike Ave in Kula. If things like this don't get designated we will lose our country way if life over time. Thank you for your attention and help in this matter, Mahalo [Shahin added - parking]
Since the 1800's this ranch land has been the home for cattle and horses alike. Our Paniolo Heritage is preserved in these Mauka lands and forests. The only other access to public land for horses is shared by hikers and Non- motorized bicycles and definitely not Drones. Access to Parking off of Kekaulike Ave is Paramount to all usage of this land. Furthermore, to be landscaped behind a tree line or natural privacy would help it not become a Haunama Bay in the future.
My name is Peter Swanzy and I am testifying in support of the inclusion of horse trails on the KAMEHAMENUI PARCEL on Maui. This parcel is historically significant as a working cattle ranch, and it is imperative that these activities are preserved in the future of this parcel.Currently there is only ONE multi-use horse trail provided on State land on Maui, which is shared with hikers, dog-walkers, and mountain bikers. The large and dedicated community of equestrian enthusiasts includes generations of individuals and families that represent all of Maui's historical cultures. This significant population is underserved by DLNR, and inclusion of horse access on the Kamehamenui Parcel will expand opportunities for families while serving as a major benefit to the equestrian community. Additionally, activities appropriate for this beautiful pastoral landscape should be highlighted in any plan that opens access to land in Paniolo country, especially non-commercial horseback riding.Access to these horse trails should be from Kekaulike Ave in Kula, where there is easy and safe access for truck and trailer parking.
I want to thank all of you who organized the meeting re Kamehamenui Forest Reserve at the Kula Community center on 10/12. It was helpful to be able to share about the specific topics that most concern each of us, and to talk with neighbors about how they feel and how changes may affect them. I live on Kekaulike Rd, about a half mile (towards Crater Rd) from the newly established Forest Reserve. While I'm very grateful that this land will be in conservation, I'm concerned about any increase in traffic on Kekaulike Rd. There are already a huge number of cars and trucks using this road, creating noise and dust. If the Reserve is marketed to visitors, that will greatly increase the number of cars, including those who are already coming up this way to visit Haleakala Park. If it is allowed to have overnight camping, that will increase the number of visitors (tourists) as well as create additional noise and potential disturbance for nearby neighbors. My hope is that there will be a very small parking lot, well off the road to protect close neighbors from seeing it, and some hiking trails. If there is a way to safely allow for deer hunting, that would be wonderful, since we all are aware of the huge axis deer overpopulation. These two things seem most in line with the principles of conservation of natural resources, as well as preserving the quality of life of those all around this beautiful land. Those of us lucky enough to live here, do so because it is one of the quietest, most beautiful parts of our beloved island. Please do what you can to keep the nature of this neighborhood and upcountry area preserved and peaceful.

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My family is excited and thankful for the opportunity to share our thoughts on the best management of these new lands for the benefit of all Hawaii residents. As public land, access must be held as a given and a priority - no matter what, the people of Hawaii must be allowed and provided the appropriate infrastructure (roads, trails, hunter check-in stations, etc.) to participate in o'hana, cultural, and local traditions. Such traditions include hunting as well as hiking, forest restoration, bird-watching, backpacking, camping, food-gathering, etc. These uses, and many more must be supported in any plan for these lands moving forward. Game management is a natural by-product of the tradition of hunting as it is enjoyed and passed down through families who harvest their own food from the land and the sea. Therefore access and the ability to pursue all cultural and family traditions are paramount to any plan put forth for these lands. Thank you for your time and consideration of our vision of what new and existing public lands should offer to the people the lands are held in trust for - the people of Hawaii. [*Shahin added conservation*]
My name is Richard Furst, and I am a resident of Wailupe in East Honolulu, on the Island of Oahu. I would like to voice my support for public hunting in the newly created Kamehamenui reserve area. I have hunted on Maui for several years. With the closure of Polipoli last year due to infrastructure damage, there is very little remaining public hunting area where harvesting axis deer is viable. Given that the axis population is such a widely accepted problem issue, I believe that prioritization should be given to public hunting as a land use in Kamehamenui. I appreciate your consideration of this input, and look forward to seeing how DOFAW will extend hunting access in this new area.
I am writing to voice my family's support of allowing public access to horse trails in the Kamehamenui Management Plan. We are so fortunate to be able to raise our family with horses and offer our daughters (ages 9 and 11) a healthy activity that connects them not only with nature and our island history, but that also promotes compassion and responsibility. However, a big concern is that we have almost no public trails on Maui, limiting our opportunities to enjoy such a beneficial activity. We are saddened by the prospect of having limited trail access reserved for the privileged few instead of opened up for our children to enjoy for a lifetime, with their friends and community. We sincerely hope that public horse trails and sufficient and safe parking/loading/unloading areas for horse trailers are included with this plan. We sincerely appreciate the consideration that the committee is putting into the plan, and thank you for your time to review our request.
I am adding my voice to those who are in favor of including equestrian trails in the plans you are drawing up for this property. I was lucky enough to be able to ride my horses around that ranch when the von Tempsky's owned it, and I know that it is rugged terrain, and that horses and cattle have been pasturing there for many decades. I know the family would be happy to see horses riding that particular range again. Of course that would require a parking lot large enough to accommodate horse trailers and their trucks, but that shouldn't be a big problem. Please consider this strongly. There are so many limitations on where anyone can ride anymore. It is sorely needed.
This is in response to the Master Plan to develop trails for recreational use on 3000 acres of State Land in Kula. I am writing in support of developing Horse Trails on the Kamehamenui Parcel. This parcel has had cattle and horses on it since it was a working Ranch in the 1800's, and therefore very suitable for Horse Trail Recreation. As it stands, Maui has only One Horse Trail on State land. This is hard to believe since Maui, and the whole of our State, has a History of Paniolu's embedded in our culture since the first cattle arrived in Hawaii in 1798. The first Horse arrived in 1803 and became common in the 1820's. As kids growing up in Waimanalo on Oahu in the 50's, we rode our Horses to Frankie's, the local hamburger stand for a Coke, and then headed up the Horse Trails on Olomana Mountain. Unfortunately, these trails are being slowly demolished and turned into Home Lots. Do we really want the same fate for Maui? Most Horse owners aren't rich people. We don't spent money on other luxuries like travel, and other high end expenditures. We love our Horses, spend time with them, and teach our children about the huge responsibilities of caring for one. We are a large underserved Community. We need more than One Trail to ride on. Also, Horses would have the lowest impact on the Land - much less than Bike Trails, Dirt Bikes Trails, and the like. Please give this mindful consideration. Please also consider Trailer Parking and Easy Access off of Kekaulike Ave.
As a Maui resident and family member of horse owners, I am asking for support for horse trailers, parking, easy access off Kekaulike Ave. and trails on the parcel to be included in the Master Plan for the Kamehamenui Management Plan. There is only one horse trail available on Maui for recreational use. Due to the numbers of horse owners, as a large community, more availability is much needed. Please provide horse trails in the plan!
As a 50 yr resident here on Maui, I have been ranching and riding all my life as well as my family members. Von Tempsky Ranch has always been a working cattle ranch. We all are asking that you keep the Ranch in preservation for the Equestrian community. As you know with Maui growth and this influx of new people buying up local land, all is being fenced off with no inventory or access for local people..We are asking for trail access on this historic ranch land!
Would you mind sending me the recording of this evening's virtual meeting. Are you able to share the slides that were used in the virtual presentation? As it was a public meeting, I understand the slides are approved for public distribution.
Thank you and your colleagues so much for taking the time to collect community input. I know it is not a requirement, and appreciate your patience and dedication in putting together a proposal that incorporates insights from all stakeholders.Please consider providing lateral access via Polipoli as opposed to vertical access by opening up new parking lots off of Kekaulike Ave. Those of us who live in the adjoining neighborhoods would be very grateful if the proposal could help preserve the peace and avoid more traffic at the already-dangerous Copp Rd. intersection.

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It has come to my attention that the previously proposed equestrian trails for the Kamehamenui Parcel are in jeopardy of not being included in the final master development plans. As an active trail rider on Maui, I believe this would be a huge missed opportunity to provide Maui equestrians a place to ride. Equestrian trails seem like a natural inclusion in the plans, as this land has historically had cattle and horses on it as a ranch. There is a large horse-owning population on Maui, but our trail riding options are very limited. Many of us were very excited to hear that equestrian trails were being considered as part of the development of the Kamehamenui Parcel. This would provide trail riders a much-needed recreational area to enjoy beyond the confines of an arena. I hope that you will strongly consider including equestrian trails in the final master plan of the Kamehamenui Parcel. In addition, easily maneuverable trailer access and trailer parking off Kekaulike Ave. in Kula would be helpful and very much appreciated. The Maui equestrian community would really love to have these trails!
As a horseback rider I would love to see horse trails in the Kamehamenui Parcel.. I have riden all my life here on Maui there are very few places with trails to ride.. Growing up on Maui in up country Maui we used to be able to ride anywhere we wanted no locks on gates and you always closed the gate..Gone are those days on Maui..Those were the wonderful days..Please consider the horse riders for trails.
As a horse owner on Maui I would advocate for horse trailer access off Kekaulike to the Kamemenui parcel. The large equestrian community on Maui deserves access to trails on the 3000 acres. Currently there is only one area on Maui available to trail riding. Horses are a part of the culture and charm of Upcountry Maui. I hope you will consider the needs of horses and their owners in determining your plan for this acreage. [*Shahin added Parking]*
I have owned a horse here on Maui for the last 18 years. As time has passed, there are less options for trail riding than there used to be- currently only one horse trail. I have many friends with horses and we'd really like the opportunity to have another on the Kamahamenui parcel. We need easy access off Kekaulike Avenue with a safe spot to park our trailers.
I'd like to support horse trails on the Kamehamenui Parcel. There is only one horse trail for recreational use available on Maui at this time, and Maui has a large horse community. We also need horse trailer parking and easy access off Kekaulike Avenue. Please include these requests in the Master Plan being designed for the future recreational use of this land.
This is to support the new horse trail on upper kula hwy We have a huge horse rider population on Maui and only one state trail. We are under served. That land is von tempsky ranch land and has had horses up there for generations. It is perfect for horse riders to be able to enjoy ourselves out in the country. Please include horseriders in your master plan. Please also recognize that we need a safe parking and staging area right off the hwy. Trailers with horses inside are carrying live previous cargo which is difficult to manoever. Please support this large community of horse people and their horses. *[Shahin added access*]
I, (Tracy Edlehertz), would like to submit my support for the inclusion of horse trails for the plans being created on the Kamehamenui Parcel. There is a large horse community here on Maui dating back to 1803. Na Lio have a rich cultural weaving into the history of Hawaii but the community is fast losing its access to places to ride with only one recreational trail currently. Please include this community into your plans for recreational use of that land with access to horse trailer parking and easy access off Kekaulike Ave in Kula to access the trail. Currently we have 1 trail on the island so help us to preserve this culture and community on Maui.
I have been a resident on Maui for 34 years. I horseback ride 2 to 3 times/weekly. I own 7 horses, 4 of which are older & retired, but I do have 3 riding horses & love for my friends to join me. We need & would be so very grateful to the state of Hawaii to designate Maui equestrian trails. We only have one riding trail on Maui at this time, Makawao Forest. Please provide us with horse riding trails on the Kamehamenui Parcel. When trailering our horses we do need a safe place to park our trailers & navigate; as they are larger vehicles with live cargo. Please allow us easy & safe entrance & exit to Kekauliki Ave.
We are strongly in SUPPORT of horse trails on the Kamehamenui Parcel. This is so much needed for our community and would be a huge benefit to the well being of our Horse Community. Please include a trailer parking and staging area, as well as easy and safe access off of Kekaualike Road. We have a large horse community here on Maui and this would be such an asset as we have very limited options to ride in a natural and open space environment. I think there is only one recreational riding trails on Maui in the Makawao forest Kahakapao. Thank you again for including this in the Master Plan! This would be such a great asset for Maui.
I would like to submit this testimony in support of including horse trails in the Master Plan for the Kamehamehanui Parcel in Kula. I am an equestrian living on Maui 20 years. In all that time I have never found a safe and dedicated horse trail for us to ride. The multi-use trail that was developed up at Kahakapao, is really not safe for horses because bicyclists and horses are basically incompatible. Yes we can all make it work but accidents happen, with potential serious injury to horses and riders. I finally quit riding up there, due to close encounters with bicyclists. Instead, we have relied on friends with private land, which may not be safely developed for riding. Cows, pigs, deer, steep terrain, holes, rocks, rivers, debris, cliffs, etc. No trail. OR - we went on roads or into fields dodging vehicles or motorcycles coming at us around corners with no warning. The benefit of a good trail for riding goes beyond the recreation of it. Exposing your horse to a different

environment is good conditioning for safer riding. Please develop horse trails on the parcel with adequate trailer parking and good access off of Kekaulike Ave. Thank you for recognizing the value of providing an equestrian recreational opportunity for the community.
I am writing in support of horse trails and trailer access to the 3000 acre von Tempsky ranch in Kula. Our horse community is underserved on Maui. As more and more homes spread across the island, we need to secure space for agriculture and animal husbandry. We also need to have access to the land for trail riding. We are very limited on Maui and this is the perfect opportunity to embrace the horse community and allow us to ride on this land. Pls help preserve the paniolo lifestyle on our island of Maui.
Regarding the Kamehamenui Management Plan. Please add my votes to your lists. NO bicycles, NO eBikes, NO Camping, NO Hunting, NO Hiking, NO Fires, NO SHEEP Hunting, NO Dogs, NO Motorcycles, NO access from Kekaulike Highway, NO Parking lot off of Kekaulike Highway, NO toilets, NO trash cans, NO tourists Please keep it in ACTIVE AGRICULTURE, Ranching is food for Maui. Please plant Native trees, plants. Please remove invasive Plants and Animals. [Shahin added - no archery, yes to conservation and do nothing]
Please make sure the equestrian community has horseback riding trails at the newly acquired land in Kula. They need easy access off Kekauliki Ave with adequate parking. All 3 of my daughters ride and there are very limited trails for equestrian use.
The equestrian community desperately needs riding trails. We only have 2 trails to ride Makawao forest and Haleakala National Park. We need easy access off Kekauliki Ave for driving in and out. We request easy access off Keakauliki Ave as it cost a lot of fuel the further and steeper we have to drive. (This is why driving to summit of Haleakala for a day ride is not practical). Large enough parking for up to 10 truck and trailer of 40 foot length minimum. Easy turn around. Many people only have 2 wheel drive so gravel with any grade to it is impossible to trailer on. Minimal turns in the road as horses do not stand up well in a trailer on big curves. For trail safety: Bicycles and horses do not mix well due to fast speed of bicycles and surprising horses on trails. The equestrian community has very limited trail riding areas and we are looking forward to being able to trail ride on the new land. We do need a large enough parking space for several trucks and trailers with easy turn around, preferable to have a loop. Horses/mules, like hikers have a safety risk with fast moving bicyclists and ebikes when sharing the same trails especially on corners.
I am submitting a testimony, that the some of the 3000 acres, of Kula land the state acquired in support of having it become another public horse trail riding, etc, place to be. With a place to park and leave trailers, tie up horses/saddle/unsaddled horses. As the equestrian community of Maui is very much wanting more public access for recreational trail riding, as only currently have the one on Piiholo. Would be a good place for us to gather together and bring the equestrian riding community closer together to explore and enjoy trail riding. As it is riding is very limited, unless you have riding access to ride on Private owned lands, otherwise really nowhere to go out and really trail ride, here on Island. [*Shahin added parking*]
I am writing to show support for horse trails and access be considered in the plan for the Kamehamenui development. We are a large community of horse owners/riders who have very limited trails for riding. Please consider including a place for us to trailer our horses to and enjoy riding on this beautiful island. They are getting fewer and fewer every year.
I am a member of the horse community on Maui since 20 years and a board member of the Maui Horse Show Association. I would like to speak out in favor of having trail rides included in the planing of the Kamehamenui Parcel. We do not have enough public trail rides on Maui to serve the large horse community. All we would need is enough space for parking and trailer turn around through Kekaulike Ave. This trail would be well used by young and old horse people in our community. Please keep us informed of upcoming meeting we can attend to make this amazing opportunity come true. [Shahin added - access via Kekaulike]
I am testifying in support of the inclusion of horse trails on the Kamehamenui Parcel. As you are aware, this parcel historically has been a working cattle and horse ranch since the 1800's. There has always been horse trails on the land and there is no reason why there shouldn't be horse trails in this plan. Access to the trails for horses should be from the bottom on Kekaulike Ave. where horse truck and trailer parking can be provided for an easier ingress and egress. We currently only have one multi-use on State land, horse trail available on Maui. We share it successfully with hikers and bikers. The horse community on Maui is large, particularly in the Upcountry area. We are underserved by DLNR for public horse trails. Inclusion of horse access on the Kamehamenui Parcel will expand our trail opportunities.

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My name is Glen Eastman and I am an avid bowhunter. Maui has a large bowhunting community however access and available public lands to enjoy bowhunting is extremely limited. There are no public hunting areas with deer and the majority of the areas are poor for any opportunities. That is why I am so excited about the 3,433 acres of Kamehamenui land in excellent deer and ungulate habitat. I think making most of this area a bowhunting zone, would greatly benefit the community and people of Maui. It would help with ungulate control and help restore native vegetation, it;s a way for families and friends to get outdoors and provide lean healthy meat. Kids can get outside and enjoy the outdoors. Bowhunting is less invasive than rifle or dog hunting so other parts of Kamehamenui could still be enjoyed by others. I would like to see the lower more wooded areas be made for walking and hiking trails and the upper elevations for bowhunting. They could also have an archery 3d range too at the lowest elevations. Maui has the back to back Vegas womens world champion archer in Liko Arreola and we don;t even have an archery range it's sad. The bowhunting area could be managed with separate entrances at different elevations to limit the pressure and number of hunters daily and those spots could be distributed by some kind of lottery for a gate code on different dates. That would make the hunt a lot more enjoyable and sustainable instead of a free for all. I see the mtn bike community thinks this should be turned into a mountain bike course but the state has already invested a lot of money into bike trails all over the Makawao Forest Reserve, this should go to the hunting community instead. U.S. Fish and Wildlife Service received a record $1.5 billion this year, all from sportsman through the Pittsman Robertson taxes on hunters and anglers with Hawaii is set to receive more than $10.7 million in federal funding to support sustainable fishing and hunting and wildlife conservation in the isles. https://www.staradvertiser.com/2022/02/14/breaking-news/hawaii-getting-over-10m-in-federal-money-for-wildlife-management-conservation/ Pretty clear who should get to enjoy this new zone and that should be hunters. I don't see mountain bikers contributing 10 million dollars this year to the Hawaii DLNR like hunters did. TIme to take care of them and make this a bowhunting area please! PLease reach out if you have any more questions or need any more testimony
Tom Calhoun here, I am the Maui member on the Hawaii Forest Industry Association board of directors and I have a few inquiries concerning the former Von Tempsky property. I was hoping to listen in to last nights meeting, however, car problems took precedent and steered my day in a different direction. I am wondering if there is a recording of the meeting that can be found on the web somewhere?Irene Sprecher, who was with DLNR until recently, and is also on the HFIA board, and I had a short discussion about what she knew in regard to Kamehamenui. She indicated that the state was most interested in reforesting the subalpine areas first, which makes some sense to me as an "avid" conservationist. Fern Duvall was an old friend as is Art Medieros. As you know, the lower edge of that property abuts Kekaulike Avenue and the pavement directly across is wide enough at a long enough length to park three or four tour buses. I used to live just down the hill a bit. I've always thought that the lower acreage would be a very good public participation area for reforestation. School kids, conservation groups, ecotourist groups, na Halau Hula, even politicians would love the easy access and photo-ops. I'm sure you're aware of HFIA's work on Hawai'i Island with Kamehameha Schools and DHHL. Our executive director, Heather Simmons can be available for a discussion most weekdays, as am I. A short talk may help us find focus for submitting written comments if any are still being sought, or help us find a way to a worthy project. [*Shahin added parking*]
Here are a few notes from the first in person meeting in Kula: • Provide designated camping spots that can be reserved
Here are a few notes from the first in person meeting in Kula: • Create trails, but only trails; do not build parking lots—landowners do not support parking lots
Here are a few notes from the first in person meeting in Kula: • Recreational users are disrespectful; produce too much litter and waste (including human waste) and damage the resources; do not allow any recreation [*Shahin added no archery, no camping, no hiking, no biking, no horses, no hunting, no trails]*
Here are a few notes from the first in person meeting in Kula: • DOFAW and DOCARE do not have enough staff to manage the area or enforce illegal activity
Here are a few notes from the first in person meeting in Kula: • Include more facilities: rest stations, viewing kiosks, toilets, trash cans, picnic areas (with pavilions, picnic tables, and BBQ pits), etc. [*Shahin added - yes trails, yes access, yes camping*]
Here are a few notes from the first in person meeting in Kula: • Do not allow any commercial activities of any kind
Here are a few notes from the first in person meeting in Kula: • More attention should be placed on cultural significance (There was no cultural table station. Need a representative to address this.)
Here are a few notes from the first in person meeting in Kula: • Plan for long term success and have long term planning. Include forethought and information for the area up to 50 years into the future
Here are a few notes from the first in person meeting in Kula: • Launch a reservation system for all activities; need to limit the number of people
Here are a few notes from the first in person meeting in Kula: • Need more equestrian opportunities—horseback riding has been used on the ranch previously for generations
Here are a few notes from the first in person meeting in Kula: • Create a parking lot, trailhead, and informational area off #5 Road in Kula Forest Reserve

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Here are a few notes from the first in person meeting in Kula: • Need more access points to Kamehamenui • Allow access to Kamehamenui from both Haleakala Ranch and Haleakala National Park
Here are a few notes from the first in person meeting in Kula: • Make trails specific to certain user groups—do not have trails that include multiuse activities (Keep hiking, biking, and equestrian trails separate.) [*Shahin added horses*]
Here are a few notes from the first in person meeting in Kula: • Need more trails (all types: equestrian, biking, and hiking)
Here are a few notes from the first in person meeting in Kula: • Allow sustained, long-term hunting opportunities while using the trail system for access
Here are a few notes from the first in person meeting in Kula: • Public safety concerns in remote areas—response time for an emergency
Here are a few notes from the first in person meeting in Kula: • Use professional trail building company and contract the trail building
I participated in last nights meeting and would like know if the images you showed with the proposed improvements are available. Also, are the recordings available of the discussions in the different breakout sessions? Would like to hear what they had to say about parking, access and reforestation.
I am very interested in the Kamehamenui project and tried to listen to the presentation Wednesday at 5:30 but it was totally unclear what we were supposed to do.PLEASE explain very clearly on the website that gives the entry link how to get in, I attend lots of state and county meetings and none of them are as difficult as yours.Is there a recording of the meeting I can view? Please send me a link.Is there documentation on the Kamehamenui project, with GIS maps and other resources so we know exactly what it is? Please send a link.Is there a project page so we can track this and learn about future meetings and how to get involved? Please send a link.I did click on the link and landed in a waiting room with no idea what to ask for. I thought there was one informational meeting where we can learn about the entire project, and expected to land there. I don't know enough to say which group I should go into. I got a bit frustrated and left.Is there a video of the Kula meeting that perhaps explains the whole project, or something I can read?
Below our a few additional comments that was said around the hunting section table. -There is a old road in the area that goes to the upper pasture, could that road be used for handicap hunters with utv?
Below our a few additional comments that was said around the hunting section table. -I don't want high power rifles or hunting in the lower portion of the property, I live across the street and I'm concern for my grandchildren's safety.
Below our a few additional comments that was said around the hunting section table. -Can the State make sure that the hunters have all the opportunities to hunt mammals. If they plan to remove all mammals, make sure we do the control work instead of the State. -Don't want helicopters shooting to remove mammals.
Below our a few additional comments that was said around the hunting section table. -Can we use the upper portion of the area now for bird season since Polipoli is closed? *[Shahin added hunting*]
Below our a few additional comments that was said around the hunting section table. -Hope you control the wattle in the area and it doesn't turn out of control like Polipoli.
Below our a few additional comments that was said around the hunting section table. Are we going to be able to remove the sheep in the area? They are also in Polipoli area.
I got Yuki Lei's email about a meeting for people to provide input on DLNR's DOFAW acquisition of property in Kula. Unfortunately I wasn't able to attend last night. Could you please send me a link or a website where I can learn more? Or maybe even a paper resource!
Thank you for the opportunity to provide comments on the management of this newly public land in Kula. The public investment of about $10 million should bring as many public benefits as possible, befitting of this large public investment. I have heard some voice the opinion it should be maintained as the Von Tempsky's would have wanted. That is absurd. If they, or subsequent owners wanted a legacy, they would not have traded the land for millions of dollars. They cant have it both ways. 1). The conservation lands must be maintained for restoration of listed species. Excellent, yes, no problem. 2) the middle and lower sections offer a great opportunity for nene restoration. Luring nesting nene from their habitual nesting areas at high elevation in Haleakala NP could greatly increase recruitment. At the altitudes of Nests winter time in Haleakala, nesting success and recruitment are very low due to unpredictable and harsh winter storms. Temperatures are much more favorable for gosling survival at lower elevations. Furthermore, construction of predator proof fence to protect goslings would be relatively easy on Kamehamenui. 2) Hiking, Mountain Biking and equestrian trails. Yes to all of the above for public recreation. 3). Camping area. Yes, why not? A good benefit for all of us. Including visitors. Remember, much of the funding came From sources outside of Maui. 4). Archery range for practice and competition. This can be safely established in a small area of a couple Acres, and would allow for tremendous public use by aspiring archers on Maui, and there are many. It can be done very safely, as is done in many suburban parks on the mainland and even Oahu. 5) Environmental Education. A great opportunity to build a Small indoor classroom and Large outdoor "classroom" to help connect children with nature. 6) ASAP remove the private grazing lease use. This benefits 1 individual at the expense of 100,000+ public owners and their stolen recreational opportunities.

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7). Hunting. Upland bird hunting would be nice, but this would be incompatible with nene nesting areas due to overlap in the winter season and the use of dogs. However, hunting of axis deer should be allowed as long as the property is not fenced and eradicated. If people object to rifle use, perhaps shotgun and air rifle are viewed as safer, or certainly archery hunting is very safe and quiet. Thank you for making this property all it can be for the public investors. Feel free to contact me for questions or additional Information. *Joy added: horse, school*
I wanted to reach out to you on behalf of ReTree Hawaii, a nonprofit dedicated to reforesting our state to combat climate change and restore our watersheds. We help organize community plantings at a variety of locations, including conservation areas, and have a fund of information on our website (www.retree-hawaii.org) for interested parties. Whatever the disposition of the new parcel at Kamehamenui, it is likely that at least some of it will be replanted with native species, and we would be most interested in collaborating with the managers to help accomplish this. For most areas, fencing and ungulate removal are necessary before sustainable restoration can occur, and I anticipate that this would also be the case for Kamehamenui. Our involvement would therefore be a future step once these actions have been completed. Please share our contact information with the site managers as they are established, and we look forward to working with you in the future.
Please use this land to further outdoor conservation, research, and public interaction with our land. We need hunting access, hiking access, camping access. Possibly archery only like unit E that would help with more public usability for local campgrounds and hiking trails.
I have a few things that I would like to see for this location. We have lost access to a lot of places that were formerly open and I think the biggest thing I would like to see is the ability to camp. Not just in a singular designated location but the ability to find peace and solitude on your own. I would like to see hunting access in perpetuity. Particularly down low where we can make an impact on deer. I would also suggest that a few places be built with a concrete slab that can be easily cleaned. Im sure you dont want people having fires and dont label it as a fire pit but make it safe because people are going to do it anyway. If you build a road make it 4x4 access only like polipoli and maybe connect them.
Please open up the Kamehamenui Forest Reserve as an archery only game management unit. The public hunting community is in dire of more public archery areas. This is my testimony to thank you
My husband and I have lived on our property which borders what is now, Kamehamenui Forest Reserve, for over 30 years. We were at the meeting on July 10th, 2022 with DLNR representatives, a meeting specifically for homeowners who border or live in the immediate area of lower Kamehamenui F.R. to discuss the issues listed on that notice. I see that the list is the same for tomorrow's meeting. QUESTIONS: Was the meeting scheduled for tomorrow meant to be a second hearing for these neighboring residents to express their concerns or is this meeting intended for the general public? If for the general public, has DLNR posted in the paper? For the General Public, I only see DLNR's notice buried on their website. Will DLNR will be heading up this meeting and or will your company be heading up this meeting which by the way, was scheduled with very short notice. Please respond to these questions asap!!!
I was at the first owners meeting and am thoroughly disappointed and disgusted at this upcoming series of meetings. I'm currently visiting friends on mainland and obviously can't attend the Oct 12 meeting. What amounts to a 4 day advance notice is ridiculous !!!!! A VIRTUAL meeting is absolute bullshit !!!!! An effective way to cut down on participants, stifle feedback and minimize any collective dissent. Congratulations on being good minions to State motives and desires. PS. With Covid restrictions minimized / lifted, what is the justification for a virtual meeting ?? Why the sudden rush to have meetings on short notice, and back to back !??
Voted for archery range
Voted for archery range
Voted for archery range
Voted for archery range
Voted for archery range
Voted for archery range
Voted for archery range
Voted for archery range
Voted for ATV access for disabled hunters
Voted for ATV access for disabled hunters
Voted for ATV access for disabled hunters
Voted for ATV access for disabled hunters

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Voted for ATV access for disabled hunters
Voted for ATV access for disabled hunters
Voted on mammal hunting
Voted on mammal hunting
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Voted Bird hunting
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Voted for Spring turked (bird) hunting
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Voted for Spring turked (bird) hunting
Voted for Spring turked (bird) hunting
Voted to allow E-bike for hunting
Voted to allow E-bike for hunting
Voted to allow E-bike for hunting
Enhance habitat, remove wattle - conservation
Can we hunt sheep?
Voted for education center - volunteer opportunities for public community (school)
Voted for education center - volunteer opportunities for public community (school)
Voted for education center - volunteer opportunities for public community (school)
Voted for education center - volunteer opportunities for public community (school)
Voted for education center - volunteer opportunities for public community (school)
Voted for education center - volunteer opportunities for public community (school)
Concentrate usage to allow for wid unaccessible zones to allow restoration of natural ecosystems (conservation)
Consider low impact usage, minimal development - there's town and there's country.
Do not make access from Kekaulike - either Poli Poli or Crater Road
Do not make access from Kekaulike - either Poli Poli or Crater Road
Do not make access from Kakaulike - expolore other entrances
Yes to access from Kekaulike and have parking here
Yes to access from Kekaulike and have parking here
Yes to access from Kekaulike and have parking here
Possible trail from Ulalani without parking
Make upper access and parking from Haleakala so there is an alternative trail access when Poli Poli shuts down - balance parking from different areas
Hiker concern to get quiet places up country
Hiker concern to get quiet places up country
Hiker concern to get quiet places up country
Parking - suggest minimal and not too many places
Recommend no bikes - bikes cause erosion
Yes to horses (equestrian)

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Move parking from front of all houses, protect people who live across the street from proposed parkiing, visual issues, plus security issues from parking
Potentially go up Poli Poli - up country instead of by road or horses (*Shahin added access)*
Cross out two green parking lot areas - no-go - go from Ulupal? Or elsewhere [Shahin added access]
Keep parking areas small - not too many spaces - also don't advertise to tourists - more residents
Keep parking areas small - not too many spaces - also don't advertise to tourists - more residents
Look at access to motorcycles
Yes to archery
Yes to archery
Yes to archery
Kula Nani Estates - 36 residents/houses - could there be possible access to trail system wihtout going to major road? Gate or available access?
No parking
Put parking at Poli Poli instead
Put parking at Poli Poli instead
Hunter check in station - add parking to existing lot
People on Maui need places to be outside including the reserve - there should be ample parking
People on Maui need places to be outside including the reserve - there should be ample parking
People on Maui need places to be outside including the reserve - there should be ample parking
No archery
There should no access for 2 gr(? Green?) parking lots
Concern (visual) to have to look at parking lot and archery range
Huge concern about commercialization - live across street - why cant it just remain ranch? (do nothing) [*Shahn added - no archery, no camping, no hiking, no biking, no horses, no hunting, no trails, no access, no parking, no conservation, no education/ school]*
Need to police - can't become another Poli Poli - dirt bike on Poli Poli only
Concern of fire around parking area - no access to water
No zone 3 commercialization. Only access in Poli Poli
Add automatic locked gates + at Poli Poli areas with times access
Voted on more trails for hiking
Voted on more trails for hiking
Voted on more trails for hiking
Voted on more trails for hiking
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Voted on more trails for hiking
Voted on more trails for hiking
Connect trails/ access from Poli Poli and Haleakala. At least two points of access if Poli Poli Shuts down.
Have parking and improved access to trails
More biking trails
More biking trails

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More biking trails
More biking trails
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More biking trails
Voted yes to electric bike use
Voted yes to electric bike use
Need camping
Voted yes to equestrian (horse) use
Voted yes to equestrian (horse) use
Voted yes to equestrian (horse) use
Voted yes to equestrian (horse) use
Voted yes to equestrian (horse) use
Voted yes to equestrian (horse) use
Voted yes to equestrian (horse) use
Voted yes to equestrian (horse) use
Voted yes to equestrian (horse) use
Voted yes to equestrian (horse) use
Make access to all trails away from homes/residential areas
Make access to all trails away from homes/residential areas
Make access to all trails away from homes/residential areas
Make access to all trails away from homes/residential areas
Make access to all trails away from homes/residential areas
Make access to all trails away from homes/residential areas
Water access available for individual campsites (not possible due to water availability now)
Platform campng through to Poli Poli
Platform campng through to Poli Poli
Platform campng through to Poli Poli
Platform campng through to Poli Poli
Camping vote
Camping vote
Camping vote
Yes for archery practice range
Yes for archery practice range
Yes for archery practice range
Preservation (conservation)
Non-motorized vehicles, walking, biking, promenage trails [*Shahin added hiking*]
Have amphitheater for engagement, storytelling, music, theater (elevation sensitive) [shahin - put under other]

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Every individual who has contributed their signature to this petiition lives or owns in a neighborhood surrouding Kamehamenui Forest Reserve and is in agreement with and confirms the following requests: 1) Overarching goal: retain PEACE and QUIET. Protect or enhance pristine views enjoyed by abutting home owners - do not turn a visual connection to the summit into a view of the parking lot. 2) Do NOT locate Reserve ENTRANCE across the street from a home owner. [Shahin added - access]. 3) Locate the parking lot far above Kekaulike Avenue. Hide it visualu and protect home owners from noise pollution and traffic. No see 'um and keep 'um out of earshot. 4) Refrain from tree planting plans along KekaulikeAvenue that would block crater views presently enjoyed by abutting home owners. Deliberatey move on to other viable options. 5) No commercial activities. **Why this is important?** Kekaulike Avenue is central to our community in order to go most anywhere, we drive along the Avenue. We walk along the Kekauike Avenue side of the Forest Reserve for exercise. The crater is a part of our life experience and a great reason why many of us habe chosed to make our homes here. Thank you for recognizng its precousness and place in our exosytem and thank you for taking great care to include us, who live our daily lives here, as an essential part of the management plan, integral to a balanced equation.
…"… same petition as above - no parking lot, put access far above, keep peace and quiet, don't plant trees along Avenue and block crater views, no commercial activities

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…"… same petition as above - no parking lot, put access far above, keep peace and quiet, don't plant trees along Avenue and block crater views, no commercial activities.
…"… same petition as above - no parking lot, put access far above, keep peace and quiet, don't plant trees along Avenue and block crater views, no commercial activities.
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…"… same petition as above - no parking lot, put access far above, keep peace and quiet, don't plant trees along Avenue and block crater views, no commercial activities.
The State should open by being forthcoming about all the impacts it anticipates and has planned for … including - water (will there be a signidicant use of water in chronicaly drought-stricken Upcountry? - adequate and maintained sanitation facilities for hikers - traffic management and mitigation so as not to interfere with local traffic and adjacent neighbors - adequate signage - prohibition of food trucks and other businesses setting up in the parking lot - special noise ordinance for benefit of area neighbors - is phone service available there for emergencies? - illegal use of motorized vehicles on trails (many off-roaders are always looking for a place to tear up trails) - and monitoring of all of this by park rangers. At least now that the land is in the state's hands, the property won't be developed or overdeveloped by private landowners, which might actually be beneficial to the neighbors - so long as they effectively express their concerns to prevent the disruption of their upcontry lifestyle.
Thank you for all your work! Looking for more bird hunting opportunities and places to work gun, dogs, and build community. Access for leeward Haleakala is a big deal for me as a Keokea resident. I would be interested in volunteer and organizing hunter work groups to help with conservation and stewardship, trail work, etc. Feel free to reach out.
No bikes or e-bikes please.
Once the fence is built and animals are removed there should be no hunting.
Create a wide variety of trails - from standpoint of different difficulty levels. At Makawao Forest most of the trails are now so manicured that they are less enjoyable for advanced riders than they were in their original state. Some people call the MF trails sidewalks becuase good riders could do them on road bikes. Some examples of challenging trails include: 1) easier to make because you dont change the natural features of the land. 2) cheaper. 3) less erosion. 4) separates advances riders from beginning riders and hikers, which improves safety and frustration. Take ski areas as an example, all the good areas have a lot of variety in their trails, that is green, blue, black runs. The last point ... if technically challenging trails are not available, advanced riders will try to build them. Makawao Forest couldn't be a better example of this scenario.
No or limited/low areas for bikes or e-bikes. No ATVs
Encourage restoration efforts from pasture; zero ungulates [Shahin added - no hunting, conservation]
More pack in pack out camping opportunities.
More bike trails
Mountain bike trails - plan for trails for the next 30 years.
My concerns are access for mountain biking. Please keep me in the loop.
I would like to see mountain biking trails developed on this parcel for community recreation. I have seen the success of Kahakapao for mountain biking, i.e. both parking lots are often full. Thank you for this meeting and input.
Stabilize this landscape. Erosion control is needed. [Shahin added - conservation]
Multiuse trails for different levels of difficulty for hikers and mountain bikers would be great.
Wilderness values most important. Quiet and darkness are powerful. Please concentrate usage to allow space for resotration and unaccessed native preservation comes first. Human play (recreation) comes second. Remember the overall land designations of the region - minimal development best. Keep country country. [Shahin added - conservation]
Remove the parking lots across the homes on Kekaulike. Move them up beside the archery range or above using the access road already up there.
Thank you for all your effort. I am a bird hunter and gun dog handler. Interested in volunteering and trying to organize hunter groups to come up and give back to the space, planting, invasive removal, trail maintenence etc. I have many years of experience in native plant propagationand conservation. Feel free to reachout. Unit accesss and a sense of stewardship are very important leeward since we've lost Poli Poli.

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In favor of fencing. In favor of aggressive invasive species removal. [Shahin added - conservation]
Work continuously to acquire private lands and secure funding. Acquire hiking and camping opportunities. There's very limited public lands camping options.
Move parking away from homes. Put parking with Poli Poli. How are you ensuring safety for homeowners neighboring the property?
Bathrooms to be built? We have a water shortage. How do you protect our water? [Shahin added -put under other]
Parking should not be across from houses along Kekaulike Hwy. Too much traffic and noise. Put parking away from homes.
(1) Security issues, alchohol, drugs, overnight camping - Polili is known for teenage drinking and drug use - State parks and parking lots encourage crime, loitering, and alchohol consumption. What is the state's plan to deter such activity? Noise level control? What are the plans for parking hours? Will the "entry gate" hours be restricted to a curfeww? **(2)** How do you expect to police and managee the this area when you can't even do that with the Poli Poli Park? The parks you are proposing are similar to Poli Poli, which is in disrepair. How does the state expect to construct and maintain the project when it cannot do so now? People hiking - what woudl be the trails and who would keep people from destroying areas off trail? Who will clean up the mess left by users? Where would the trails be? **(3)** What commercial enterprises have been in touch with DLNR? What are teh commercial plans? What does that mean? Commercial - no ATVs of any kind. Ruin slopes of Haleakala, plus dust and noise. Master plan for project? Traffic impact? Need more information. Parking lot placement? Potential parking up at Poli Poli not near homes. Who is going to control the parking lot? Concern is traffic. What about traffic control if parking lot is full? Getting to this idea could cause congestion on Copp Road and Pulehuiki ROad. Apple maps navigates people up these narrow roads as the fastest way to get to Kekaulike Avenue. Can there be an agreement made with Haleakala Ranch for access through their property on Crater Road? Will acccess be fee based? - parking - camping - other. **(4)** Positive is native forest reforestation Idea - what about having the University of Hawaii use this protected land for research to benefit the people? What type of trees will be planted? Where? Trees planted down to road? View corridor consideration? Will planting of trees block view of homeowners looking up the mountain. **(5)** What is the ecological impact native species of these parks, trails, development? Makawao Reserve Environmental Study - can information gained from this study be taken into consideration for Kamehamenui? What about possible light pollution from the parking area? Native birds may hit the light fixtures. What watershed? **(6)** Where is funding coming from? Property devalue. Property value could potentially go down with an increase in people/traffic. Cattle/ranching history. [Shahin added - conservation]
Have access from Haleakala Ranch. Or have access and archery range from Kula side at Ululani Road.
Interest to make trails is where the group of pine trees is - why cannot keep as is - concerned trees will be taken down - interfere with site line - lower portion should stay as is, don't commercialize. Keep leasing lowermost part. Neighbors not happy. Upper area does not matter much but not in lower areas. Afraid of vandalism close to road - people jump fence to vandalise. Poli Poli not managed well. Who will watch the archery range; will someone be there? Put a program for trails in the upper elevation.
Overuse of Makawao now. Stuck as no more trails. It will be populated very soon and we need opportunity to accommodate more growth of hikers and forest reserve users. The EA should cover at least 30 years. Need more access to new forest reserve.
Put the parking area near Kula - mid elevation. Don't put trails on the property because people will not use it well and will abuse it. Lives right across the Kekaulike Highway. Not enough DOFAW staff to maintain the reserve. How will staff work overlapping all these trails?
Local resident - likes camping. Long wait to get permit to camp at Haleakala and Poli Poli. Public use of camping are very limited. Would like to see more low impact camping opportunities. In general, concentrate all recreational use of the reserve in one section of the forest reserve. Don't spread recreation all over the reserve. Preserve slices of ecozone. [Shahin added - conservation]
Cannot build any more trails at Makawao. Bring in outside entity to get the trails infrastructure in. How many miles of trails?
Hate to see Kamehamenui become Poli Poli. Take care of that first. Keep buffer and access through Crater Road. Taking away food is foolish, at least keep ranching going in some area for food. Ranchers after all maintain the land. Having ranching is win-win; food plus buffer then do stuff in upper area. Mix management of livestock is good there and would like to see it continue. Don't overgraze - the last 4 or 5 ranchers have done a good job.
Be careful about bikers - cause a lot of erosion. Just have no wheels. If the trais are not built property then it can also cause erosion. Vice President Theresa of Maui introduced herself too.
Have more public use - hiking, mountain biking etc. Need more trails. Have public land for the public. Lower trails - use them to connect.

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Do Nothing. Leave the land as it is. [Shahn added - no archery, no camping, no hiking, no biking, no horses, no hunting, no trails, no access, no parking, no conservation, no education/ school]
Consider horsetrails (Shahin added - equestrian)
Many are concerned about commercial. We will recommend no commercial activity. [Shahin added - other]
Why do any of this? Maui has everything. Why not put in restricted reserve in its entirety. Huge clapping from audience. Why not restrict and do research, monitor, state can benefit. We don't have a closed system; this represents type of land in Kula. Reforest? Pipe dream for water restoration. Pipe dream. Leave it undeveloped and use for research. [[Shahn added - no archery, no camping, no hiking, no biking, no horses, no hunting, no trails, no access, no parking, no conservation, no ranching, yes education, school, research, yes for doing nothing]
Why take piece of property in ranch land; part of ag community for long time; then turn into possibility of access, parking, etc.? Lend voice to leave it the way it is. [[Shahn added - no archery, no camping, no hiking, no biking, no horses, no hunting, no trails, no access, no parking, no conservation, no education/ school, do nothing]
Grew up riding here equestrian park would be a good idea for Kula residents. Paniolo lifestyle. [Shahin added - horse]
My heart's desire is to be a steward, keep as is, and manage as is. Ranching legacy will dissipate/go away? Scary to have it commercial. Polipoli: refuge for recreational drugs/drinking: terrifying. Teens make poor decisions. Concerned of fire risk; water holder capacity that ranch has to save from fires (especially with drought).[*Shahn added - no archery, no camping, no hiking, no biking, no horses, no hunting, no trails, no access, no parking, no conservation, no education/ school, do nothing*]
Lived on Kula property 8 years. Breaks our heart to impair view corridor with planting and no cattle to keep wattle down, grass, and fire. Want no commercial activity whatsoever. Concern it could become like Polipoli [Shahn added - no archery, no camping, no hiking, no biking, no horses, no hunting, no trails, no access, no parking, no conservation, no education/ school, yes ranching, do nothing]
off grid, mauka. Fire when girls lighting candles. Would be good to have non-motorized trail for access. Seem plenty places to have vehicles. Anything other than that, Polipoli fireworks and bad activity. Add: nationally strapped for maintenance now. Polipoli not maintained. Why spend $ without taking care of what you have? Many clap.
How about renewing his lease? Keep it ranch. Open to discussion to renew it. Need to maintain the ranch.
Ihea place residence. Multiple gulches. How maintain the gulches? How get water? Get water; will be hazard. If already access at Polipoli, why not keep? No other access point?
Easier to let land fallow? Back to nature? Elephant in room. DLNR could use then change to single family residents due to housing crisis. Clapping. [Shahn added - no archery, no camping, no hiking, no biking, no horses, no hunting, no trails, no access, no parking, no conservation, no education/ school, no ranching, do nothing]
Question on reforestation? Native plants? Invasive sp remove? Goal to get rid of whattle, eukes. No pines across top. [Shahin added - conservation]
A gate on parking lot put? Need analysis of figures for how much public access – how much visitors? No more Disney land. This place is still quiet and residential. Keep it – only last refuge for residents. Polipoli: more residents; stop vehicles 80%
Great concerns about parking especially. Lived 30 years with my husband. Walked. Much crime up there. Lower portion especially. Should not have parking down there at all. Real trouble with security. Seen it all. Many concerns for lower potion. Trail system.
What about bus fitting along the road? Does DOT designate no parking etc? Like Hana where no enforcement? We need to see it and issue enforcement. Try best. No parking lot at all – just prevent due to no control of DLNR, due to police, DOT, others to enforce. Manage the parking? Could there be fee for parking? Local tours coming in?
Concern of 1 mil trail. Risk of horses with bikes. How to manage up keep upcountry HI. Don't see it.
Conserve and NOT develop. Do nothing is where I am coming from. [Shahn added - no archery, no camping, no hiking, no biking, no horses, no hunting, no trails, no access, no parking, no conservation, no education/ school, no ranching, do nothing]
Hunting and carcass -Carcasses smell bad and the prevailing winds spread it. DLNR not going to remove them. Doesn't affect water. Eradication of animals on Molokai study. Only take back strap and not rest of it. Most deer are by the street. Good intentions but no follow through per DLNR.
Plan for long-term 30-40 years
Why lease land? Is it part plan?
32-person submittal from community headed to us

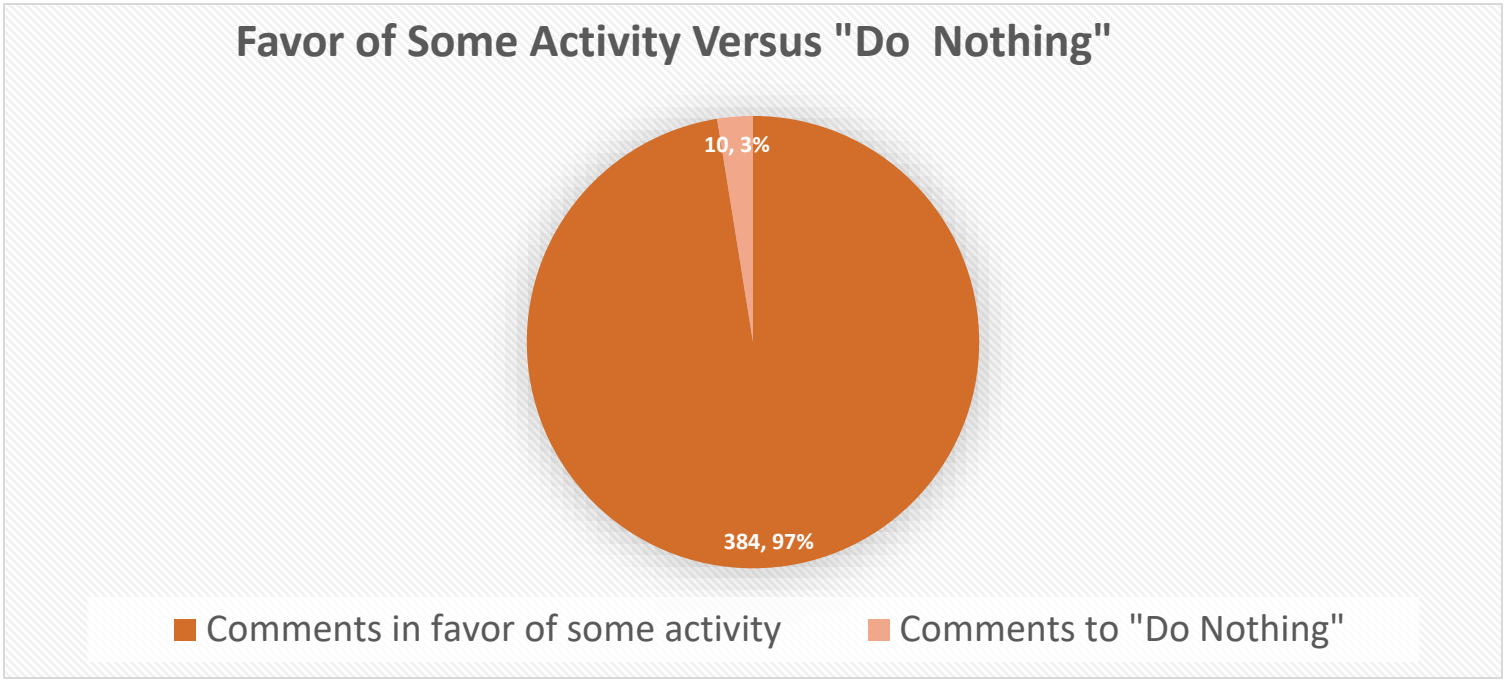
Kamehamenui Forest Reserve Management Plan
Compilation of All (Verbal and Written) Comments Received from Public Scoping Meetings

Concerns about trash
Concern no fire protection or understandig of fire danger
Kaonoulu Ranch to Poli Poli - any straight way available?
Others available to take over lease from Balthazar
Our tax payer dollars. We should know who the donor is.
Is there a heiau there?
Need roping practice zone.
Concerns - Kids setting fires, drunkness, teenage antics, withouth water possible loss of life to both humans and livestock
Frisbee, golf
Have an area that is "open space" undefined
Have workout stations
Have areas for indigenous practices
Free flight (4 votes) [Shahin added - not sure what this means]
The State should open by being forthcoming about all the impacts it anticipates and has planned for … including - water (will there be a signidicant use of water in chronicaly drought-stricken Upcountry? - adequate and maintained sanitation facilities for hikers - traffic management and mitigation so as not to interfere with local traffic and adjacent neighbors - adequate signage - prohibition of food trucks and other businesses setting up in the parking lot - special noise ordinance for benefit of area neighbors - is phone service available there for emergencies? - illegal use of motorized vehicles on trails (many off-roaders are always looking for a place to tear up trails) - and monitoring of all of this by park rangers.
Please share meeting information better, sooner, wider, and greater depth
DLNR trying to manage lands. What was intention of Von Tempsky family – late 1800s, formed ranch, made profit but also conservation. 40k Eucalyptus, Jacarandas planted in late 1800s. No erosion. All eukes planted by family as dream to cut erosion. Recognize he was a capitalist. But want to understand family goals.
Intent to deer fence property? It is currently a deer and wattle sanctuary. That's what we have coming if ranching goes away.
Parking will include restrooms? Any plans to tie in roads?
Any studies on doing reforestation and creating system – hydrology studies done to estimate change in fog drip? Kahikinui vs Polipoli? Reforestation: make it look like it. How to manage access?
Are you going to hire DLNR workers to manage lands? What does hiring look like?
Gate times, illegal activities etc: what assurance that it won't become another Polipoli or what?
Need to have firefighters and first responders up country. Trouble now—will this add to problem?
Proposed: invasive species but then trails that bring in tires, shoes. Or spread Ohia fungus on shoes. Some conflicting uses. Which one has priority to cross off?
Forest products? Koa tree? Can call if local woodworker on dead tree?
Anonymous donor who belongs to hiking organization? If see? $1 million? Anything for he/she to where it goes? Cannot divulge the name of the person? Is it completely off?
Is DLNR beholden to donor?
Native reforestation where is water coming from? Phased approach? Remove cattle then koa trees – very tall what about the view? Want to see forest vs. the view of Haleakala? What is more important? If put light in parking lot? Pueo harmed by light? HI Petrels? Timeline transition? Lease can be revoked?
Can DLNR sell the property?
How do we pronounce Kamahamnui? Kula: Uncle Tom told me, come: Take care of his property on Kula. As trustee take position. How much to move to Maui? 50%. Left Aiea home. 2006 made move. 15 years fresh – etc. watching grandkids growing up. When group visited, hens etc. saw cows "huge dog", 3rd and 4th generation of this property. Hope to see the views. Reserve needs to conserve. Oh give me a home. Etc. No blocking of the view
Residents don't want to be saddled with enforcement responsibilities.

Appendix A5.

Analysis of all Verbal and Written Comments to Guide Development and Management of Public Use Activities at Kamehamenui Forest Reserve.

DO NOTHING VERSUS PROPOSE SOME AVTIVITY

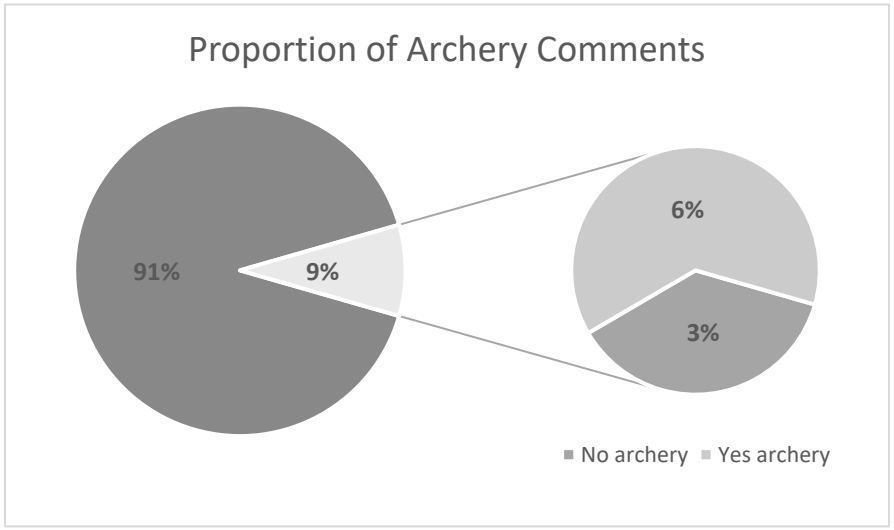


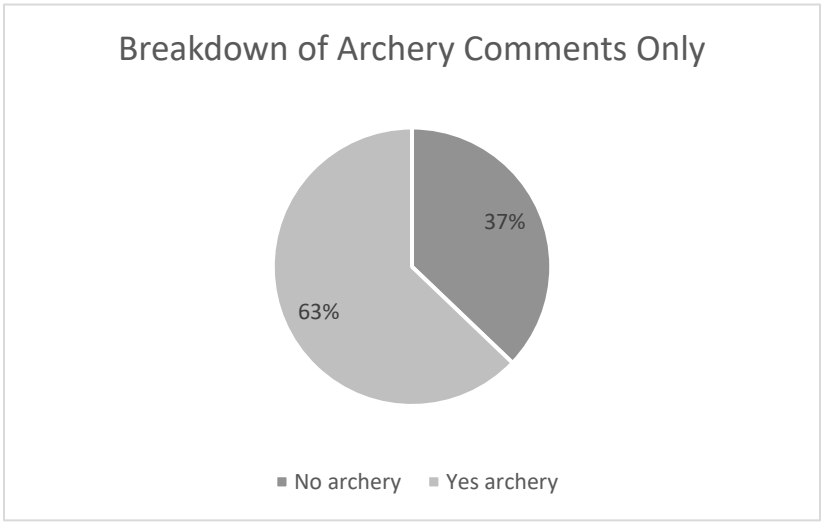
Summary

1) About 97% of the total comments advocated for some activity at Kamehamenui Forest Reserve

2) About 3% of the comments received were in favor of doing nothing at the Reserve and leaving the land as is.

ARCHERY

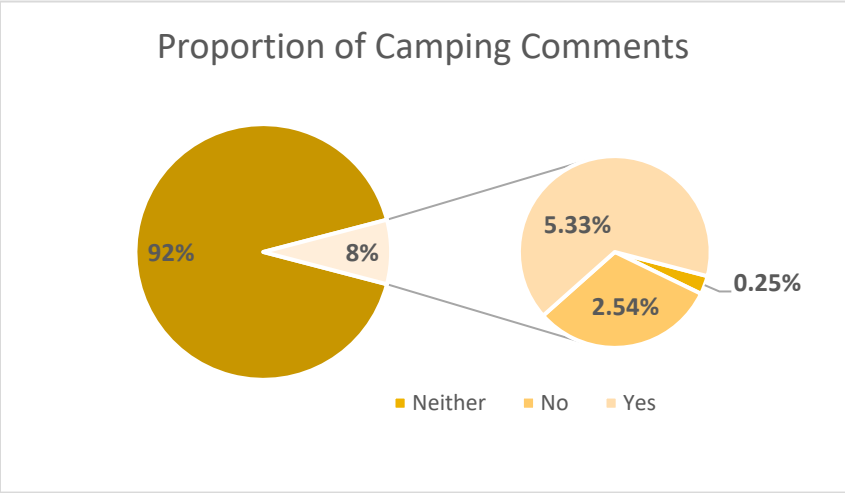


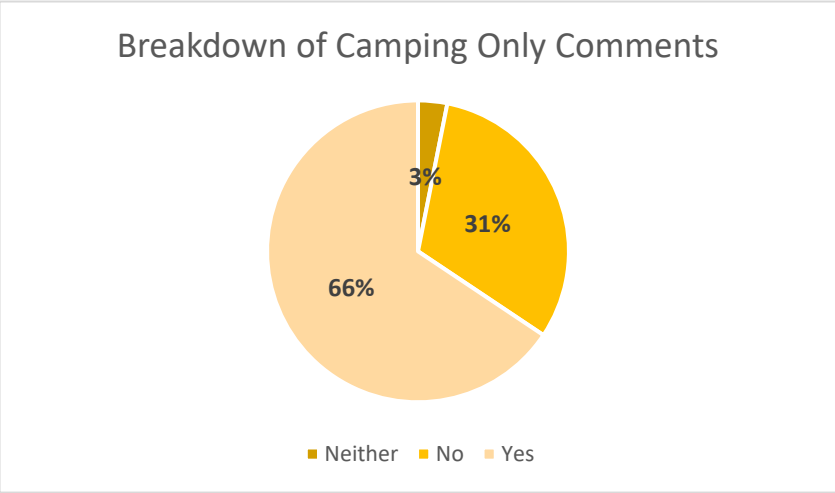


Summary

1) About 9% of the total comments recorded addressed archery.
2) 6% of the total number of comments recorded are in favor of archery in the forest reserve.
3) Among archery comments about 63% (22 out of 35) are in favor of archery and 37% (13/35) are not in favor.
4) The comments against archery include those comments that mentioned to do nothing.
5) Comments recorded about archery were during in-person meeting or submitted via email.

CAMPING

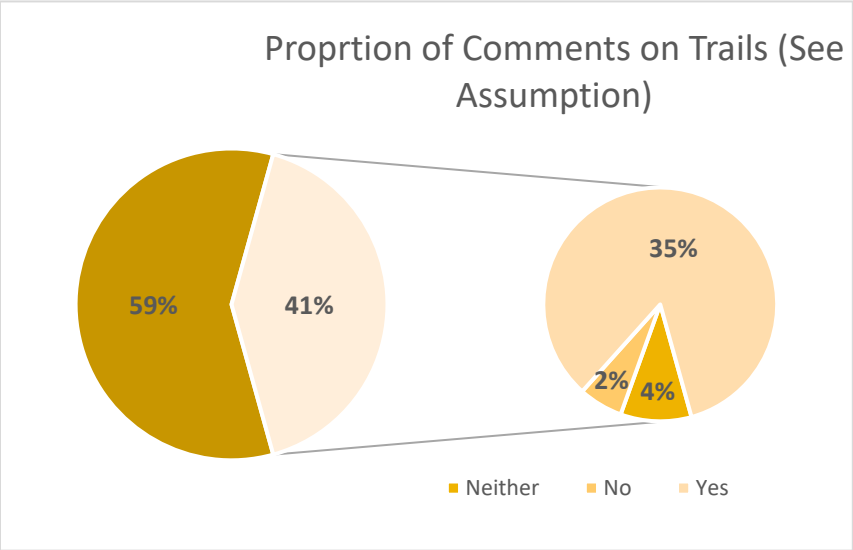


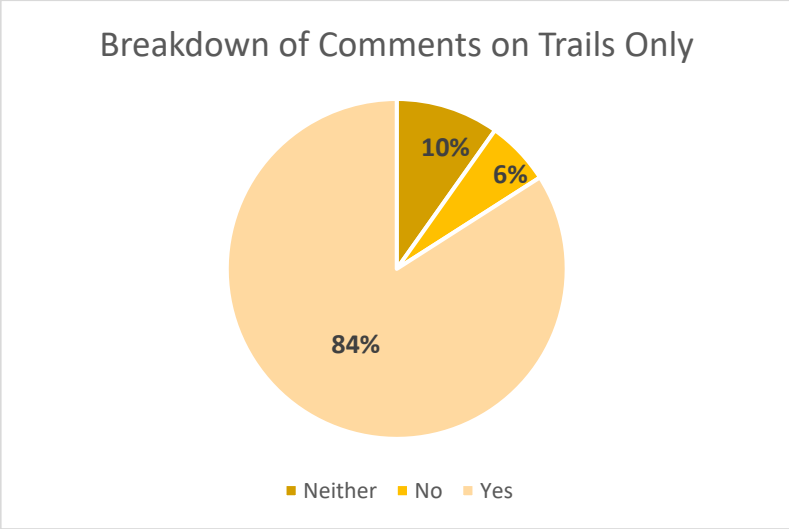


Summary

1) About 8% of the total comments recorded addressed camping.
2) About 5% of the total number of comments recorded are in favor of camping in the forest reserve and about 3% against.
3) Among camping comments about 66% (21 out of 32) are in favor of camping and 31% (10 out of 32) are against camping.
4) The comments against camping include those comments that mentioned to do nothing.
5) Comments on camping were recorded during in-person meeting, via email submission, and also via a petition drive.

TRAILS

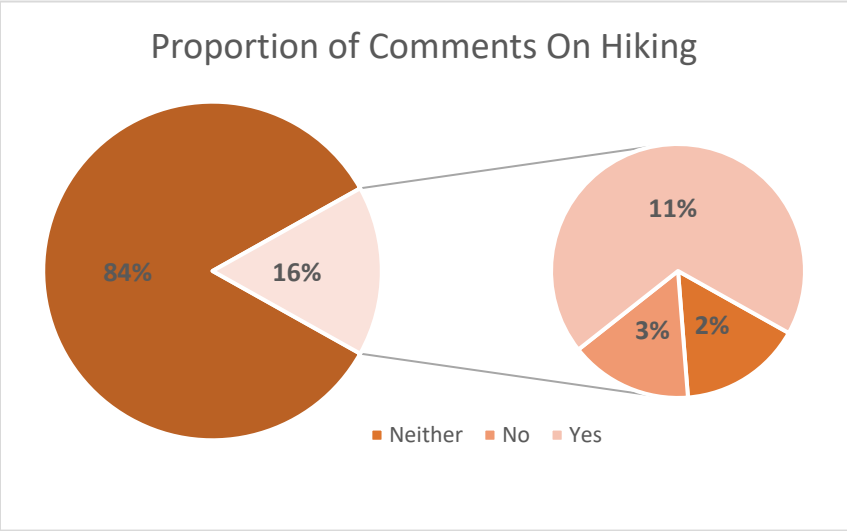


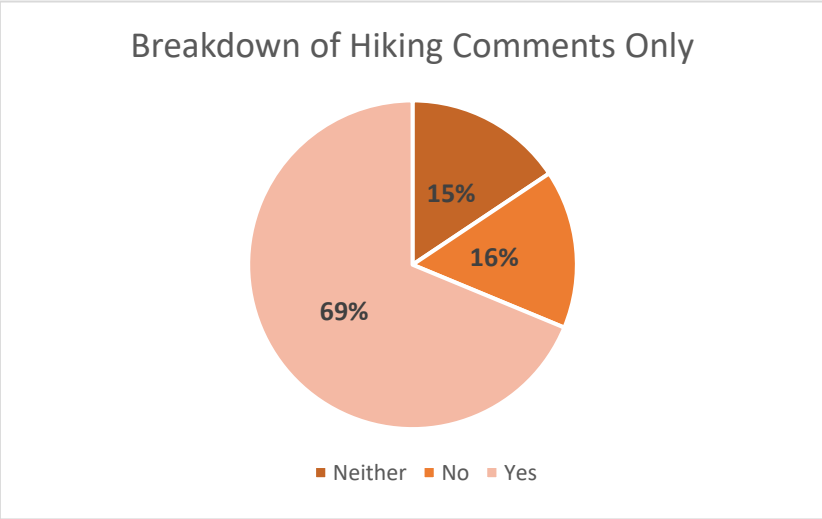


Summary

1) About 41% of the total comments recorded addressed trails (hiking or biking, or equestrian).
2) 35% of the total number of comments recorded are in favor of trails in the forest reserve and 2% against trails.
3) Among comments regarding trails about 84% (137 out of 163) are in favor and 6% (10 out of 163) are against trails.
4) The comments against trails include those comments that mentioned to do nothing at Kamehamenui.
5) Comments on trails were recorded during in-person meetings, via email submission, and also via a petition drive.

HIKING

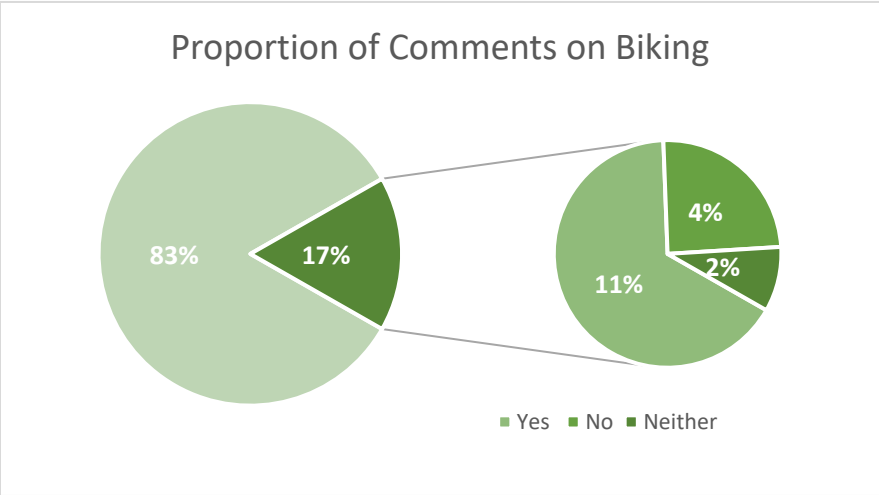


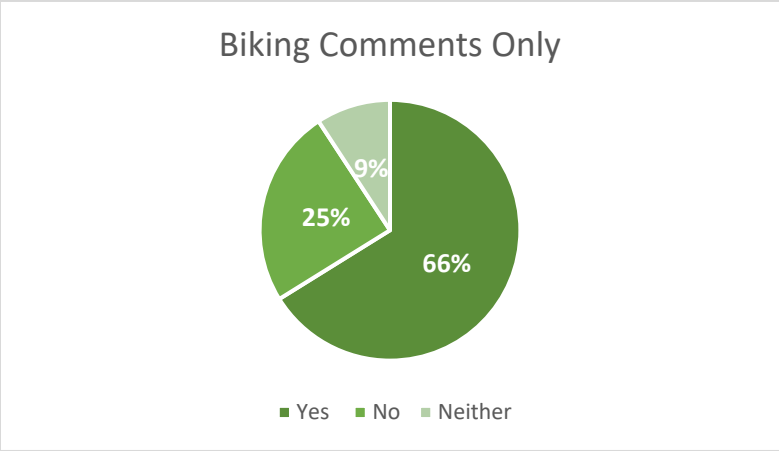


Summary

1) About 16% of the total comments recorded addressed hiking.
2) 11% of the total number of comments recorded are in favor of hiking in the forest reserve.
3) Among hiking comments about 69% (44 out of 64) are in favor of hiking and 10% (10 out of 64) are against hiking.
4) The comments against hiking include those comments that mentioned to do nothing at Kamehamenui.
5) Comments on hiking were recorded during in-person meeting, via email submission, and also via petition drive.

BIKING

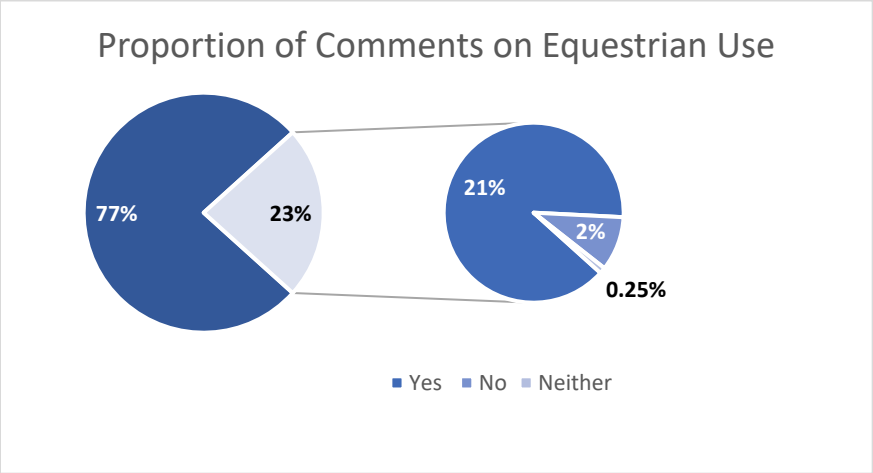


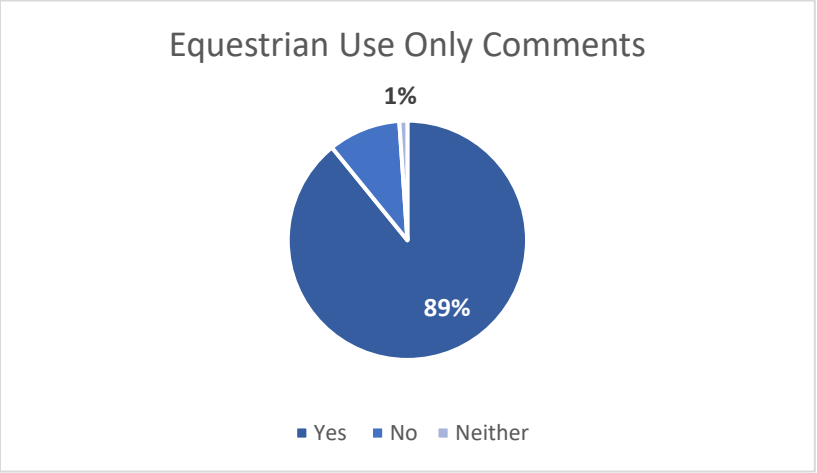


Summary

1) About 17% of the total comments recorded addressed biking.
2) 11% of the total number of comments recorded are in favor of biking in the forest reserve.
3) Among biking comments about 66% (43 out of 65) are in favor of biking and 25% (16 out of 65) are against biking.
4) The comments against biking include those comments that mentioned to do nothing at Kamehamenui.
5) Comments on biking were recorded during in-person meetings, via email submission, and from the virtual meeting.

EQUESTRIAN USE

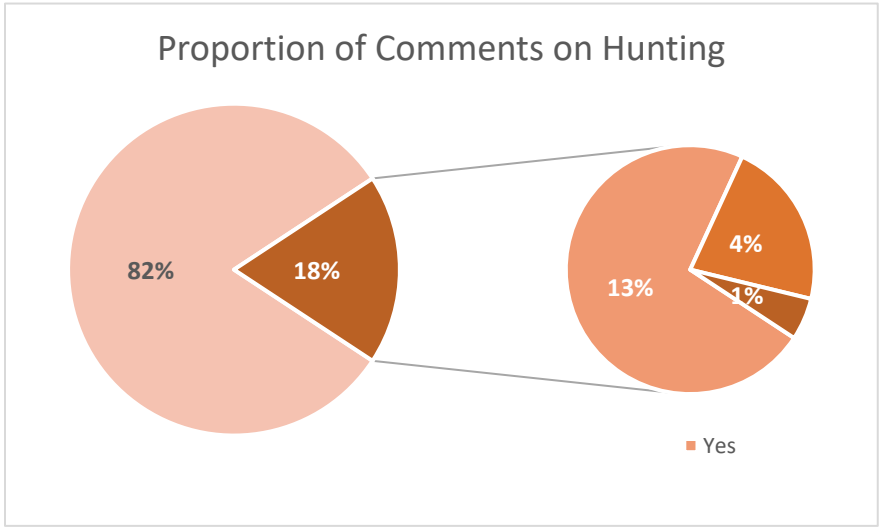


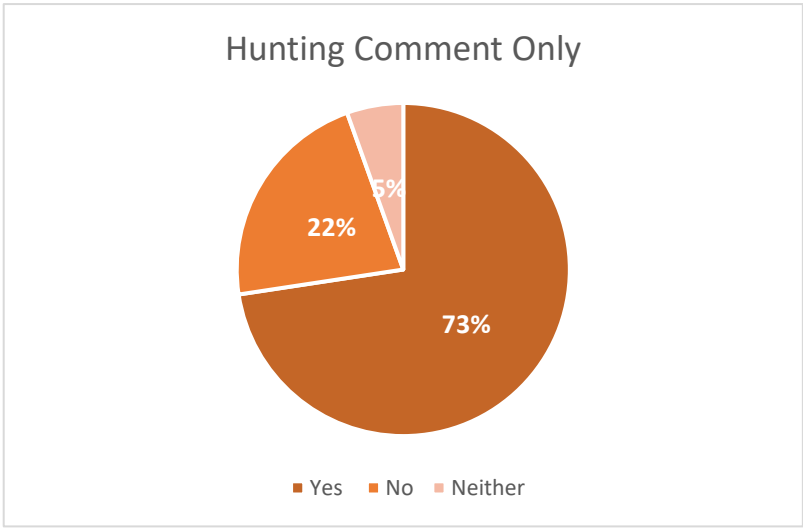


Summary

1) About 23% of the total comments recorded addressed equestrian use.
2) 21% of the total number of comments recorded are in favor of equestrian use in the forest reserve.
3) Among equestrian use comments about 89% (82 out of 92) are in favor of equestrian use and 10% (9 out of 92) are against equestrian use
4) The comments against equestrian use include those comments that mentioned to do nothing at Kamehamenui.
5) Comments on equestrian use were recorded mostly via email submission and during in-person meetings.

HUNTING

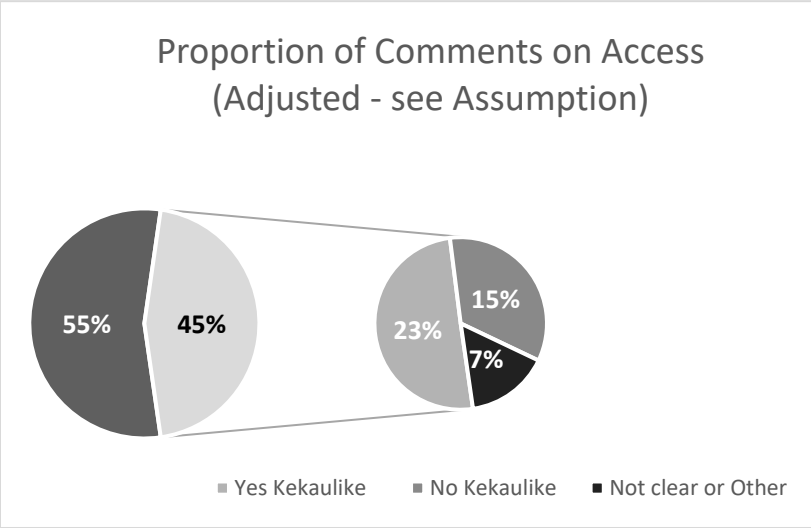


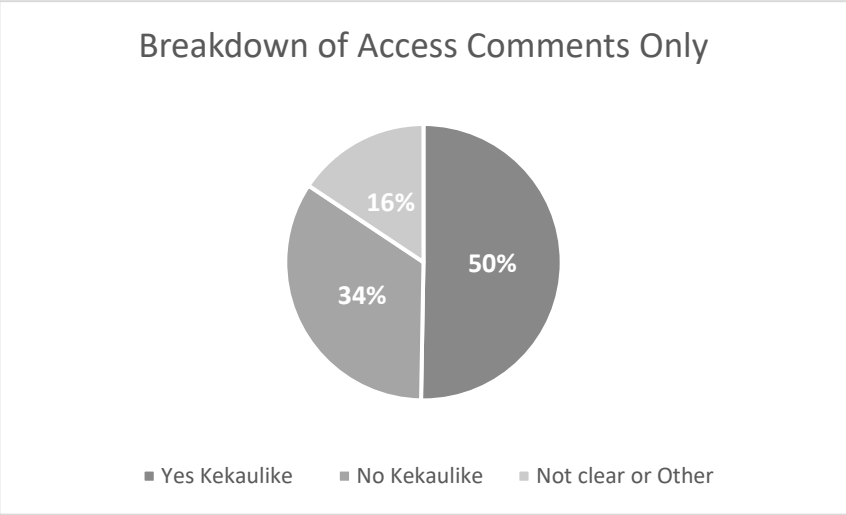


Summary

1) About 18% of the total comments recorded addressed hunting
2) 13% of the total number of comments recorded are in favor of hunting in the forest reserve.
3) Among hunting comments about 73% (53 out of 73) are in favor of hunting and 22% (16 out of 73) are against hunting
4) The comments against hunting include those comments that mentioned to do nothing at Kamehamenui.
5) Comments on hunting were recorded during in-person meeting and via email submissions.

ACCESS





Summary

1) About 45% of the total comments recorded addressed access.

2) 23% of the total number of comments recorded are in favor of access to the forest reserve via Kekaulike Ave and 15% are against access from Kekaulike Ave.

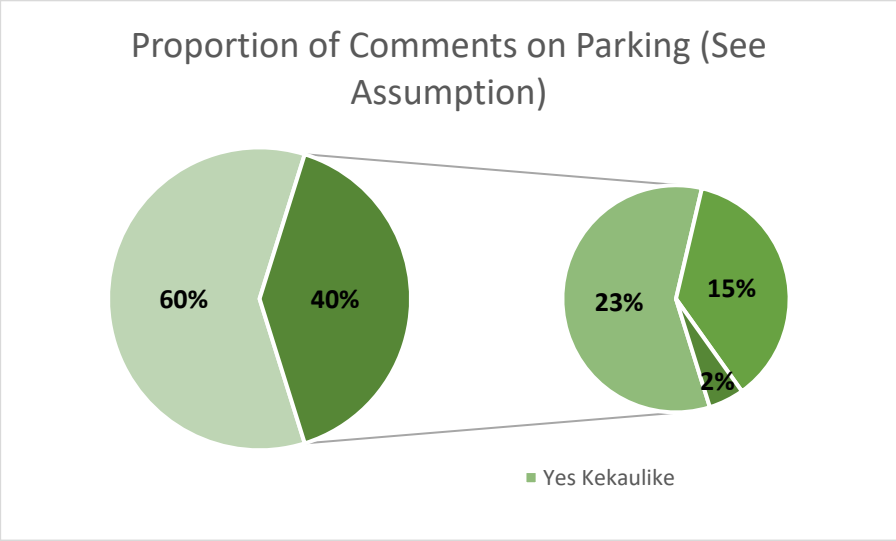
3) Among access comments about 50% (90 out of 179) are in favor of access from Kekaulike Ave and 34% (61 out of 179) are against access from Kekaulike.

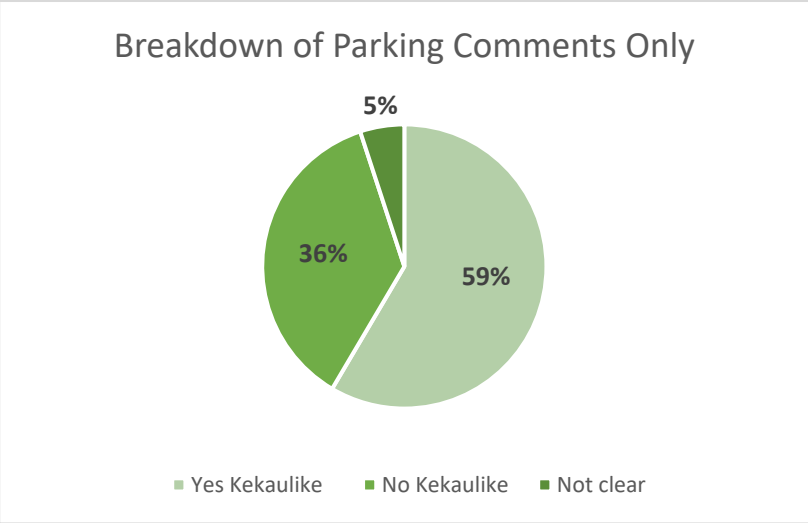
4) The comments against access include those comments that mentioned doing nothing at Kamehamenui.

5) Comments on access were recorded during in-person meetings, via email submission, and also via petition drive.

6) Assumption: Most emailed comments requesting equestrian trails also requested for safe access from Kekaulike along with parking for horse trailers as it is hard to maneuver large trailers with live cargo on narrow roads. Therefore comments that requested for horse trails but did not comment about access or parking have been adjusted as positive for access and parking from Kekaulike Avenue.

PARKING

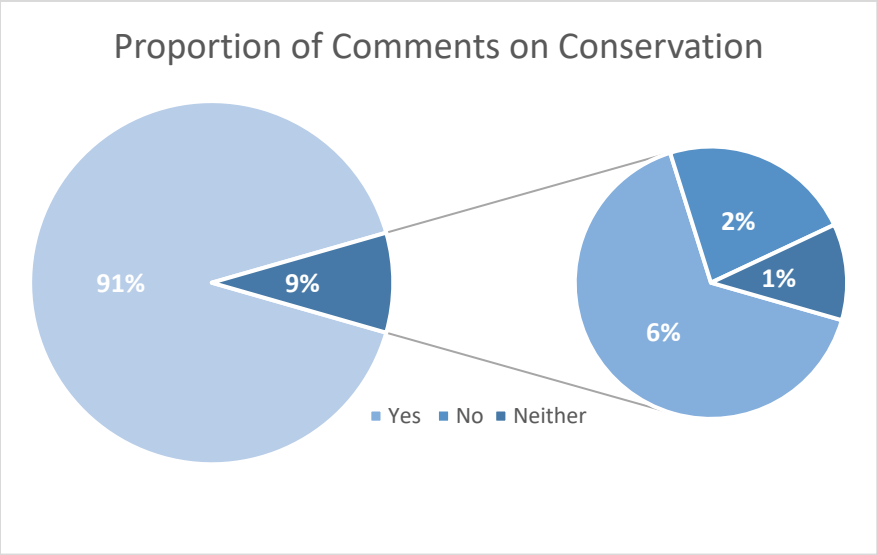


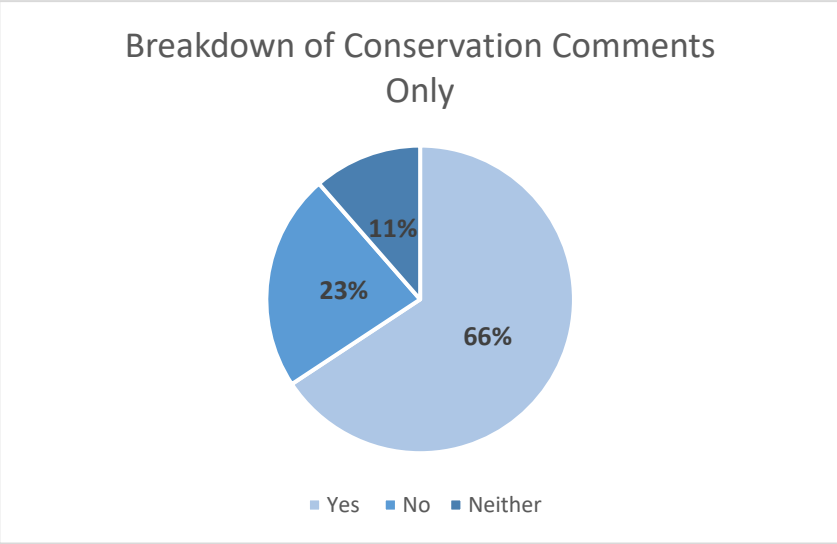


Summary

1) About 40% of the total comments recorded addressed parking.
2) 23% of the total number of comments recorded are in favor of parking at Kekaulike Avenue.
3) Among parking s comments about 59% (93 out of 159) are in favor of parking at Kekaulike Ave and 36% (58 out of 159) are against parking at Kekaulike Avenue.
4) The comments against parking include those comments that mentioned doing nothing at Kamehamenui.
5) Comments on parking recorded during in-person meeting, via email submission, and also via petition drive.
6) Assumption: Most emailed comments requesting equestrian trails also requested for safe access from Kekaulike along with parking for horse trailers as it is hard to maneuver large trailers with live cargo on narrow roads. Therefore comments that requested for horse trails but did not comment about access or parking have been adjusted as positive for access and parking from Kekaulike Avenue.

CONSERVATION

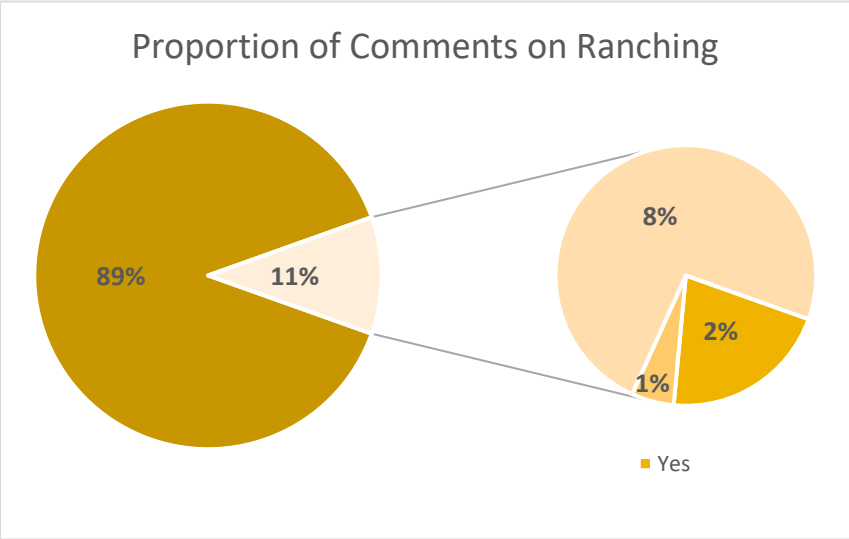


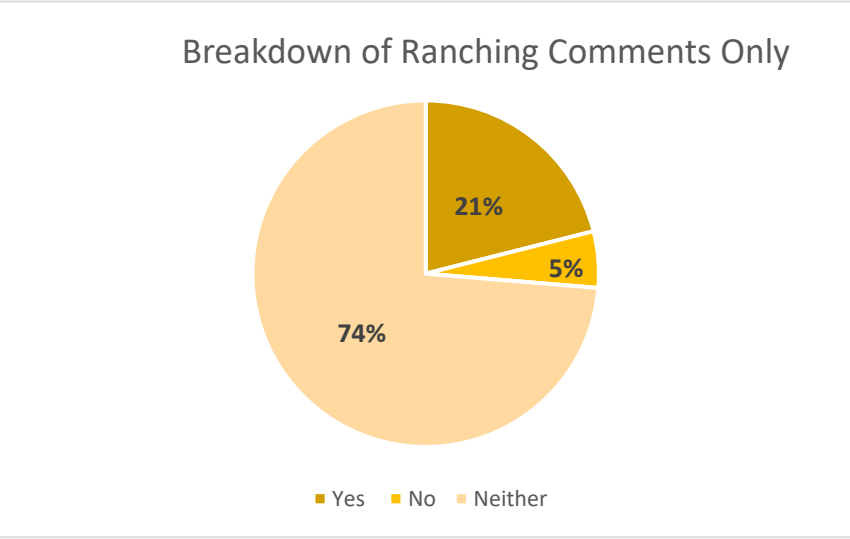


Summary

1) About 9% of the total comments recorded addressed conservation
2) 6% of the total number of comments recorded are in favor of conservation in the forest reserve.
3) Among conservation comments about 66% (23 out of 35) are in favor of conservation and 23% (8 out of 35) are against conservation
4) The comments against conservation include those comments that mentioned doing nothing at Kamehamenui.
5) Comments on conservation were recorded during in-person meetings, via email submission, and via petition drive.

RANCHING





Summary

1) About 11% of the total comments recorded addressed ranching
2) 8% of the total number of comments recorded are in favor of ranching in the forest reserve.
3) Among ranching comments about 74% (8out of 38) are in favor of ranching and 5% (2 out of 38) are against ranching.
4) The comments against ranching include those comments that mentioned doing nothing at Kamehamenui.
5) Comments on ranching were recorded during in-person meeting, via email submission, and also via petition drive.

APPENDIX B. CULTURAL IMPACT ASSESSMENT FOR THE PROPOSED INFRASTRUCTURE IMPROVEMENTS IN PORTIONS OF THE KAMEHAMENUI FOREST RESERVE

Cultural Impact Assessment for the Proposed Infrastructure Improvements in Portions of the Kamehamenui Forest Reserve

TMK: (2) 2-3-005:002 (por.)

Kamehamenui and Kealahou 3 & 4 Ahupua‘a
Kula District
Island of Maui

DRAFT VERSION



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ASM Project Number 39140.00

Cultural Impact Assessment for the Proposed Infrastructure Improvements in Portions of the Kamehamenui Forest Reserve

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1. INTRODUCTION

At the request of H.T. Harvey & Associates on behalf of the Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW) Maui Branch, ASM Affiliates (ASM) prepared this Cultural Impact Assessment (CIA) to inform an Environmental Assessment (EA) being prepared for the proposed improvements within portions of the Kamehamenui Forest Reserve, located on Tax Map Key (TMK) (2) 2-3-005:002, Kamehamenui and Kealahou 3rd and 4th Ahupua‘a, Kula District, Island of Maui (Figures 1, 2, and 3). To fulfill part of the vision of the Kamehamenui Forest Reserve, which includes providing *mauka* (upland) recreational opportunities, DOFAW is proposing to construct an archery range and parking areas in the *makai* section of the subject parcel (within select portions of a roughly 320-acre area). DOFAW also plans to construct an additional 25 miles of trail routes, some of which will connect with exiting trails in the Kula Forest Reserve in the upper portion of the parcel between 6,300- and 8,600-feet elevation. The location of the proposed archery range, parking areas, and trail routes are depicted in Figure 4.

This CIA, which is intended to inform an EA conducted in compliance with HRS Chapter 343, is being prepared pursuant to Act 50 and in accordance with the Environmental Review Program (formerly the Office of Environmental Quality Control [OEQC]) *Guidelines for Assessing Cultural Impacts*, adopted by the Environmental Council, State of Hawai‘i, on November 19, 1997 (OEQC 1997). Act 50, which was proposed and passed as Hawai‘i State House of Representatives Bill No. 2895 and signed into law by the Governor on April 26, 2000, specifically acknowledges the State’s responsibility to protect native Hawaiian cultural practices. Act 50 further states that environmental studies “. . . should identify and address effects on Hawaii’s culture, and traditional and customary rights” and that “native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the ‘aloha spirit’ in Hawai‘i. Articles IX and XII of the state constitution, other state laws, and the courts of the State impose on governmental agencies a duty to promote and protect cultural beliefs, practices, and resources of native Hawaiians as well as other ethnic groups.”

The current report is divided into four main chapters. Chapter 1, the introduction, includes an overview of the proposed improvements project as well as a physical description of the project area. To provide a cultural context of the project area, Chapter 2 includes cultural-historical background information specific to the project area and the broader geographical region of Kamehamenui and Kealahou, and at times the greater Kula District. This chapter also includes a summary of prior archaeological and cultural studies that have been conducted within and near the project area. The methods and results of the consultation process are then presented in Chapter 3. Lastly, Chapter 4 includes a discussion of potential cultural impacts as well as actions and strategies that may help to mitigate any identified impacts.

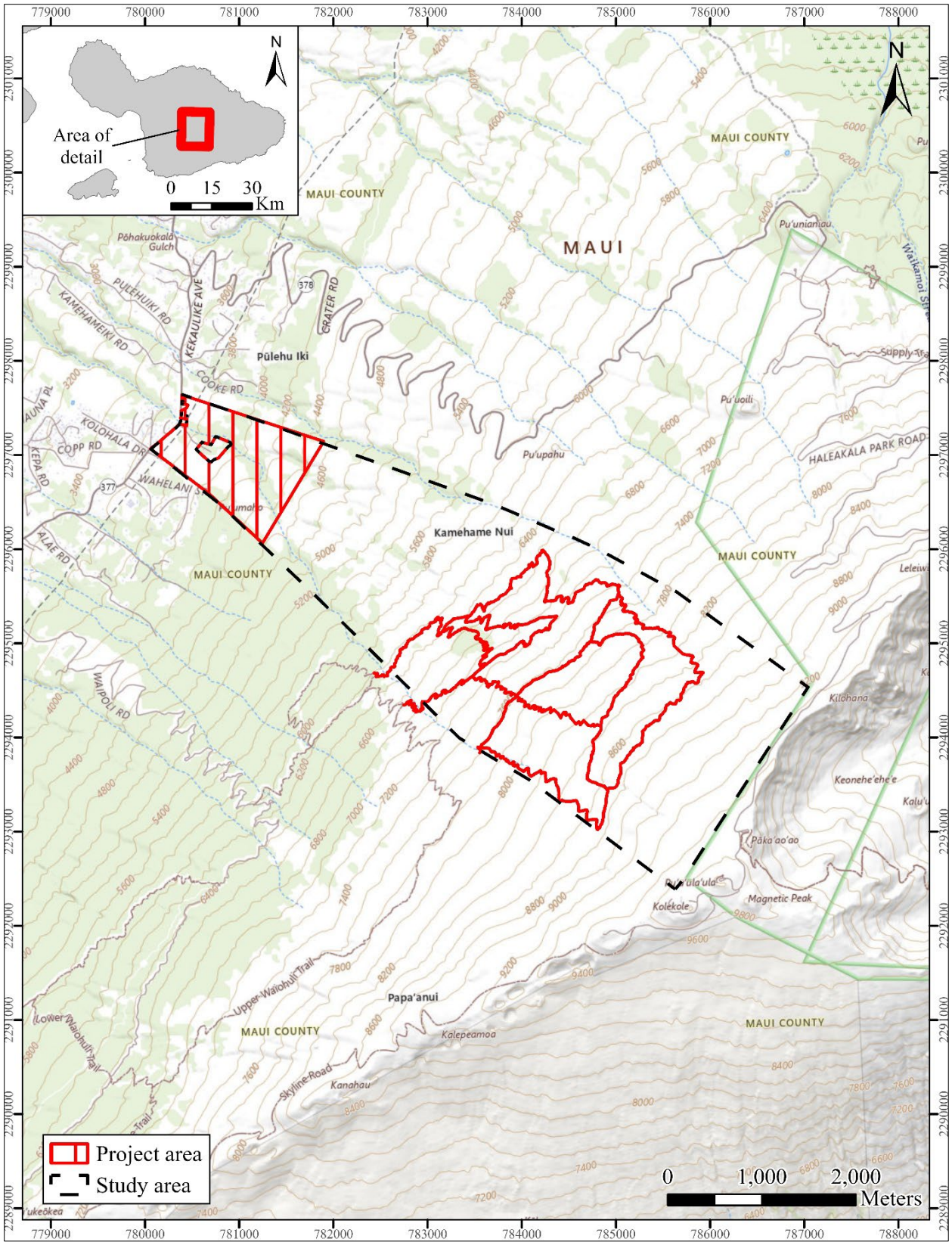
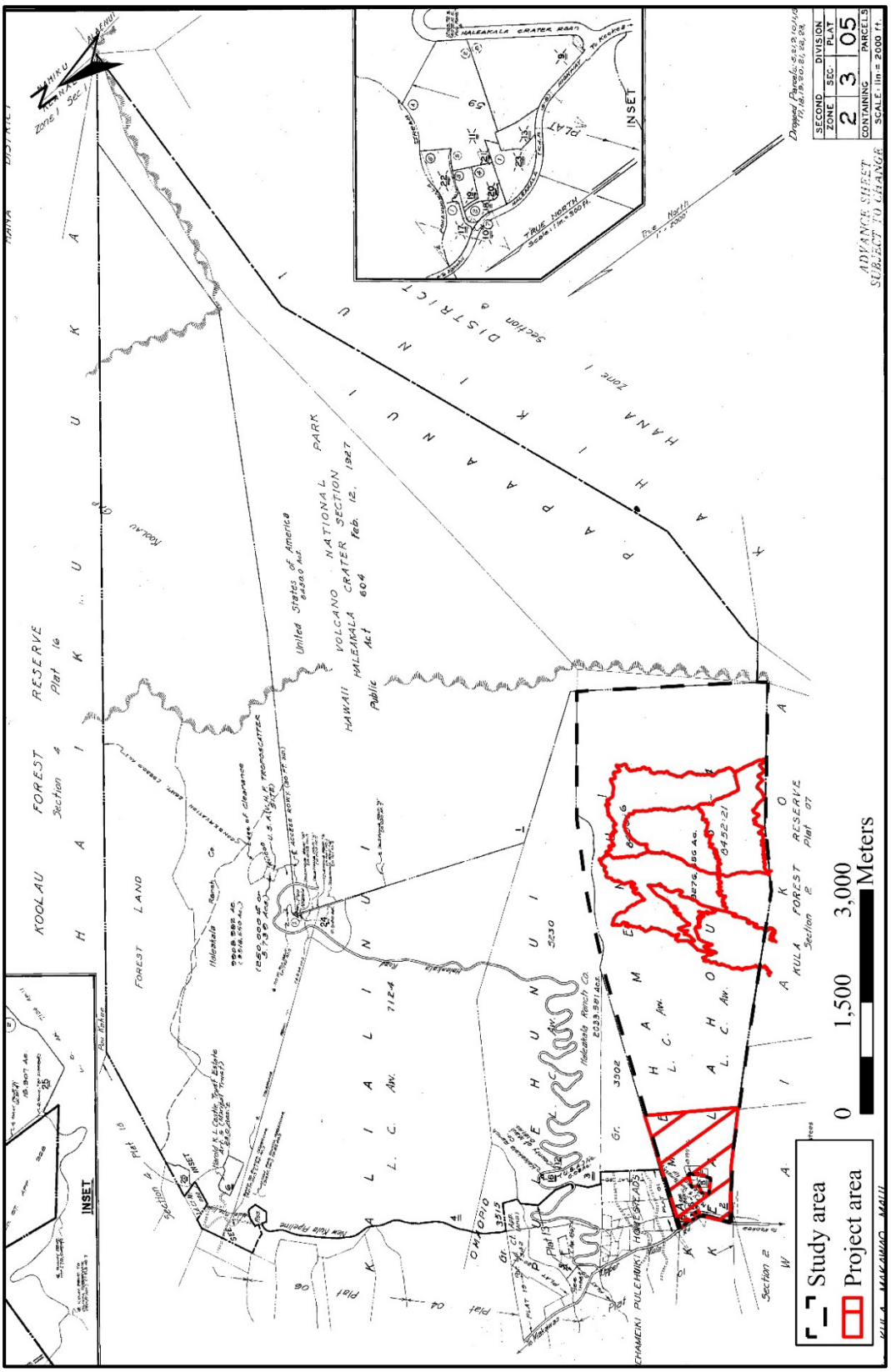


Figure 1. Project area location.


Study area
Project area
0
1,500
3,000
Meters
INSET
KOOLAU FOREST RESERVE
Section 4
Plat 16
KULA FOREST RESERVE
Section 2
Plat 07
HANA DISTRICT
Section 2
ZONE 1
HAWAII VOLCANO NATIONAL PARK
HALEAKALA CRATER SECTION
Feb. 12, 1927
Act 604
Public
United States of America
Haleakala Ranch
Kula Forest Reserve
Section 2
Plat 07
Section 4
Plat 16
Plat 04
Plat 06
Plat 15
Plat 21
Plat 22
Plat 23
Plat 24
Plat 25
Plat 26
Plat 27
Plat 28
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Plat

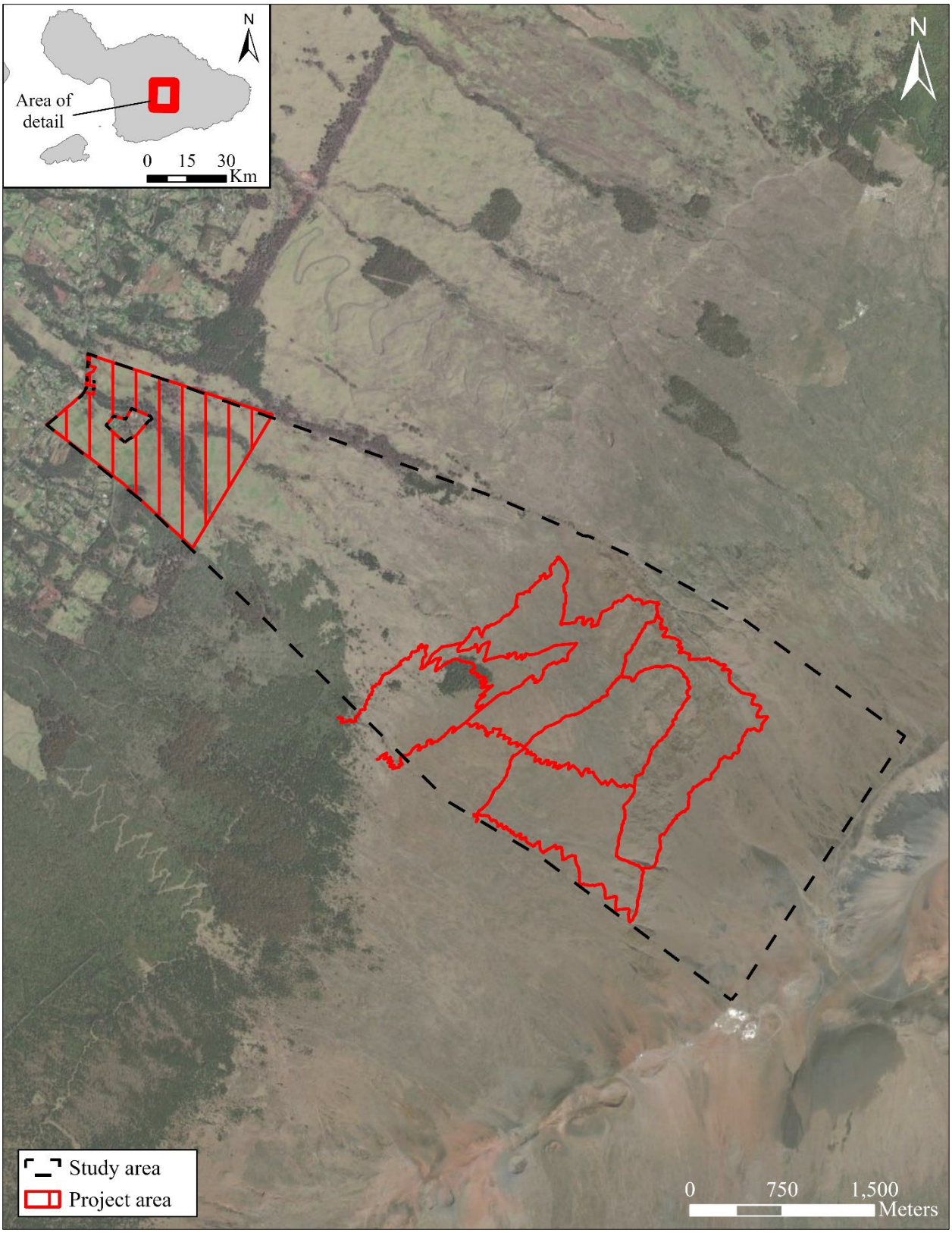


Figure 3. Google Earth™ satellite image showing project area location.

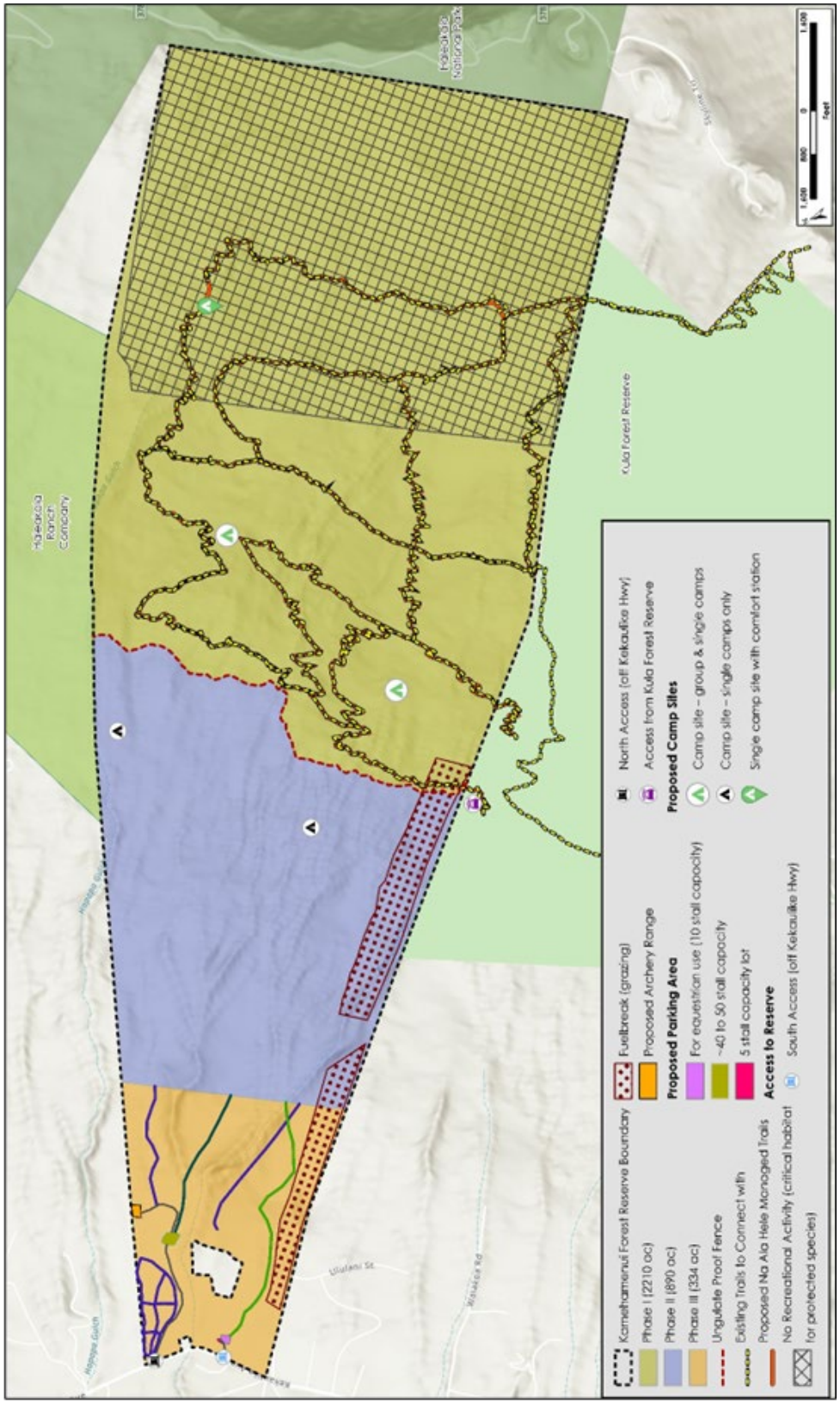


Figure 4. Planned improvements in Kamehamenui Forest Reserve.

PROJECT AREA DESCRIPTION

The current project area, consisting of a roughly 320-acre portion of a 3,433.72-acre parcel, is situated at elevations ranging from 1,125 to 1,349 meters (3,691 to 4,426 feet) above sea level, approximately 15.7 kilometers (9.75 miles) inland from the coast at Maʻalaea Bay. The overall subject parcel is bounded to the north by two contiguous privately-owned agricultural parcels and also by a conservation/agriculturally-zoned parcel owned by the Haleakalā Ranch Company, to the east by the lands of Haleakalā National Park, to the south by a portion of the Kula Forest Reserve and a conglomeration of variously-zoned agricultural and residential parcels, and to the west by Kekaulike Avenue (Figure 6) which provides access into the current project area.



Figure 5. Western boundary of the project area adjacent to Kekaulike Avenue, view to the northeast.

The geology underlying this portion of the Kula District is generally formed of moderately deep to deep volcanic ash that originated from Haleakalā Volcano between 140,000 and 950,000 years ago during the Pleistocene epoch (labeled 'Qkul' and 'Qkuls' in Figure 7) (Sherrod et al. 2007; Wolfe and Morris 1996). The *mauka* section of the parcel, where the trails are located includes this geology as well as a small section in the southern corner of the parcel, 50,000 to 140,000-year-old Hana volcanics (labeled 'Qhno' in Figure 7) (Sherrod et al. 2007; Wolfe and Morris 1996). Well-drained Andisol soils that have developed from these parent materials throughout the project area are separated by the rock land (labeled 'rRK' in Figure 8) of Keāhuaiwi Gulch and its branch gulches. Soils that encompass the western half of the project area are classified as Kula loam on 12 to 20 percent slope, while those comprising the eastern half are characterized by a large, steeply *makai*-sloping swath of Kapoipoi loam on 7 to 40 percent slopes (labeled as 'KxD' and 'KDIE', respectively, in Figure 8). Additionally, soils classified as Kula loam on 4 to 12 percent slopes occur in pockets along the project area's western southern boundary (labeled as 'KxC' in Figure 8). Within the *mauka* portion of the subject parcel, the trails southwest traverse Laumaia loam of 7 to 40 percent slopes (labeled as 'LME' in Figure 8). The northwestern portion of the trails encompasses an area of Laumaia loam soil with 40 to 70 percent slopes (labeled as 'LMF' in Figure 8). The eastern portions of the trails cover very stony ground with the middle section of the trails soil being made up of Laumaia extremely stony loam with 40 to 70 percent slopes (labeled as 'rVS' and 'LNE' in Figure 8).

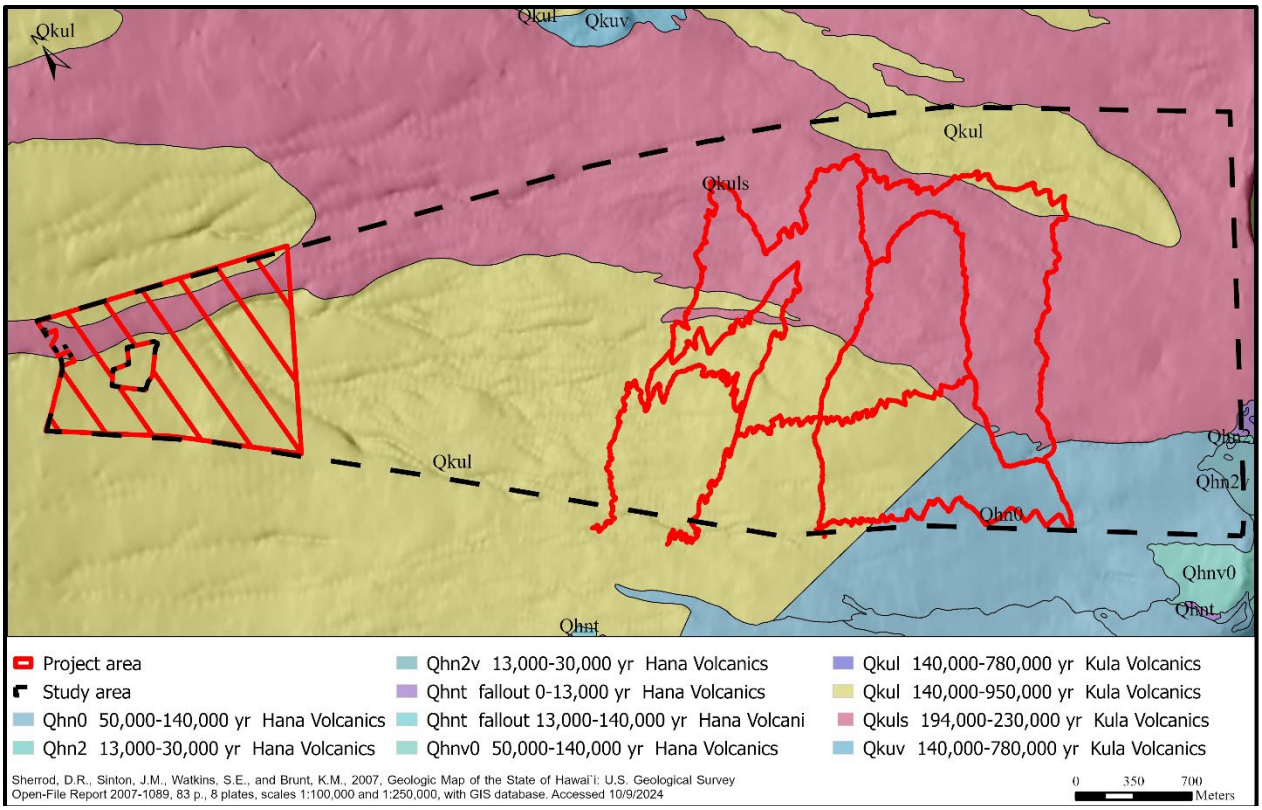


Figure 6. Geological units in the current project area (Sherrod et al. 2007).

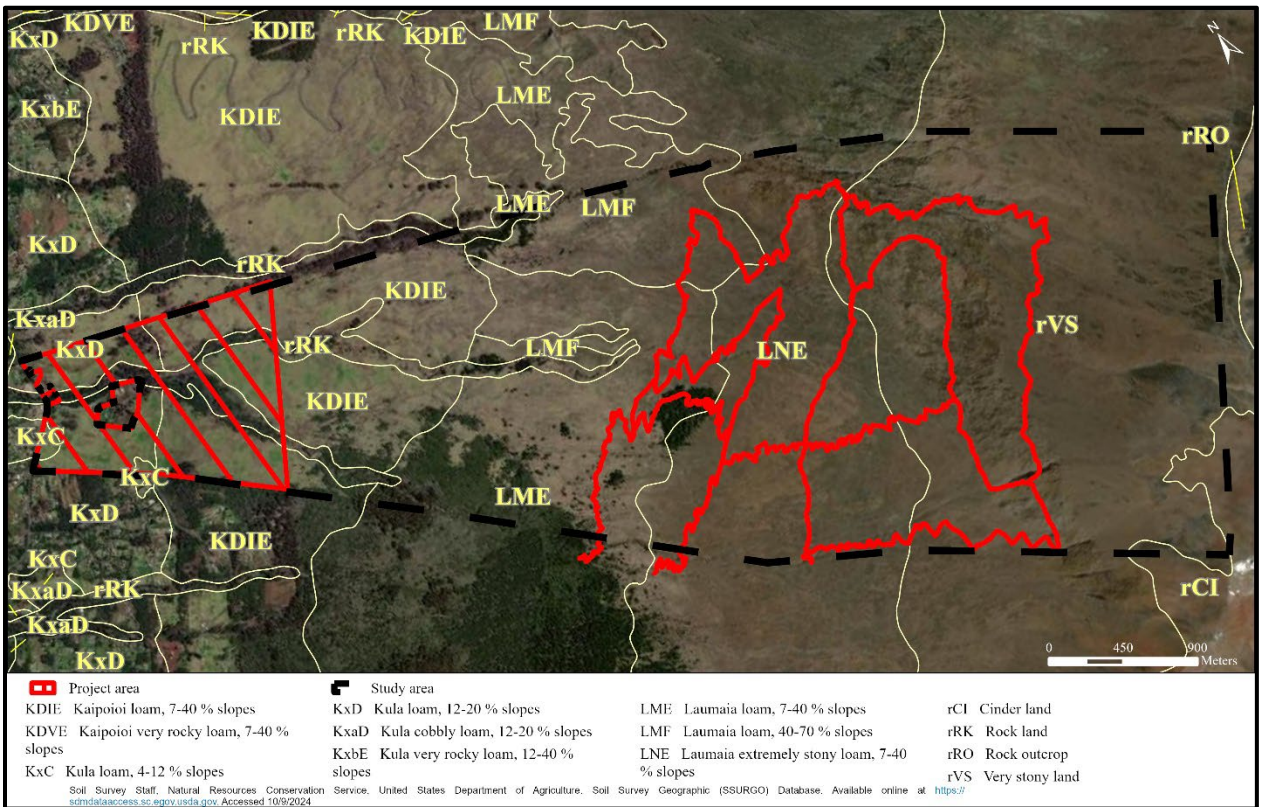


Figure 7. Soils within the project area (Soil Survey Staff 2019).

The climate at this elevation in Kula ranges from cool to cold depending upon elevation and season. At the warmer western end of the project area, the mean annual temperature ranges between 57° to 64° Fahrenheit throughout the year. The upper reaches of the project area, is, however, much cooler with temperatures ranging between 43° to 50° Fahrenheit throughout the year (Giambelluca et al. 2014). Precipitation within the extent of the project area varies according to elevation with the western end receiving more rainfall than the eastern end. Rainfall averages between approximately 560-430 millimeters (22-17 inches) (Giambelluca et al. 2014). Trade winds often blow from east to west across this region, except when *kona* winds are blowing (typically during the summer months), which results in a reversed wind pattern.

The terrain within the project area is characterized by an undulating, gentle to steep slope *makai* (northwest) towards the western boundary of the project area adjacent to Kekaulike Avenue (Figure 9). Meandering cattle trails and dugouts are scattered about the rolling pastures which are intermittently dissected by numerous drainage channels of varying depths (Figure 10). In the *mauka* portion of the project area, many of these drainages are characterized by deeper and wider channels of exposed, heavily weathered *pāhoehoe* bedrock that gradually transition as they extend *makai* to more gently sloped grass-covered drainages allowing for ephemeral flow from the uplands. Being that the *kula* lands of the project area are actively grazed and utilized as a cattle ranch, vegetation throughout the majority of the project area consists primarily of a continuous blanketing of low-lying *kikuyu* (*Pennisetum clandestinum*) forage grass almost entirely bereft of cobbles interspersed with apple of Sodom (*Solanum linnaeanum*), fireweed (*Senecio madagasceriensis*), and the occasional pine (*Pinus* sp.) tree (Figure 11). These grazing lands are interrupted occasionally by moderately-sloped *mauka*/*makai* oriented outcroppings of exposed *pāhoehoe* bedrock containing the rare occurrence of *pūkiawe* (*Styphelia tameiameiae*) amongst scattered boulders that remain exposed to the elements (Figure 12).



Figure 8. Example of gentle to steep *makai* (northwest) slope towards the western boundary of the project area adjacent to Kekaulike Avenue, view to the northeast



Figure 9. Meandering cattle trails and dugouts are scattered about the rolling pastures, intermittently dissected by numerous drainage channels of varying depth; view to the southeast.



Figure 10. Vegitation consists of low-lying *kikuyu* (*Pennisetum clandestinum*), apple of Sodom (*Solanum linnaeanum*), fireweed (*Senecio madagasceriensis*), and pine (*Pinus* sp.) tree; view to the north.



Figure 11. Example of occasional outcroppings of exposed *pāhoehoe* bedrock containing the rare occurrence of *pūkiawe* (*Styphelia tameiameiae*); view to the northwest.

Variance in the vegetative pattern exists almost exclusively along the edges and throughout the interior slopes of Keāhuaiwi Gulch, which roughly bisects the project area, as well as along and within a fairly pronounced branch gulch that adjoins Keāhuaiwi in the *mauka* third of the project area. Despite the presence of not only Keāhuaiwi Gulch, a relatively large branch gulch, and several minor drainages, none were flowing at the time of the current study and there are no active perennial freshwater sources within the project area. The tree canopy in the vicinity of Keāhuaiwi and the primary branch gulch consists of relatively dense overstories of mature and juvenile non-native Australian black and silver wattle (*Acacia mearnsii* and *Acacia dealbata*, respectively) trees which have largely shaded out the underbrush except for hearty dense thickets of wild sawtooth blackberry (*Rubus argutus*) and bigpod ceanothus (*Ceanothus megacarpus*) shrubs, resulting in a ground surface generally devoid of vegetation (Figure 13). In the shade of the fringe canopy, a highly eroded ground surface of silty soil and the occasional loose *pāhoehoe* cobble and boulder of varying sizes are exposed; the result of intensive trampling by axis deer (*Axis axis*) which has greatly contributed to the erosion of the *kula* lands directly flanking Keāhuaiwi and its interior slopes.

An additional topographic anomaly occurs in the southern central portion of the project area where a *puʻu* (hill), Puʻu Maho, intrudes slightly into the boundary, sloping steeply north and northwest into the pasture. This *puʻu* is nearly concealed by thick overgrowths of black and silver wattle trees with a ground surface nearly entirely buried in fallen tree trunks and overgrowths of thorny blackberries. Much of the southern and northern boundaries of the project area are marked by systematically planted linear configurations of mature Eucalyptus (*Eucalyptus* sp.) trees that were likely planted at the conception of Erehwon Ranch to demarcate its boundaries.

Modern land disturbance is quite evident throughout the majority of the project area in the ground surface which is largely absent of cobbles and exhibits signs of having been previously chain-dragged and mechanically altered for grazing purposes. Additionally, networks of paddocks fenced in wooden posts, t-posts, and barbed wire, delineate modern grazing areas and also line the western, southern, and much of the eastern project area boundaries

where Eucalyptus trees are not present. There are several cattle troughs throughout the property with a few accompanying watercathcment systmes with galvanized and pvc waterlines transporting water across the pastures to select cattle troughs. Modern rubbish consiting of torn peices of shade cloth, metal debris and fencing materials as well as glass water jugs are found throughout the property. A single unpaved road enters the property from Kekaulike Avenue, proceeding mauka to the Kula Forest Reserve. For the most part the road is visible by the deep swells created by the tire tracks where it crosses over erroding red dirt hills covered in forgaging grass. Other portions of the road cross over fairly level pasture lands with a single crossing near the von Tempsky residence (Figure 14) over exposed bedrock across a low area in the gulch which bisects the property.Off of the main access roadseveral roads branched off to access opposite ends of the property with numberous ranch gates along the way. In the mauka portions of the project area several isolated plantings of peaches, apples, figs which appeareared to have been without anykind of recent maintenece were crossed



Figure 12. Trampled ground surface beneath a grove of young wattle trees along southern edge of Keāhuaiwi Gulch, view to the northwest.



Figure 13. View of von Tempsky residence from the project area, view to the northwest.

2. BACKGROUND

As specified in the OEQC *Guidelines for Assessing Cultural Impacts* (OEQC 1997:1),"…the geographical extent of the inquiry should, in most instances, be greater than the area over which the proposed action will take place. This is to ensure that cultural practices which may not occur within the boundaries of the project area, but which may nonetheless be affected, are included in the assessment." For this CIA, the *ahupua'a* of Kamehamenui and Kealahou 3 & 4 is considered the 'study area', while the location of the proposed development activities is referred to as the 'project area'.

To generate a set of expectations regarding the nature of cultural resources and customary practices that might be encountered within the current project area and to establish a context within which to assess the significance of such resources, the background section begins with a general culture-historical context. This is followed by culture-historical background information concerning the history of Kamehamenui and Kealahou 3 & 4 . Limited background information for Kula, the broader regional designation in which Kamehamenui and Kealahou 3 & 4 is situated, also falls within the parameters of the OEQC guidelines and ensures that a broader set of cultural practices and histories are considered. Following this background section is a discussion of relevant prior archaeological and cultural studies that have been conducted within and in the immediate vicinity of the project area.

RESEARCH METHODS

The culture-historical context and summary of previously conducted archaeological and cultural research presented below are based on original research conducted by ASM Affiliates at various physical and digital repositories. Primary English language and Hawaiian language resources were found at multiple state agencies, including the State Historic Preservation Division, Hawai'i State Archives, and the Department of Accounting and General Services Land Survey Division. Digital collections provided through the Office of Hawaiian Affairs Papakilo and Kīpuka databases, Waihona 'Āina, the Ulukau Hawaiian Electronic Library, and Newspapers.com were also reviewed as part of this study. Lastly, secondary resources curated at ASM Affiliates' Hilo office offer general information regarding the history of land use, politics, and culture change in Hawai'i, enhancing the broad sampling of source materials cited throughout this CIA.

CULTURE-HISTORICAL CONTEXT

While the question of when Hawai‘i was first settled by Polynesians remains contested, scholars working in the fields of archaeology, folklore, Hawaiian studies, and linguistics have offered several theories. With advances in palynology and radiocarbon dating techniques, Kirch (2011), Athens et al. (2014), and Wilmshurst et al. (2011) have argued that Polynesians arrived in the Hawaiian Islands sometime between A.D. 1000 and A.D. 1200. This initial migration on intricately crafted *wa‘a kaulua* (double-hulled canoes) to Hawai‘i from Kahiki, the ancestral homelands of Hawaiian deities and peoples from southern Pacific islands, occurred at least from initial settlement to the 13th century. According to Fornander (1969), Hawaiians brought from their homeland certain Polynesian customs and beliefs: the major gods Kāne, Kū, Lono, and Kanaloa (who have cognates in other Pacific cultures); the *kapu* system of political and religious governance; and the concepts of *pu‘uhonua* (places of refuge), *‘aumakua* (ancestral deity), and *mana* (divine power). Archaeologist Kenneth Emory who worked in the early to mid-20th century reported that the sources of early Hawaiian populations originated from the southern Marquesas Islands (Emory in Tatar 1982). However, Emory’s theory is not universally accepted, as Hawaiian scholars in the past and present have argued for a pluralistic outlook on ancestral Hawaiian origins from Kahiki (Case 2015; Fornander 1916-1917; Kamakau 1866; Kikiloi 2010; Nakaa 1893; Poepoe 1906).

Although stories of episodic migrations were widely published in the Hawaiian language by knowledgeable and skilled *kū‘auhau* (individuals trained in the discipline of remembering genealogies and associated ancestral stories), the cultural belief that living organisms were *hānau ‘ia* (born) out of a time of eternal darkness (*pō*) and chaos (*kahuli*) were brought and adapted by ancestral Hawaiian populations to reflect their deep connection to their environment. As an example, the *Kumulipo*, Hawai‘i’s most famed *ko‘ihonua* (a cosmogonic genealogical chant), establishes a birth-rank genealogical order for all living beings (Beckwith 1951; Liliuokalani 1978). One such genealogical relationship that remains widely accepted in Hawai‘i is the belief that *kalo* (taro) plants (in addition to all other plants, land animals, and sea creatures), are elder siblings to humans (Beckwith 1951). This concept of hierarchical creation enforces the belief that all life forms are intimately connected, evidencing the cultural transformations that occurred in the islands through intensive interaction with their local environment to form a uniquely Hawaiian culture.

In Hawai‘i’s ancient past, inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy et al. 1991). Following the initial settlement period, communities clustered in the *ko‘olau* (windward) shores of the Hawaiian Islands where freshwater was abundant. Sheltered bays allowed for nearshore fisheries (enriched by numerous estuaries) and deep-sea fisheries to be easily accessed (McEldowney 1979). Widespread environmental modification of the land also occurred as early Hawaiian *mahi‘ai* (farmers) developed new subsistence strategies, adapting their familiar patterns and traditional tools to work efficiently in their new home (Kirch 1985; Pogue 1978). Areas with the richest natural resources became heavily populated over time, resulting in the population’s expansion to the *kona* (leeward) side of the islands and to more remote areas (Cordy 2000).

Overview of Traditional Hawaiian Land Management Strategies

Adding to an already complex society was the development of traditional land stewardship systems, including the *ahupua‘a.* The *ahupua‘a* was the principal land division that functioned for both taxation purposes and furnished its residents with nearly all subsistence and household necessities. *Ahupua‘a* are land divisions that typically include multiple ecozones from *mauka* (upland mountainous regions) to *makai* (shore and near-shore regions), assuring a diverse subsistence resource base (Hommon 1986). Although the *ahupua‘a* land division typically incorporated all of the eco-zones, their size and shape varied greatly (Cannelora 1974). Noted Hawaiian historian and scholar Samuel Kamakau summarized the ecozones that could be found in a given *ahupua‘a*:

> Here are some names for [the zones of] the mountains—the *mauna* or *kuahiwi*. A mountain is called a *kuahiwi*, but *mauna* is the overall term for the whole mountain, and there are many names applied to one, according to its delineations (*‘ano*). The part directly in back and in front of the summit proper is called the *kuamauna*, mountaintop; below the *kuamauna* is the *kuahea*, and makai of the *kuahea* is the *kuahiwi* proper. This is where small trees begin to grow; it is the *wao nahele*. Makai of this region the trees are tall, and this is the *wao lipo*. Makai of the *wao lipo* is the *wao ‘eiwa*, and makai of that the *wao ma‘ukele*. Makai of the *wao ma‘ukele* is the *wao akua*, and makai of there is the *wao kanaka*, the area that people cultivate. Makai of the *wao kanaka* is the *‘ama‘u*, fern belt, and makai of the *‘ama‘u* the *‘apa‘a*, grasslands.
>
> A solitary group of trees is a *moku la‘au* (a “stand” of trees) or an *ulu la‘au*, grove. Thickets that extend to the *kuahiwi* are *ulunahele*, wild growth. An area where *koa* trees suitable for canoes (*koa*

> *wa'a*) grow is a *wao koa* and mauka of there is a *wao la'au*, timber land. These are dry forest growths from the *'apa'a* up to the *kuahiwi*. The places that are "spongy" (*naele*) are found in the *wao ma'ukele*, the wet forest.
>
> Makai of the *'apa'a* are the *pahe'e* [*pili* grass] and *'ilima* growths and makai of them the *kula*, open country, and the *'apoho* hollows near to the habitations of men. Then comes the *kahakai*, coast, the *kahaone*, sandy beach, and the *kalawa*, the curve of the seashore—right down to the *'ae kai*, the water's edge.
>
> That is the way *ka po'e kahiko* [the ancient people] named the land from mountain peak to sea. (Kamakau 1976:8-9)

The *maka'āinana* (commoners, literally the "people that attend the land") who lived on the land had rights to gather resources for subsistence and tribute within their *ahupua'a* (Jokiel et al. 2011). As part of these rights, residents were required to supply resources and labor to *ali'i* (chiefs) of local, regional, and island chiefdoms. The *ahupua'a* became the equivalent of a local community with its own social, economic, and political significance and served as the taxable land division during the annual *Makahiki* procession (Kelly 1956). During the time of *Makahiki*, the paramount *ali'i* sent select members of his/her retinue to collect *ho'okupu* (tribute and offerings) in the form of goods from each *ahupua'a*. The *maka'āinana* brought their share of *ho'okupu* to an *ahu* (altar) that was marked with the image of a *pua'a* (pig), serving as a physical visual marker of *ahupua'a* boundaries. In most instances, these boundaries followed mountain ridges, hills, rivers, or ravines (Alexander 1890). However, Chinen (1958:1) reports that "oftentimes only a line of growth of a certain type of tree or grass marked a boundary; and sometimes only a stone determined the corner of a division." These ephemeral markers, as well as their more permanent counterparts, were oftentimes named as evidenced in the thousands of boundary markers names that are listed in Soehren (2005).

Ahupua'a were ruled by *ali'i 'ai ahupua'a* or chiefs who controlled the *ahupua'a* resources. Generally speaking, *ali'i 'ai ahupua'a* had complete autonomy over the *ahupua'a* they oversaw (Malo 1951). *Ahupua'a* residents were not bound to the land nor were they considered property of the *ali'i*. If the living conditions under a particular *ahupua'a* chief were deemed unsuitable, the residents could move freely in pursuit of more favorable conditions (Lam 1985). This structure safeguarded the well-being of the people and the overall productivity of the land, lest the chief loses the principal support and loyalty of his or her supporters. In turn, *ahupua'a* lands were managed by an appointed *konohiki*, oftentimes a chief of lower rank, who oversaw and coordinated stewardship of an area's natural resources (Lam 1985). In some places, the *po'o lawai'a* (head fisherman) held the same responsibilities as the *konohiki* (Jokiel et al. 2011). When necessary, the *konohiki* took the liberty of implementing *kapu* (restrictions and prohibitions) to protect the *mana* of an area's resources from environmental and spiritual depletion.

Many *ahupua'a* were divided into smaller land units termed *'ili* and *'ili kūpono* (often shortened to *'ili kū*). *'Ili* were created for the convenience of the *ahupua'a* chief and served as the basic land unit which *hoa'āina* (caretakers of particular lands) often retained for multiple generations (Jokiel et al. 2011; MacKenzie 2015). As *'ili* were typically passed down in families, so too were the *kuleana* (responsibilities, privileges) that were associated with it. The right to use and cultivate *'ili* was maintained within the *'ohana*, regardless of the succession of *ali'i 'ai ahupua'a* (Handy et al. 1991). Malo (1951) recorded several types of *'ili*, including the *'ili pa'a* (a single intact parcel) and *'ili lele* (a discontinuous parcel dispersed across an area). Whether dispersed or wholly intact, *'ili* required a cross-section of available resources, and for the *hoa'āina*, this generally included access to agriculturally fertile lands and coastal fisheries. *'Ili kūpono* differed from other *'ili* lands because they did not fall under the jurisdiction of the *ahupua'a* chief. Rather, they were specific areas containing resources that were highly valued by the ruling paramount chiefs, such as fishponds (Handy et al. 1991).

Ali'i 'ai ahupua'a, in turn, answered to an *ali'i 'ai moku* (chief who claimed the abundance of the entire *moku or* district) (Malo 1951). The island of Maui is comprised of twelve *moku* (districts) that include Ka'anapali, Lāhainā, Wailuku, Kula, Honua'ula, Kahikinui, Kaupō, Kipahulu, Hāna, Ko'olau, Hāmākua Loa, and Hāmākua Poko. Although a *moku* comprises multiple *ahupua'a*, *moku* were considered geographical subdivisions with no explicit reference to rights in the land (Cannelora 1974). While the *ahupua'a* was the most common and fundamental land division unit within the traditional Hawaiian land management structure, variances occurred, such as the existence of the *kalana*. By definition, a *kalana* is a division of land that is smaller than a *moku. Kalana* was sometimes used interchangeably with the term *'okana* (Lucas 1995; Pukui and Elbert 1986), but Kamakau (Kamakau 1976) equates a *kalana* to a *moku* and states that *'okana* is merely a subdistrict. Despite these contending and sometimes conflicting definitions, what is clear is that *kalana* consisted of several *ahupua'a* and *'ili 'āina*.

This form of district subdividing was integral to Hawaiian life and the product of advanced natural resource management systems. As populations resided in an area over the centuries, direct teaching and extensive observations of an area's natural cycles and resources were retained, well-understood, and passed down orally over the generations. This knowledge informed management decisions that aimed to sustainably adapt subsistence practices to meet the needs of growing populations. The *ahupua'a* system and the highly complex land management system that developed in the islands are but one example of the unique Hawaiian culture that developed in these islands.

Intensification and Development of Hawaiian Land Stewardship Practices

Hawaiian philosophies of life in relation to the environment helped to maintain both natural, spiritual, and social order. In describing the intimate relationship that exists between Hawaiians and *'āina* (land), Kepā Maly writes:

> In the Hawaiian context, these values—the "sense of place"—have developed over hundreds of generations of evolving "cultural attachment" to the natural, physical, and spiritual environments. In any culturally sensitive discussion on land use in Hawai'i, one must understand that Hawaiian culture evolved in close partnership with its' natural environment. Thus, Hawaiian culture does not have a clear dividing line of where culture and and nature begins.
>
> In a traditional Hawaiian context, nature and culture are one in the same, there is no division between the two. The wealth and limitations of the land and ocean resources gave birth to, and shaped the Hawaiian world view. The *'āina* (land), *wai* (water), *kai* (ocean), and *lewa* (sky) were the foundation of life and the source of the spiritual relationship between people and their environs. (Maly 2001)

The *'ōlelo no'eau* (proverbial saying) "*hānau ka 'āina, hānau ke ali'i, hānau ke kanaka*" (born was the land, born were the chiefs, born were the commoners), conveys the belief that all things of the land, including *kanaka* (humans), are connected through kinship links that extend beyond the immediate family (Pukui 1983:57). *'Āina* or land, was perhaps most revered, as noted in the *'ōlelo no'eau* "*he ali'i ka 'āina; he kauwā ke kanaka,*" which Pukui (Pukui 1983:62) translated as "[t]he land is a chief; man is its servant." The lifeways of early Hawaiians, which were dependent entirely from the finite natural resources of these islands, necessitated the development of sustainable resource management practices. Over time, what developed was an ecologically responsive management system that integrated the care of watersheds, natural freshwater systems, and nearshore fisheries (Jokiel et al. 2011).

Disciplined and astute observation of the natural world became one of the most fundamental stewardship tools used by the ancient Hawaiians. The vast knowledge acquired through direct observation enabled them to detect and record the subtlest of changes, distinctions, and correlations in the natural world. Examples of their keen observations are evident in the development of Hawaiian nomenclature to describe various rains, clouds, winds, stones, environments, flora, and fauna. Many of these names are geographically unique or island-specific, and have been recorded in *oli* (chants), *mele* (songs), *pule* (prayers), *inoa 'āina* (place names), and *'ōlelo no'eau* (proverbial sayings). Other Hawaiian arts and practices such as *hula* (traditional dance), *lapa'au* (traditional healing), *lawai'a* (fishing), *mahi'ai* (farming) further aided in the practice of knowing the rhythms and cycles of a particular place.

Comprehensive systems of observing and stewarding the land were coupled by the strict adherence to practices that maintained and enhanced the *kapu* and *mana* of all things in the Hawaiian world. In Hawaiian belief, all things natural, places, and even people, especially those of high rank, possessed *mana* or "divine power" (Pukui and Elbert 1986:235; Pukui et al. 1972). *Mana* was believed to be derived from the plethora of Hawaiian gods (*kini akua*) who were embodied in elemental forces, land, natural resources, and certain material objects and persons (Crabbe et al. 2017). Buck (1993) expanded on this concept noting that *mana* was associated with "the well-being of a community, in human knowledge and skills (canoe building, harvesting) and in nature (crop fertility, weather etc.)" (c.f. Else 2004:244).

To ensure the *mana* of certain resources, places, and people, *kapu* of various kinds were implemented and strictly enforced to limit over-exploitation and defilement. Elbert and Pukui (1986:132) defined *kapu* as "taboo, prohibitions; special privilege or exemption." Kepelino noted that *kapu* associated with *akua* (deities) applied to all social classes, while *kapu* associated with *ali'i* were applied to the people (in Beckwith 1932). As *kapu* dictated social relationships, they also provided "environmental rules and controls that were essential for a subsistence economy" (Else 2004:246). The companion to *kapu* was *noa*, translated as "freed of taboo, released from restrictions, profane, freedom" (Pukui and Elbert 1986:268). Some *kapu*, particularly those associated with maintaining social hierarchy and gender differentiation were unremitting, while those *kapu* placed on natural resources were applied and enforced according to seasonal changes. The application of *kapu* to natural resources

ensured that such resources remained available for future use. When the *ali'i* or the lesser chiefs (including *konohiki* and *po'o lawai'a*) determined that a particular resource was to be made available to the people, a decree was proclaimed indicating that *kapu* had been lifted, thereby making it *noa*. Although transitioning a resource from a state of *kapu* to *noa* allowed for its use, people were expected to practice sustainable harvesting methods and pay tribute to the paramount chief and the *akua* associated with that resource. *Kapu* were strictly enforced and violators faced serious consequences including death (Jokiel et al. 2011). Violators who escaped execution sought refuge at a *pu'uhonua*, a designated place of refuge or an individual who could pardon the accused (Kamakau 1992). After completing the proper rituals, the violator was absolved of his or her crime and allowed to reintegrate back into society.

In summary, the layering and interweaving of beliefs, land stewardship practices, and the socio-political system forms the basis of the relationship shared between the Hawaiian people and the land. It is through the analysis of these dynamic elements that we develop an understanding of the complexity of place.

CULTURE HISTORICAL CONTEXT OF KAMEHAMENUI AND KEALAHOU

The project area extends across the *ahupua'a* of Kamehamenui and Kealahou 3rd and 4th which are three of approximately seventeen *ahupua'a* that make up the expansive Kula District. The name Kamehamenui is sometimes referred to in the historical record as Kamehame 1st and is sometimes spelled Kamehame Nui (*lit.* large Kamehame). This *ahupua'a* name is derived from the endemic *Antidesma sp*. of tree known in Hawaiian by several names including *hame*, *hamehame*, *mehamehame*, *ha'a*, and *ha'āmaile* (Bishop Museum 2021). There are two known *Antidesma* species in the Hawaiian Islands, *A. platyphyllum* which is commonly found in mesic to wet forests between the 150-1,525 meter elevation, and *A. pulvinatum* which is found in dry to mesic forests between the 30-1,220 meter elevation (Wagner et al. 1999). According to Malcolm N. Chun, different parts of the *hame* plant were utilized medicinally and sometimes mixed with other plant parts to treat ailments such as nausea, vomiting, ulcers, and scrofulous sores (Chun in Bishop Museum 2021). In addition to its medicinal value, the fruit and bark of the *hame* tree were traditionally used to dye *kapa* in shades of reds and purples, and the hardwood was used as house framing and for making *kua* (anvil) used in *kapa* making (Abbott 1992; Krauss 1993; Rock 1913).

Whereas Kamehamehanui comprises the north half of the project area, the southern half encompasses a portion of Kealahou Ahupua'a whose name has been translated by (Pukui et al. 1974:101) as "the new pathway." The *ahupua'a* of Kealahou, which lies between Kamehamenui and Waiakoa, was divided into four relatively narrow strips of land, and the project area encompasses that portion identified as Kealahou 3rd and 4th (see Figure 2).

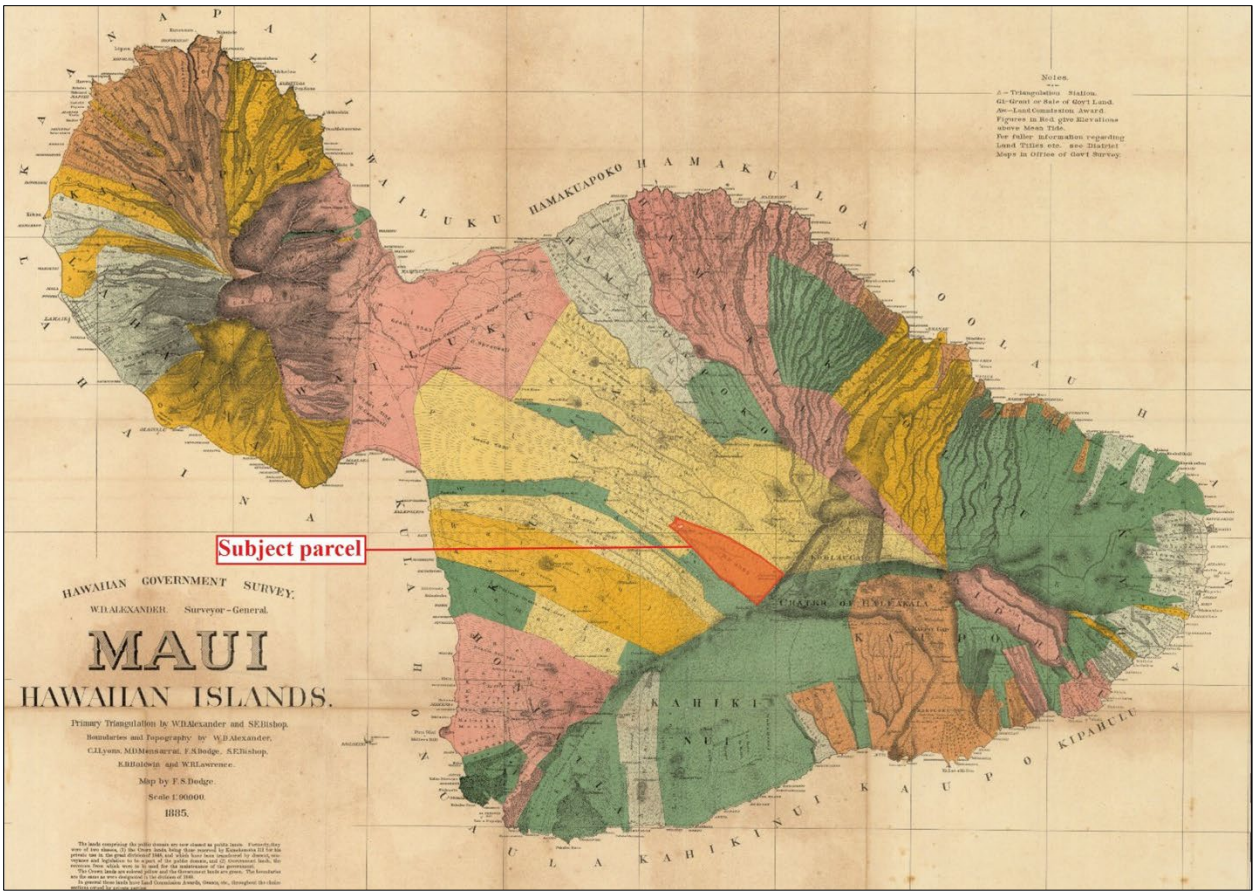


Figure 14. Hawai‘i Registered Map 1268 by F. S. Dodge from 1885 showing subject parcel within Kula District (Dodge 1885).

Kamehamenui and Kealahou are situated in the traditional *moku* of Kula (see Figure 15), whose name has been translated as “plain” and is one of twelve traditional *moku* that make up the island of Maui (King 1935; Pukui et al. 1974:123). In expanding on the historical use of the term *kula*, Lucas (1995:60) adds that it is “...the open country back from the sea; the name of the region of a mountain near its base,” and that it also refers to “any open uncultivated land; a field for cultivation; a pasture...” that was distinct from wet or meadowland. According to Robert D. King (1935:216), the Principal Cadastral Engineer of the Territory of Hawai‘i, in 1859 “...for taxation, educational, and judicial purposes...”, the *moku* boundaries were adjusted and the Kula District was renamed the Makawao District. In providing a general description of Kula, Handy et al. explain:

> Kula is the *‘okana* [sub-district] directly north of Honua‘ula, and occupies most of the central plain of Maui, created by the joining of the two volcanic domes of West and East Maui. *Kula* means open country, or plain as distinct from valley or stream bottom, and has long been used as a term to distinguish between dry, or “*kula* land.” and “wet-taro land.” This is an essential characteristic of Kula, the central plain of Maui which is practically devoid of streams.
>
> Kula was always an arid region, through its long, low seashore, vast stony *kula* lands, and broad uplands. Both on the coast, where fishing was good, and on the lower westward slopes of Haleakalā a considerable population existed. So far as we could learn Kula supported no Hawaiian taro, and the fisherman in this section must have depended for vegetable food mainly on *poi* brought from the wet lands of Waikapu and Wailuku to westward across the plain to supplement their usual sweet-potato diet. In recent times, however, Chinese taro has been raised at a considerable elevation. Kula was widely famous for its sweet potato plantations. *‘Uala* was the staple of life here. (Handy et al. 1991:510-511)

Furthermore, Handy et al. add that:

> All the country below the west and south slopes of Haleakala, specifically Kula, Honua‘ula, Kahikinui, and Kaupo, in old Hawaiian times depended on the sweet potato. The leeward flanks of Haleakala were not as favorable for dry or upland taro culture...However, some upland taro was grown, up to an altitude of 3,000 feet. A few such small patches belonging to cowboys were visited in 1931. But there never were extensive upland plantations here...The prevalence of prayers invoking rain and the existence at ‘Ulupalakua of a rain cult evidence a scarcity of enough rain even for the sweet-potato crops. There was excellent deep-water fishing available to the folk of Kula and Honua‘ula...(Handy et al. 1991:276)

Precontact populations in the vicinity of the project area were believed to be significant. Handy and Handy (1972:272) state that “[O]n the south coast of Maui, from Kula to ‘Ulupalakua, a consistently dry and lava-strewn country...was a notable area for sweet potato, which, combined with the fishing, must have supported a sizable population...”

Traditional Agricultural Practices

As evidenced in Handy et al.’s (1991) description, *‘uala* (sweet potatoes) were an important staple crop to the native inhabitants of this region. In the Kula District, where perennial streams are absent, dryland horticultural techniques were employed and the native farmers often constructed stone and earth embankments, practiced crop rotation, and relied upon rainfall to irrigate their dryland fields (Kolb 1997). Malo (1951) points out that farming *kula* land was fraught with many challenges and goes on to note some of the methods the ancient planters employed for successful yields. Malo writes:

> 3. On the *kula* lands, farming was a laborious occupation and called for great patience, being attended with many drawbacks. On some of these were grubs, or caterpillars, or blight, *hauoki* (frost), of *kahe* (freshets), or the sun was too scorching; besides which there were many other hindrances.
>
> 8. The cultivation of *kula* lands was quite different from that of irrigable lands. The farmer merely cleared of weeds as much land as he thought would suffice. If he was to plant *taro* (upland *taro*), he dug holes and enriched them with a mulch of *kukui* leaves, ashes, or dirt, after which he planted the *taro*. In some places they simply planted without mulch or fertilizer.
>
> 10. If a field of potatoes was desired, the soil was raised into hills, in which the stems were planted; or the stems might merely be thrust into the ground any how, and the hilling done after the plants were grown; the vines were also thrown back upon the hill. In six months the potatoes were ripe. Such was the cultivation of the *kula* land. (Malo 1951:204-205)

According to Malo (1951), *‘uala* (sweet-potato) was the primary crop grown in the *kula* regions and because of the prolonged dryness, the people of these lands frequently suffered from famine. Despite the difficult environmental conditions, the Kula natives labored diligently all while transforming once forested areas into arable fields. Kolb and O‘Claray (in Kolb et al. 1997:45) provide some idea of the cultivation pratices observed by the native farmers:

> In ancient times, cultivating sweet potato was a critical component of the upcounty field system, and a laborious and demanding task. The first step of cultivation was to clear a planting area. A sweet potato patch required arable soil free from other plants, and since Kula was an open forested aera, this required that planting occurred either in a forest clearning or that a section of forest had to be cleared of existing vegetation. Vegetation and trees were cut and then burned in order to help fertilize the soil. We assume that after a number of plantings when soil nutrients became depleated, gardens were abandoned and left to become fallow for ten to twenty years before being cleared again...Thus cleared garden areas (*mala*) were probably rotated routinely through an areas of forest of secondary growth in a shifting fashion.

Once an area was cleared, sweet potatoes were planted using specific methods suitable to the local environmental conditions. One such method recorded by (Kamakau 1976) was known as *malo‘eka* (lit. dirty loin cloth), in which the farmer built large bonfires so that the smoke cloud would shelter the patch from the heat of the sun. This method made the planters exceptionally dirty, covering them with dirt and smoke. In the wetter areas, native planters utilized a method known as *ha‘aheo* (proud), likely a reference to the ease of cultivation in areas with ample rainfall (Kolb and O‘Claray in Kolb 1997). In addition to the methods described above, the native planters also constructed features such as terraces to help with soil retention, channel and absorb water run-off, or to delineate individual plots (Handy et al. 1991; Kamakau 1992; Kuykendall 1938).

The people of Kula spent so much of their time in the uplands that they became known for their ignorance in marine subsistence acvities. Such ideas are evident in several *ʻōlelo noʻeau* including "*O Kula i ka hoe hewa,*" translated as "Kula of the ignorant canoe paddler" which was said as a pun about how those of Kula "did not know how to paddle canoes because they were uplanders" (Pukui 1983:270). Another saying, "*Kula unahi pikapika heʻe*" translates as "Kula people, scalers of the suckers on the tentacles of the octopus" which according to Pukui (1983:205) was:

> said in fun of the people of Kula, Maui. A Kula chiefess who lived inland did not know what the suckers on an octopus were and tried to scale them as one scales a fish."

Lastly, Pukui (1983:255) recorded yet another saying, "*No Kula ia poʻe ke hoe hewa nei"* which translates as "To Kula belong the people who are such poor paddlers." Aside for the perceived ignorance in coastal subsistence activities, the native farmers of Kula took great length to develop place-based agricultural practices—practices that would carry them well into the 19th century and afford opportunities for native farmers to participate in the market economy.

Traditional Moʻolelo of Kamehamenui and Kealahou Ahupuaʻa and the Greater Kula District

Moʻolelo offers rich resources for understanding the cultural landscape, land use, and practices of an area. They are another source of history that informs our understanding of how peoples of the past expressed their relationships to their lands and environment. An exhaustive search through published resources and historical Hawaiian language newspapers resulted in no *moʻolelo* that explicitly named the *ahupuaʻa* of Kamehamenui or Kealahou. However, there are a few *moʻolelo* that speak of events that take place in the broader *moku* of Kula, which area summarized below.

The Legend Concerning the Battle of the Owls and the Massacre of the People and Chiefs of Maui

A traditional account published by W. H. Uaua in the June 29th, 1871 edition of the Hawaiian language newspaper, *Ke Au ʻOkoʻa* relates the story of ʻAʻapueo, a mother owl who hailed from Kula, who along with her husband, Pueokaia and how they exacted revenge on the men and chiefs of Wailuku after they had committed cruel acts against their owl children (Uaua 1871). Presented below is a translated summary of Uaua's published account.

This tale concerns two *pueo* (owls), ʻAʻapueo and her mate Pueokaia, who planned a raid on the men and chiefs of Wailuku to exact their revenge on the cruel acts against their children. The story begins with the wife of a man named Kapoʻi. The woman, who is unnamed in this story traveled to the plains of Papalekailiu and upon reaching Pohaku O Makaku discovered a large rock called Alaha, which was situated near the boundary of Hamakuapoko. There at Alaha, the woman discovered an owl nest with seven eggs nestled within. She removed all the eggs and returned home to her husband in Kaimuheʻe above the famous waters of Kanuha and Mauai in Wailuku and told her husband of her findings. Meanwhile, back at Alaha, ʻAʻapueo, the mother owl from Kula, discovered that her eggs were missing and frantically searched for them. ʻAʻapueo eventually found her eggs in the hands of Kapoʻi and begged him to return them.

"Kapoi, those eggs are mine, return them," to which he replied, "How many eggs did you have?" ʻAʻapueo, responded "seven" and with heartless intent, Kapoʻi smashed her eggs on a rock wall, leaving nothing but shattered shells and yolks for ʻAʻapueo. ʻAʻapueo flew to the wall where her eggs had been destroyed and wept. She picked up the broken shells and yolks and hurried back to her husband, Pueokaia, who lived on a hill in the uplands of Awau near the Wailuku River. Upon arriving home, she told her husband of the callous deeds of Kapoʻi and revealed to him the remnants of what was left of her eggs.

Furious, Pueokaia traveled to each island from Hawaiʻi to Kauaʻi to enlist the help of his fellow owls to exact their revenge on Kapoʻi. The owls from Hawaiʻi heeded Pueokaia's cry for help and those owls from Hilo, Puna and Kaʻū gathered in Hana at a place called Kapueokahi, and the owls from Kona, Kohala, and Hāmākua gathered at Puʻupueo in Kīpahulu. Meanwhile, ʻAʻapueo gathered the owls of Oʻahu where they met at Kaulanaakapueo in Makapuʻu and showed them the broken shells. Agreeing to help, the owls waited there at Makapuʻu as she traveled to Kauaʻi to summon all the owls of that island, upon which the news of this gathering reached the island of Niʻihau and swiftly those owls flew to Kauaʻi. Once the owls of Kauaʻi and Niʻihau heard the pleas of ʻAʻapueo they quickly traveled to Oʻahu to meet with the others that waited at Kaulanaakapueo in Makapuʻu and together the flock traveled to Molokaʻi, Lānaʻi, and Kahoʻolawe. With every owl from Molokaʻi to Kauaʻi, ʻAʻapueo led them to Manawaipueo to meet with the owls of East and West Maui. It was said that their numbers filled the sky and shut out the sun's light. The owls led their attack and slaughtered many men, including chiefs, from *Nā Wai ʻEhā*.

Amongst those that were killed were the perpetrators responsible for the attack, Kapoʻi, and his wife. This great battle between men and owls was commemorated in the naming of Wailuku (Uaua 1871).

The Legend of Kawaunuiaola

Fornander (1916-1917) recorded the following account which tells the story of a cunning woman named Kawaunuiaola from Kula and her crafty efforts to lure her husband, Hoeu, back into her life. Having lived together for some time, Hoeu left Kawaunuiaola and took unto himself another wife. Overcome with sadness after her husband had left her, Kawaunuiaola placed a *kapu* around her home and isolated herself. Living in total isolation, the cunning woman devised a plan. At mealtime, she would petition her husband, as her god, where she offered the following words:

Eia ka ai e Hoeu,	Here is the food Hoeu,
Eia ka ia	Here is the fish,
Eia ka wai,	Here is the water,
Amama ua noa,	Accept them all, they are free from restrictions.

After she uttered these words, she would have the following conversation but would reply in a different voice:

E ai paha wau?	May I eat?
O ai paha.	You may.
O kuu wahi ai hea la auanei?	Which food shall it be?
E Laalaawale.	Say, Laalaawale,
O ko waho ai hea auanei?	Which food shall it be?
O ko wahi poi paha.	Shall it be your poi?
O ai hoi ha	Proceed and partake of the food

In addition to her conversations, the woman also prayed each night for her husband's return. Passerbys would hear Kawaunuiaola having this conversation and soon people began to suspect that she had taken a new husband. Rumors of Kawaunuiaola having another husband quickly spread and soon reached Hoeu in the following manner:

> Say, Hoeu, your wife, Kawaunuiaola acts in a strange very strange way; she must have obtained a new husband, for we have heard two voices talking; one in the voice of a female and the other in the voice of a man. It must be a new husband. (Fornander 1916-1917:554)

When Hoeu heard these words, he deserted the woman he was living with and returned to Kula and inquired with Kawaunuiaola about the rumors, which she denied. Soon the couple made up and Hoeu and Kawaunuiaola lived on as husband and wife (Fornander 1916-1917).

Winds, Rains Associated with Kamehamenui and the Greater Kula District

In addition to the *moʻolelo* summarized above, the following narratives and subsequent *ʻōlelo noʻeau* (proverbial sayings; listed in Table 1) relate information about the *makani* (winds) and *ua* (rains) of Kamehamenui and the broader Kula region. Such knowledge evidences the long-term relationship of the district communities to their immediate environment. Native Geographer Katrina-Ann R. Kapāʻanaokalāokeola Nākoa Oliveira offers a concise description regarding the natural environment as it was understood by Native Hawaiians of the past:

> Ancestral Kānaka recognized the connection between the heavens, lands, and oceans and how all three were interconnected and interdependent upon one another. In spite of the interwoven nature of the sky, land, and sea, however, Kānaka of ancestral times did not have a term that directly translates to what we have come to know today as "environment." Rather, the *Hawaiian Dictionary* offers two phrases that approximate the notion of environment: (1) "ʻano o ka nohona" and (2) "nā mea e hoʻopuni ana." ʻAno o ka nohona refers to the nature of one's relationship to one's surroundings or places. Nā mea e hoʻopuni ana relates to everything that surrounds or encircles a person. (Oliveira 2014:64)

Reacquainting ourselves with such information allows us to appreciate and understand the local environment as it was once observed by ancetral Hawaiian populations.

Winds of Kula Described in He Kaʻao no Pakaʻa

Natural features such as winds and rains are well documented in historical literature and compositions one of which includes the story title *He Kaʻao no Pakaʻa* penned by Fornander (1918-1919). This legendary account concerns a man named Pakaʻa, who was a respected servant of Keawenuiaʻumi, a chief of Hawaiʻi Island. As a valued advisor

to the king, he had the duty of caring for the king's possessions and his double hauled canoe, and whatever Pakaʻa advised, the king obeyed. Pakaʻa's brother, Lapakahoe also served as an advisor in the chief's royal court. Pakaʻa kept a special gourd calabash called Laʻamaomao, which he named after his mother, who during her lifetime had developed a special relationship with the winds. Within this special container were her bones and Pakaʻa would call upon her to summon the power of the winds. While Pakaʻa was serving under Keawenuiaʻumi, two men Hoʻokeleihilo and Hoʻokeleipuna joined the court and Pakaʻa soon found himself being mistreated by the king. His responsibilities with the exception of caring for the king's personal items were stripped from him and given to the two men. After some time, Pakaʻa left Keawenuiaʻumi's court and took some of the king's possessions including his *kapa* (bark cloth), *malo* (loin cloth), and placed them in his sacred calabash.

Pakaʻa settled on the leeward side of Molokaʻi and took up a wife, who was a chiefess. She later gave birth to their son, who they named Kuaapakaʻa. Pakaʻa taught his son all the chants and everything he knew about Keawenuiaʻumi for he wanted to be prepared should the king desire to have him back in his court. His son had mastered all that he had taught him. Pakaʻa's prediction had come true and one day a canoe arrived from Hilo carrying the message that Keawenuiaʻumi was looking for his long lost servant. Pakaʻa, however, did not tell the messengers that he was indeed Pakaʻa. In a dream, Pakaʻa and Keawenuiaʻumi came to each other and Pakaʻa told the chief of his whereabouts. Without hesitation, Keawenuiaʻumi summoned his six district chiefs to seek out Pakaʻa.

Pakaʻa and his son set out in their canoe pretending to be fishing for *ʻuhu* (parrot fish), a fishing style that required one to continuously gaze down at the ocean to avoid being seen by Keawenuiaʻumi's chiefs. The canoes of the district chiefs led the way with Keawenuiaʻumi's canoe following behind. As each of the canoes belonging to the district chiefs passed, Kuaapakaʻa at the advice of his father chanted insultingly out to each of the district chiefs, pointing out discrepancies in their lineage and the shortcomings of the lands they ruled. This greatly angered the district chiefs causing them to sail past the father and son.

The king's double hauled canoe finally made its way toward the small fishing canoe and onboard was Lapakahoe, brother of Pakaʻa. Lapakahoe inquired with the young boy about his knowledge of these chiefs, pointing out that such knowledge was only held by a few people, one of which was Pakaʻa and asked if he knew where the chief's former servant was. The boy however, continued with his taunts, this time calling forth all the winds of the various lands, including those of Maui and Molokaʻi—an incantation that brought about a violent storm. The line describing the winds of Kula reads, "He kehau ko Kula," translated as "The kehau is of Kula" (Fornander 1918-1919:100-101).

After calling forth all the winds of the islands, Kuaapakaʻa proceeded to call forth all the men aboard the king's canoe by name. Angered by the boy's remarks, the chief's canoe drew away until nothing, but a mere speck of the canoe was in sight. At which time, at the orders of his father, Kuaapakaʻa uncovered the sacred wind gourd Laʻamaomao, sending a fury of wind over the ocean that caused the ocean to churn and overwhelmed the chief's canoe. After watching the chief's canoe nearly swamped with water, the boy placed the cover back on the sacred gourd, causing the ocean to become calm once again. Although devoid of all their possessions, the chief and his men landed on Molokaʻi.

Although Pakaʻa remained out of sight of the chief, gave specific orders to his son on how to best care for the chief for he knew of all the chief's favorite things. He gave his son the chief's *malo* and told the son to offer it to Keawenuiaʻumi. Pakaʻa then gave his son the chief's *kapa* which was scented with fragrant plants of Laʻa (ʻŌlaʻa), Puna. As Kuaapakaʻa handed the *kapa* to the chief, he recognized the scent. Pakaʻa intended to grow the chief's desires by giving him all of his favorite things that reminded him of how he once cared for the chief. This went on for some time as Kuaapakaʻa again uncovered Laʻamaomao causing a storm that kept the chief on the island which lasted for four months. After closing the gourd, the weather had calmed and Keawenuiaʻumi strongly desired to have the young Kuaapakaʻa join his court. After negotiating with the king, the boy consented. The chief's canoe was made prepared and they set sail for Kauaʻi, where they encountered a storm incited by the wind gourd Laʻamaomao. Nonetheless, Kuaapakaʻa had come prepared with food and other necessities. The young boy offered protection and food to everyone on the canoe except for the sailing masters, Hoʻokeleihilo and Hoʻokeleipuna, the very men that had replaced his father. Weak and battered from the storm, the two men eventually fell overboard at which time Kuaapakaʻa covered the sacred gourd sending calmness over the waters. Kuaapakaʻa ordered the canoe back to Hawaiʻi Island and after several more cunning acts, Kuaapakaʻa revealed his true identity to Keawenuiaʻumi and ordered the boy to bring his father Pakaʻa to him. Pakaʻa refused the king's orders until full restoration was made to which the king agreed and upon Pakaʻa's return to Hawaiʻi, the whole of Hawaiʻi Island was given to him.

Nāulu and ʻŪkiukiu, the Cloud Warriors

This is a story told to Armine von Tempsky by Makalii and retold in *Sites of Maui* by Elspeth Sterling (1998); these two were trade wind-driven clouds, with Nāulu traveling along the southern flank of Haleakalā and ʻŪkiukiu along the northern flank. These two clouds were in an eternal battle for the summit of Haleakalā. While ʻŪkiukiu usually won, occasionally Nāulu succeeded in pushing ʻŪkiukiu back and then on other occasions a truce would be called and the two cloud warriors would rest, leaving clear blue skies between "heaped white masses of vapor" along the summit. According to Makalii, this space of blue skies "was called Alanui o Lani—The Highway to Heaven" (Sterling 1998:243).

In Akana and Gonzalez (2015) book, *Hānau Ka Ua*, a complilation of Hawaiian rain names, they provide additional insight into the Nāulu and ʻŪkiukiu rain clouds and offered the following synonpsis on the cultural significance of rain:

> Our kūpuna [ancestors] had an intimate relationship with the elements. They were keen observers of their environment, with all of its life-giving and life-taking forces. They had a nuanced understanding of the rains of their home. They knew that one place could have several different rains, and that each rain was distinguishable from another. They knew when a particular rain would fall, its color, duration, intensity, the path it would take, the sound it made on the trees, the scent it carried, and the effect it had on people. (Akana and Gonzalez 2015:xv)

Although Akana and Gonzalez (2015) did not document any specific rain names for Kamehamenui or Kealahou, they did document two rain names that were associated with the Kula District including the Nāulu, which was known throughout all of East Maui and the ʻŪkiu, which was also known as ʻŪkiukiu. Concerning the Nāulu rain, Akana and Gonzalez (2015:187) describe it as a "sudden shower" and that this name is applied to both the cloud and a wind that accompanies this rain. When observed in the Kula Distrct, the Nāulu shower is described as a cold, misty rain. Akana and Gonzales (2015) does not offer any concise description of the ʻŪkiu rain, however, Sterling (1998:99) described it as "a soft drizzel" and associated it with Makawao.

Whereas *Hānau Ka Ua* provides us with a comprehensive listing of rain names across the Hawaiian Islands, there is no comparable publication f*or wind names* to date. Listed in Table 1 are wind names that can be found in an the referenced Hawaiian and English language primary sources:

Table 1. Wind names associated with Kula District

Wind Name	*Notes*
Hau	Translates as "cool, iced; ice, frost, dew,snow" (Pukui and Elbert 1986:60). A cool breeze that descends from the uplands of Kula (Stodden n.d:7)
Nau	Translates as "to chew, munch, masticate" (Pukui and Elbert 1986:262). A wind of Kula, Maui (Stodden n.d:7)
ʻŪkiu	Refers to a chilly north wind; same as ʻŪkiʻukiu; also a rain name (Pukui and Elbert 1986).
ʻŪkiʻukiu	Translates as "to blow gently." Same as ʻŪkiu. Refers to a chilly north wind; also a rain name (Pukui and Elbert 1986:366).
Kēhau	Translates as "dew, mist, dewdrop" (Pukui and Elbert 1986:142). A gentle land breeze associated with Kula, Maui.
Kiu	Translates as "spy, scout, observe secretly"(Pukui and Elbert 1986:155). A strong, moderately cold northwesterly wind that blows directly from Kahaleakala; a wind which prostrates houses (Green 1871)

In Pukui's (1983) book titled *ʻŌlelo Noʻeau Hawaiian Proverbs and Poetical Sayings*, she recorded the following sayings along with their literal and fugurative translation that speaks of the *Hau* and the *Kēhau* breeze of Kula, Maui:

Kokolo ka uahi o Kula, he Kēhau.

The smoke of Kula Creeps along when the Kēhau breeze blow.

Where there is smoke there is fire (Pukui 1983:197).

Moe kokolo ka uahi o Kula, he Hau.

The smoke of Kula traveled low and swift, borne by the Hau wind.

> Said of one who is swift in movement. Also, in love and war much depends on the swiftness and subtlety. (Pukui 1983:236)

Traditional Place Names in Kamehamenui and Kealahou

The following paragraphs contain a presentation of *inoa ʻāina* (place name) that were compiled from several map collections including Department of Accounting and General Services Hawaiʻi Registered Maps, and the United State Geological Survey (USGS). The earliest maps found in theses collections date back to 1878. In addition to maps, *inoa ʻāina* are recorded in a variety of Hawaiian oral arts including, *oli* (chants), *mele* (songs), *moʻolelo* (stories), *nane* (riddles) and *ʻōlelo noʻeau* (proverb and poetical expressions). Since the introduction of the written language, place name information has been recorded in ethnographic surveys, historic maps, and a number of early historical documents including *Māhele ʻĀina* records and Boundary Commission testimonies. Kikiloi (2010:75) asserts that the recovery of traditional place names "help to transform once-empty geographic spaces into cultural places enriched with meaning and significance." As such, a place like Kamehamenui and Kealahou, where written records of its history are sparse or couched in terms of its broader regional historical context, place names are helpful in illuminating place specific information. Place names located within the immediate vicinity of the project area are listed below on Table 2 and their locations are illustrated in Figure 16.

Table 2. Place names in the project area.

Place Name	*Notes*	*Reference Map*
Peeluakolo	Translated as "creeping caterpiller" (Pukui and Elbert 1986) An *ʻili ʻāina* awarded to Kalaulaula (LCAw 8816).	Location unmapped. Appears in Land Commission Award No. 8816.
Helani	Translated as "a sky, or a royal chief" (Pukui et al. 1974:44). An *ʻili ʻāina* awarded to Kuapuu (LCAw 9027).	Location unmapped. Appears in Land Commission Award No. 9027.
Hāpapa Gulch	Translated as "rock stratum" (Pukui and Elbert 1986:59) This gulch joins Kolaloa Gulch at 1540 feet elevation and includes a stream.	(Monsarrat 1878); (USGS 1924)
Keāhuaiwi Gulch	Translated as "the bone pile" (Pukui and Elbert 1986) This gulch includes a stream which flows into Keālia Pond.	(USGS 1957)
Kilohana	Translated as "lookout" or "highest point"(Pukui and Elbert 1986:151). A boundary point at the junction of Kamehamenui, Pulehunui, Kalialinui, Papaanui along the crater of Haleakalā. Also identified on some maps as Kalahaku.	(Wall 1929);(Monsarrat 1878); (Monsarrat 1884); (Dodge 1885)
Kulaai Noni/Nani	Kula translated as field, pasture, open country (Pukui and Elbert 1986:178) and *ai* possibly *ʻai* translated as food or food plant. Interpreted as field of noni (Kulaʻai Noni) or beautiful food field (Kulaʻai Nani)	(Hawaii Government Survey 1887); (Dodge 1885)
Puʻu Moho	Moho translated as " Hawaiian rail, an extinct flightless bird," lit. Moho Hill (Pukui and Elbert 1986). Hill marking the boundary point along Kealahou Ahupuaʻa with an elevation of roughly 4,200 feet above sea level. Misspelt sometimes as Puʻu Maho.	(USGS 1957)
Pakaoao	Pākaoao, translated as "enclosure of Kaoao (younger brother of Kekaulike). Also known as White Hill. (Soehren 2010)	(Monsarrat 1884)

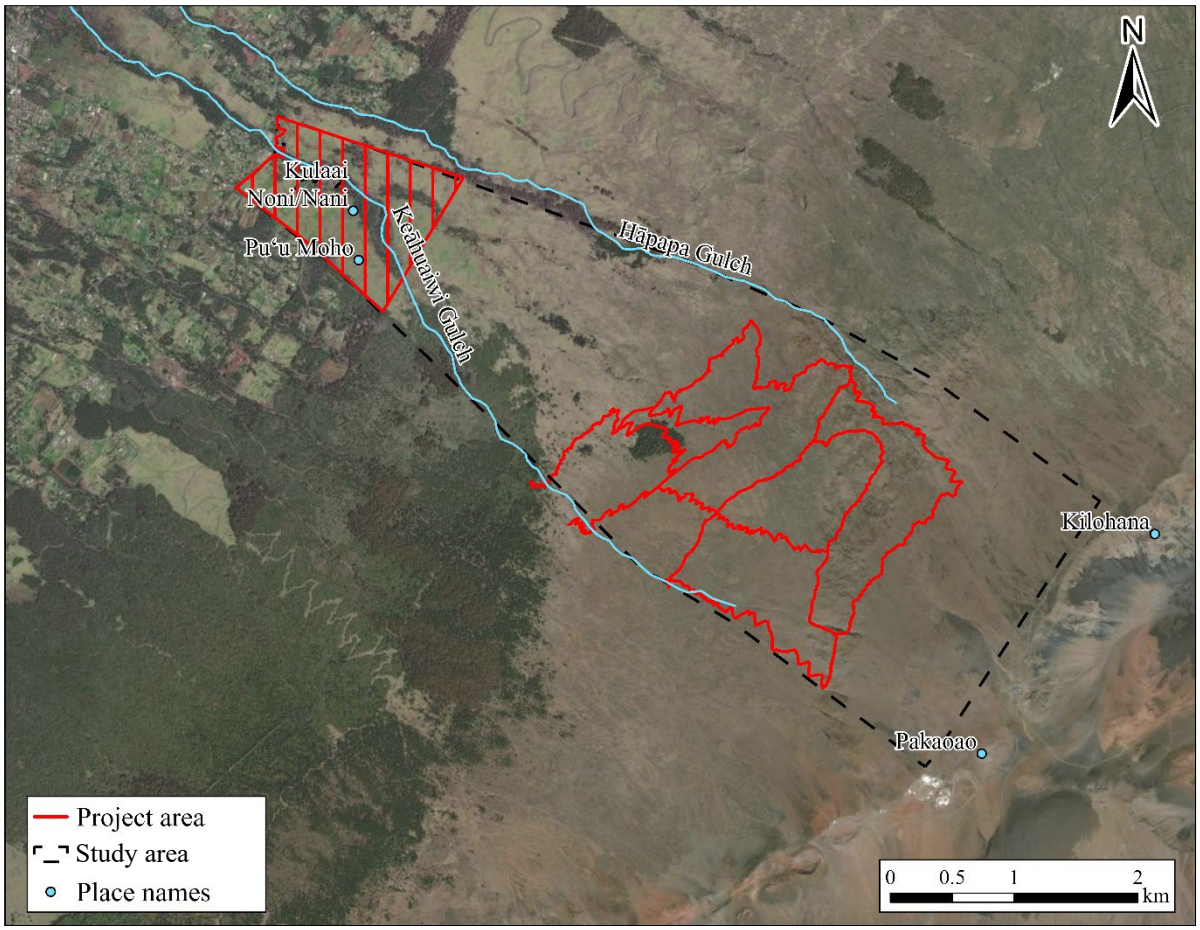


Figure 15. Traditional place names within the project area.

Chiefly Accounts Associated with Kula

Concerning chiefly accounts in Kula, it has been established that throughout much of the Precontact and Early Historic periods, the island of Maui was ruled by two independent chiefdoms each with their geographical domain (Cachola-Abad 2000; Fornander 1880; Kamakau 1992). These chiefdoms are commonly referred to in historical literature as the West Maui chiefdom whose land area included the *moku* (districts) of Kaʻanapali and Lahaina and those of the East Maui or Hāna chiefdom whose rule extended over the greater part of Maui to include the *moku* of Hāmākua Poko, Hāmākua Loa, Koʻolau, Hāna, Kīpahulu, Kaupō, Kahikinui, Honuaʻula, Kula, and Nāpoko or Wailuku (King 1935). The formalization of these districts has been credited to two brothers, Kākaʻe and Kakaʻalaneo who reigned sometime about the 1500s (Maly and Maly 2005). It was during this time that ties with the neighboring islands of Lānaʻi and Molokaʻi were strengthened (Beckwith 1970). Fornander (1880) traces the Maui chiefly lineage to Paumakua, who descended from the Hema branch of the Ulu line, and whose genealogy spread over Maui and Hawaiʻi Island. Fornander writes:

> …there is little to tell of the Maui *Paumakua* of the *Hema* line, the son of *Huanuikalalailai*... Through his son *Haho* and grandson *Palena* he became the great-grandfather and progenitor of the noted *Hanalaa*, whom both the Maui and Hawaii chiefs contended for as their ancestor under the varying names of *Hanalaa-nui* and *Hanalaa-iki*, asserting that *Palena* was the father of twins who bore those names. (Fornander 1880:26-27)

Cachola-Abad (2000:175) writes that "each of these aliʻi nui seemed to have served as the nominal sovereign over the entire of Maui." However, the political distinction between the East and West Maui chiefs appears to have occurred during the time of Palena or Hanalaʻa's reign (Cachola-Abad 2000). This political division persisted until the time of the 16th-century high chief Kiha-a-Piʻilani, who managed to consolidate East and West Maui under his rule (Kirch 2010). Prior to Kiha-a-Piʻilani's consolidation, the chiefs ruling the great part of Maui also ruled over the

island of Lānaʻi, and at times Molokaʻi (Fornander 1880). Kiha-a-Piʻilani was also instrumental in completing the construction of the *ala loa*, a trail that encircled the entire island, a project that was initiated by his father, Piʻilani.

The few recorded accounts of Hawaiian royalty visiting Kula are limited and those that have been recorded begin around the first half of the 18th century (Fornander 1880; Kamakau 1992). This period of Maui's history has been "...characterized by a resurgence of political instability and social upheaval..." with on-going inter-island and intra-island conflict (Kolb 1997:18). Kamakau describes the Kula District during the reign of the *aliʻi* (chief) Kiha-a-Piʻilani and the efforts undertaken by the *aliʻi* to restore food production during a famine. As a preamble to the telling of this story, both Kamakau (1992) and Fornander (1916-1917) detail the feud and subsequent vie for power between Kiha-a-Piʻilani and his brother Lono-a-Piʻilani after the death of their father, high chief Piʻilani. After inheriting his father's kingdom, the eldest Lono-a-Piʻilani began to display great displeasure towards his younger brother. After one particularly cruel incident, Kiha-a-Piʻilani escaped from the royal court and retreated to the countryside of Makawao where he lived covertly as a farmer and took Koleamoku, a chiefess who descended from the ruling line of East Maui. In detailing the account of Kiha-a-Piʻilani while in the Kula area, Kamakau writes:

> There was a famine in Kula and Makawao, and the people subsisted on *laulele*, *pualele*, *popolo*, and other weeds. One night, Kiha-a-Piʻilani went to clear a patch of ferns to plant sweet potatoes, and on that same night he made a large one that would naturally require the labor of eighty men to clear. When morning came, the huge patch was noticed, an immense one indeed. The people said skeptically of this great undertaking, "Where will he find enough sweet-potato slips to cover the patch." Next day Kiha-a-Piʻilani went to Hamakuapoko and Haliʻimaile to ask for potato slips...then he made a carrier (*ʻaweʻawe*) of morning-flory vines, placed the bundles of slips in it, and lifted it with great strength onto his back. The sunshine beat down on his back, the ʻUkiʻukiu breeze blew in front of him, the ʻUlalena rain added its share, and intense heat reflected from the *ʻulei* vines.
>
> One old man remarked to another, "There must be a chief near by for this is the first time that a rainbow is spread before the trees." As they were speaking a man came from below with a huge load on his back, and they called to him to come into the house. He shifted his load, saw the old men, Kau-lani and his companion, let down his burden, and entered. Each of them gave him a bundle of *popolo* greens and sweet potato which he ate until he was satisfied. They asked, "Where are you going?" He answered, "I am returning to the boundary of Kula and Makawao." "Are you a native of the place?" they inquired. "Yes," he replied. They said, "There is not a native from Kula to Hamakua with whom we are not acquainted. You are a stranger." "Yes, I am a stranger." They said, "The god has revealed your identity. You are chief, Kiha-a-Piʻi-lani." He answered, "I am he. Conceal your knowledge of me and tell no one..."(Kamakau 1992:23-24)

Kihaapiʻilani stayed in the country for some time, until he was able to garner the support needed to dethrone his elder brother, Lonoapiʻilani and his father-in-law and ruling chief of East Maui, Hoʻolaemakua (Fornander 1916-1917). As Kihaapiʻilani plotted to overthrow his brother, he developed political alliances with ʻUmi, a powerful Hawaiʻi Island chief who was the husband of his sister, Piʻikeaapiʻilani (Cordy 2000; Fornander 1916-1917; Kirch 2010). ʻUmi summoned his war counselors to prepare for an invasion of Maui. ʻUmi then ordered his district chiefs to make ready the war canoes and gather the warriors. Kiha's forces first attacked Hoʻolaemakua and gained control over East Maui. After Hoʻolaemākua's death, Kiha turned his attention to slaying his brother. Differences arise regarding who was ruling West Maui at the time of this invasion. Fornander (1916-1917) writes that Lonoapiʻilani had already died and that his son Kalaninuikupuapāikalaninui was ruling West Maui. Kamakau (1992) contends that Lonoapiʻilani was still ruling at the time of the invasion and that upon hearing about the death of Hoʻolaemākua he "trembled with fear of death, and died." It was through this powerful invasion that Kihaapiʻilani was able to gain full control over the entire island of Maui, just as his father, Piʻilani had.

Kamakau (1992) documented the following account of Alapaʻinui's (a Hawaiʻi Island chief), visit to Kīhei in coastal Pūlehunui (the *ahupuaʻa* laying to the north of Kamehamenui), in Kula, sometime around the mid-1730s:

> Alapaʻi sailed from Kohala on Hawaii with a great company of the chiefs of Hawaii, his war leaders, warriors, and the district chiefs of the island, to the great consternation of the chiefs of Maui. But when he landed at Mokulau in Kaupo [Maui] and heard that Ke-kau-like was dying, he gave up all thought of war and wished only to meet Ke-kau-like and his [half] sister Ke-kuʻi-apo-iwa-nui. He had heard that Kamehameha-nui had been chosen ruler over Maui and he had no desire to make war upon his sister's child. He landed at Kiheipukoa with all his chiefs and fighting men, commanded by the two leaders, Ka-lani-ʻopuʻu and Keoua, who acted as spies over the

> district for Alapaʻi. There the great chief, Alapaʻi, son of Ka-uaua son of Mahi, had a friendly meeting with Ke-kuʻi-apo-iwa-nui and her son Kamehemeha-nui, to whom the land had descended, and with Ka-lola, Ka-hekili, and Ku-hoʻoheihei-pahu, the other children of Ke-kau-like by Ke-kuʻi-apo-iwa-nui. (Kamakau 1992:70)

Fornander (1880) related the following story of a petty chief named Kukeawe, who around 1785, was given charge of Kahekili's hogs that were allowed to freely roamed the Kula slopes. Kukeawe, however, abused his authority which resulted in a civil revolt and his death. According to Fornander:

> While *Kahekili* was carrying on the war on Oahu and suppressing the revolt of the Oahu chiefs, a serious disturbance on Maui had occurred which gave him much uneasiness. It appears that he had given the charge of his heard of hogs that were running in the Kula district and on the slopes of Haleakala to a petty chief named Kukeawe. This gentleman, not satisfied with whatever he could embezzle from his master's herds, made raids upon the farmers and country people of Kula, Honuaula, Kahikinui, and even as far as Kaupo, robbing them of their hogs, under the pretext that they belonged to *Kahekili*. Indignant at this tyranny and oppression, the country people rose in arms and a civil war commenced. *Kukeawe* called the military forces left by *Kahekili* at Wailuku to his assistance; a series of battles were fought, and finally *Kukeawe* was killed at Kamaole-i-kai, near Palauea, and the revolted farmers remained masters of the situation. (Fornander 1880:227-228)

Because of the oppression caused by Kukeawe, the following *ʻōlelo noʻeau* (poetical expression) has been recorded by Pukui (1983:12), "*ʻAi puaʻa a Kukeawe*" which is "[s]aid of a person who is not satisfied with the number of his own pigs and so robs his neighbors of theirs." Pukui (1983:12) recounted the following version of the rebellion:

> Kukeawe was a friend of Kahekili who was allowed to help himself to any of Kahekiliʻs pigs in Kula, Maui. But Kukeawe also took the pigs belonging to the people of Kula, Honuaʻula, and Kahikinui and plundered their possessions. These people rose in rebellion, led by ʻOpū, and surprised the followers of Kukeawe while they were ascending Haleakalā on the way to Kula. Kukeawe's party retreated but found their way blocked by other parties led by Kawehena, Kahoʻoluhina, and Kuheana. Kukeawe was killed and his body set up at Palauea for all to see.

Kamakau recorded that while the battles between the forces of Kalaniʻōpuʻu and Kahekili were occurring, sightings of the first European explorers off the windward coast of East Maui were made in November of 1778 (Kamakau 1992).

The Arrival of Europeans and Agricultural Transformations (1778-1854)

The arrival of foreigners to the Hawaiian Islands in 1778 marks the end of the Precontact Period and the beginning of the Historic Period. The foreign vessels observed during the battle between Kalaniʻōpuʻu of Hawaiʻi Island and Kahekili of Maui, were those of European explorer, Captain James Cook. Although Cook, did not travel to the lee side of East Maui where the project area is located, he penned a few observation of the northeast side of the island and noted his encounters with canoes carrying goods that belonged to Kalaniʻōpuʻu:

> Monday 30th. In the afternoon of the 30th being off the NE end of the island, several canoes came off to the Ships, most of them belonged to a Chief named Terryaboo [Kalaniopuu] who came in one; he made me a present of two or three small pigs and we got by barter from the other people a little fruit. After a stay of about two hours they all left us except six of eight who chused [*sic*] to remain, a double sailing canoe came soon after to attend upon them which we towed astern all night. In the evening we discovered another island of the windward [Hawaii]...our Indian friends not chusing [*sic*] to accompany us, imbarked [*sic*] in their canoe and left us (Beaglehole 1967:476)

The arrival of foreigners to Hawaiʻi signified the beginning of drastic changes to the culture and economy. By 1810, Kamehameha conquered the Hawaiian Islands through military force, with the exception of Kauaʻi, which was brought under his control through peaceful negotiations (Kamakau 1992). By 1811 and until his death in 1819, Kamehameha I was completely vested in the sandalwood industry and controlled all rythms of the trade. This industry brought numerous sailing vessels into Maui and foreign goods that would become an important bargaining tool to further the trade in the islands (Cottrell 2002). By 1820, Lahaina was the seat of the Hawaiian government and was at the center of the sandalwood trade—a trade that greatly benefitted the king but was terribly destructive to the *ʻāina* (land) and the *makaʻāinana* (commoners). The introduction of this industry shifted the focus of the *makaʻāinana* from cultivating the land to working exclusively on filling the coffers of the *aliʻi* with the prized *ʻiliahi*

(Hawaiian sandalwood) (Kuykendall and Day 1976; Oliver 1961). The devastation caused by the sandalwood trade left entire forests throughout Maui badly depleted and many chiefs including his son Liholiho (Kamehameha II) in debt with sandalwood traders. By 1830, the sandalwood trade was no longer profitable, and the entire industry had collapsed (Lahaina Restoration Foundation 1972). As the sandalwood trade ceased, the island of Maui continued to experience an influx of foreigners, some of whom came to preach the Christian gospel, while other temporary residents like whalers saw the area as merely a stopping and provisioning port.

The increase in whalers added more pressure to the island's forest resources as the demand for fuelwood spiked. According to Korte (1961), the demand for fuelwood between 1824 and 1861 destroyed at least 10,000 acres of native forest. Korte (1961) also reported on a number of sawmills harvesting *koa* (*Acacia koa*) before 1854 in East Makawao and Kula on Maui. Forest resources in Kula were hard hit throughout the mid-19th century and intensified agriculture which required expansion into the forest areas furthered the degradation.

By the 1840s, the increase in whaling ships created a demand for foreign produce including wheat and potato. Concerning wheat production, (1844:1) commented that although the "natives of the island [did] not wish it for their own consumption" "nor do they desire, the change from their favorite *"fish and poi"...*" some of them nonetheless took up wheat cultivation in Kula. J.S. Green speculated that wheat was introduced to the islands by a visitor to the Lahaina area, and mentions his first purchase of wheat from a Kula man in 1835 (Green 1871). Green (1844) described wheat being grown in the valleys to allow for shelter from the occasional strong winds; to be of large growth and of excellent quality and recognized the challenge of the *pe'elua* (caterpillar) in the Kula region which would often ravage the vegetation of the area resulting in famine. Regardless, beginning in 1843 and for several years thereafter, Kula continued to produce an abundance of wheat which was typically sold to Lahaina or Wailuku for one dollar per bushel (Green 1844). Kula's agriculture "were among the early commodities to be offered for sale by Hawaiians to the foreigners" (Donham 1992:5). In addition to the environmental challenges, wheat production was extremely laborious, including high cleaning costs (Green 1852). By 1852, wheat cultivation was in decline as Green (1852) reports that only a single gentleman by the name of Kupanihi continued to cultivate wheat in Kula. As wheat gradually declined, the market for foreign varieties of potatoes was on an uptick.

Prior to the 1830s, the only available potatoes were those of the native variety (*'uala maoli*) but with new varieties being transported by ship and exchanged with native farmers, demand for foreign varieties (*'uala haole* or *'uala kahiki*), specifically Irish potatoes led to production boom that spread both locally and eventually to the continental U.S. (Kuykendall 1938). Gilman (1854) reported that three varieties of Irish potatoes were being grown in Hawaiian soil, including the red, white, and the long pink-eye variety. According to Thrum, "a large red variety was said to have been introduced by Captain Joseph Maughan, who gave some to Boki, who in turn gave some to Hoapili of Maui, where they flourished…" (Thrum in Barrère 1975:45). However, the red potato was favored for it could withstand the harsh conditions associated with the long voyage between Hawai'i and North America. In a report submitted to the Royal Hawaiian Agricultural Society in 1854, G. Gilman related information about the beginnings of this industry:

> …sometime previous to 1830 a few Irish potatoes had been left here, it is presumed, by some whaleship, and an "old resident" informs me that from '30 to '35 they used to consider themselves fortunate in getting an occasional calabash full, from some of the valleys back of Lahaina. A few found their way to Wailuku, on this island, and for years there was but one patch cultivated at that place. From that patch the seed is supposed to have been taken to Kula, or as it is sometimes called, the "Potato District," which is that belt of land lying on the side of the mountain Hale a ka la on east Maui, about 2000 feet above the sea and extending from Makawao to and inclusive of Honuaula, or Mr. Torbert's plantation (Gilman 1854:138).

Johnathan S. Green described the potato growing region in the following account which was published in *The Polynesian* in 1844:

> 1st There is a strip or belt of land of from two to four miles in width, I should judge, for no measurement has been made—gradually ascending and terminating at the base of Haleakala, the high mountain of East Maui. The upper part of this belt is, I presume, in the region of frost, it being 4,000 feet or more above the level of the sea. This land is higher up in the mountain than the land occupied by the people, only now and then a house being seen, and these occupied temporarily by canoe makers. This belt of land extends from Makawao, say from Mr. McLane's sugar plantation to Honuaulu [Honua'ula], some fifteen miles I should judge. 2d. The land below the belt above described, among the habitations of natives, and where they cultivate the sweet potatoe, banana and sometimes dry kalo, is capable, much of it, being cultivated with wheat.

> Nearly all the wheat that has been raised was produced here. 3d . The best land which I have seen in Kula, for wheat or any thing else, is the land which produces the Irish potatoe—This is a strip of land commencing near the middle of Kula, and extending to Honuaula. It commences about mid-way from the habitations of the natives and the mountain, and may be three-fourths of a mile in width. (Green 1844:1)

Although small planting of potatoes were taken up in different parts of Maui to supply visiting ships, the native farmers of the Kula District were some of the first to pioneer the large-scale cultivation of Irish potatoes (Kuykendall 1938). In describing the extent of the Kula potato planting area in 1846, James Jackson Jarves wrote:

> It ranges along the mountain [Haleakala] between 2000 and 5000 feet elevation, for the distance of 12 miles. The forest is but partially cleared, and the seeds put into the rich virgin soil. The crop now in the ground is immense. The fields being all in blossom have a fine appearance, spreading as they do, over the broad surface of the mountain. (Jarves in Kuykendall 1938:313)

By the fall of 1849, the stimulating effects of the California Gold Rush and the neglect of agriculture in California created an agriculture boom in the Hawaiian Islands. This led to intensified efforts to grow vegetables that could be exported, mainly Irish potatoes. The demand led to more native residents either taking up farming Irish potatoes or relocating to places like Kula or Honua‘ula, which were the major potato production centers on Maui (Kuykendall 1938). This resulted in a population influx for the district. During this time, native farmers cultivated, harvested, barreled, then hauled each barrel to the coast, which was between ten to twelve miles from the fields (Gilman 1854). Kuykendall (1938:313) reported that “...the potatoes were carried down to the shore and taken to Lahaina or were sold directly to ships which called at Kalepolepo” in coastal Kīhei. The native farmers either bartered or sold each barrel for 50 cents, which was, in turn, sold to visiting ships anywhere between $1.50 upwards of $3.00 per barrel. By 1847, carts and pack bullocks aided with hauling the potatoes to the coast, however, the use of these tools was not widespread amongst the native farmers. In quoting an article printed in the November 24th, 1849 edition of the the newspaper *Polynesian*, Kuykendall (1938:321) conveys:

> The call for [potatoes] is loud and pressing, as some vessels bound for Californa have taken as many as a thousand barrels each. The price is high, and the probability is that the market can not be supplied this autumn. Kula, however, is full of people. Strangers from Wailuku, Hamakua and Lahaina are there preparing the ground and planting, so that if the demand from California shall be as urgent next spring as it is now the people will reap a rich harvest... They often repeat the saying of a foreigner, who, after having visited the mines of California, came back to Maui quite satisfied, and said to his neighbors at Waikapu, “Californa is yonder in Kula. There is the fold without the fatigue and sickness of the mining country.”

It has been reported that because of the stir caused by the California Gold Rush, Kula was known by the epithet “Kalifonia” and “Nu Kalifonia” (Kuykendall 1938:321). Between 1848-1849, the first Hawaiian-grown Irish potatoes were carried on the American schooner *Boston* by an old whaleman, Captain Cole to the shores of San Francisco. Exporting potatoes proved to be lucrative as Gilman (1854) reported that a single barrel of Hawaiian-grown potatoes could be sold in California between $40 or $50 per barrel. The exporting of Irish potatoes to California, which peaked between 1849 to 1851, was considered by Gilman (1854:139) to be “the most important and largest branch of our exporting trade.” The local and international demand for Irish potatoes significantly outpaced production (Gilman 1854). In an attempt to keep up production, Chinese farmers were brought in and they added to the vegetable repertoire to include vegetables such as corn, beans, cabbage, onions, wheat, and cotton (Kolb et al. 1997). Meager crops, depleted fields coupled with poor planting practices, and untimely drought conditions devastated the market. Despite efforts to market Hawaiian potatoes under different guises, the once sought-after Hawaiian-grown Irish potatoes soon developed a less than favorable reputation on the continental U.S. Unable to recover from the quandary, by 1854, the international boom for Irish potato was bust and production shifted to domestic use (Gilman 1854).

The Legacy of the *Māhele ‘Āina*

As the potato boom swept through Kula during the mid 19th century, the Hawaiian Kingdom had become an established center of commerce and trade in the Pacific, recognized internationally by the United States and other nations in the Pacific and Europe (Sai 2011). As Hawaiian political elites sought ways to modernize the burgeoning Kingdom, and as more Westerners settled in the Hawaiian Islands, major socioeconomic and political changes took place, including the formal adoption of a Hawaiian constitution by 1840, the change in governance from an absolute monarchy to a constitutional monarchy, and the shift towards a Euro-American model of private land ownership.

This change in land governance was partially informed by ex-missionaries and Euro-American businessmen in the islands who were generally hesitant to enter business deals on leasehold lands that could be revoked from them at any time. *Mōʻī* (Ruler) Kauikeaouli (Kamehameha III), through intense deliberations with his high-ranking chiefs and political advisors, separated and defined the ownership of all lands in the Kingdom (King n.d.). They decided that three classes of people each had one-third vested rights to the lands of Hawaiʻi: the *Mōʻī*, the *aliʻi* and *konohiki*, and the native tenants (*hoaʻāina*). In 1846, King Kauikeaouli formed the Board of Commissioners to Quiet Land Titles (more commonly known as the Land Commission) to adopt guiding principles and procedures for dividing the lands, grant land titles, and act as a court of record to investigate and ultimately award or reject all claims brought before them (Bailey in Commissioner of Public Lands 1929). All land claims, whether by chiefs for an entire *ahupuaʻa* or *ʻili kūpono* (nearly independent *ʻili* land division within an *ahupuaʻa*, that paid tribute to the ruling chief and not to the chief of the *ahupuaʻa*), or by *hoaʻāina* for their house lots and gardens, had to be filed with the Land Commission within two years of the effective date of the Act (February 14, 1846) to be considered. This deadline was extended several times for chiefs and *konohiki*, but not for native tenants (Soehren 2010).

The King and some 245 chiefs spent nearly two years trying unsuccessfully to divide all the lands of Hawaiʻi amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d.; Kuykendall 1938). Once Kauikeaouli and his chiefs accepted the principles of the Privy Council, the *Māhele ʻĀina* (Land Division) was completed in just forty days (on March 7, 1848). The names of nearly all of the *ahupuaʻa* and *ʻili kūpono* of the Hawaiian Islands, as well as the names of the chiefs who claimed them, were recorded in the *Buke Māhele* (*Māhele* Book) (Buke Māhele 1848; Soehren 2010). As this process unfolded, King Kauikeaouli, who received roughly one-third of the lands of Hawaiʻi, realized the importance of setting aside public lands that could be sold to raise money for the government and also purchased in fee simple by his subjects. Accordingly, the day after the division when the name of the last chief was recorded in the *Buke Māhele*, the King commuted about two-thirds of the lands awarded to him to the government (King n.d.). Unlike Kauikeaouli, the chiefs and *konohiki* were required to present their claims to the Land Commission to receive their Land Commission Awards (LCAw). The chiefs who participated in the *Māhele* were also required to provide to the government commutations of a portion of their lands in order to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the King and chiefs became known as "Government Land." The lands personally retained by the King became known as "Crown Land." Lastly, the lands received by the chiefs became known as "Konohiki Land" (Chinen 1958:vii; 1961:13). To expedite the work of the Land Commission, all lands awarded during the *Māhele* were identified by name only, with the understanding that the ancient boundaries would prevail until the lands could be formally surveyed.

In 1848, the chiefess, Ane Keohokālole (mother of Queen Liliʻuokalani and King David Kalākaua) was awarded roughly 5,067 acres in Kamehamenui (also identified as Kamehame 1) and Kealahou 3rd and 4th (Commissioner of Public Lands 1929). Kamehamenui was awarded as parcel 6 of LCAw 8456, whereas Kealahou 3rd and 4th was awarded to her as parcel 21 of LCAw 8452. In 1858, Kamehamenui was conveyed to Keohokālole via Royal Patent Grant 4388 and Kealahou 3rd and 4th was conveyed via Royal Patent Grant 7453. The location of Keohokālole's awards in shown in Figure 17. A year later, in 1859, through an act of the legislature, adjustments of district boundaries "...for taxation, educational, and judicial purposes..." would begin consolidating the traditional districts of Hāmākualoa, Hāmākuapoko, Hāliʻimaile, Makawao and Kula to be renamed the Makawao District (King 1935).

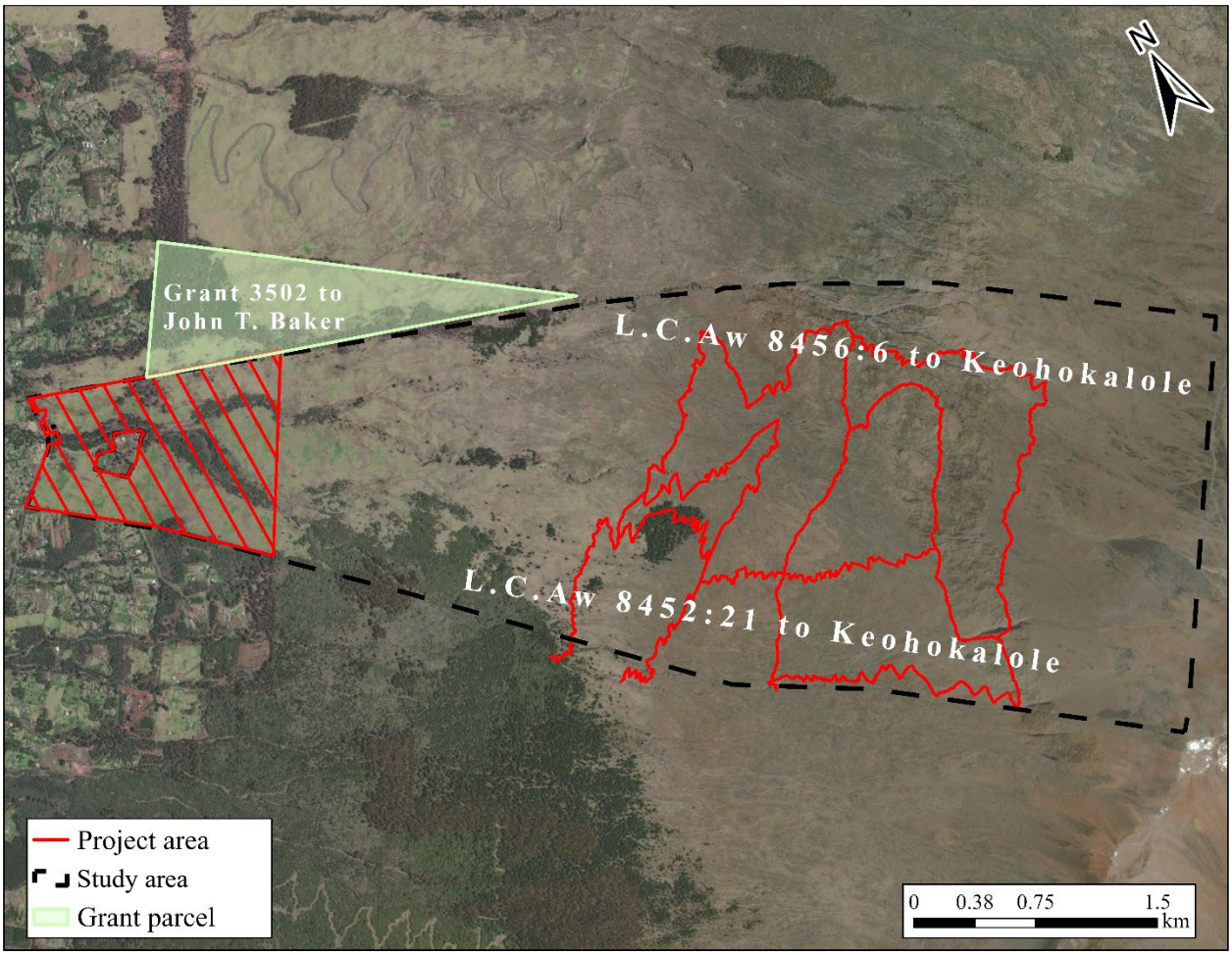


Figure 16. Google Earth™ map showing location of LCAw and Grants in and adjacent to the project area.

Kuleana Awards

As the King and his *ali'i* and *konohiki* made claims to large tracts of land via the *Māhele*, questions arose regarding the protection of rights for the native tenants. To resolve this matter, on August 6, 1850, the *Kuleana* Act (also known as the Enabling Act) was passed, clarifying the process by which native tenants could claim fee simple title to any portion of lands that they physically occupied, actively cultivated, or had improved (Garavoy 2005). The *Kuleana* Act also clarified access to *kuleana* parcels, which were typically landlocked, and addressed gathering rights within an *ahupua'a*. Lands awarded through the *Kuleana* Act were and still are, referred to as *kuleana* awards or *kuleana* lands. The Land Commission oversaw the program and administered the *kuleana* as Land Commission Awards (LCAws.) (Chinen 1958). Native tenants wishing to make a claim to their lands were required to register in writing those lands with the Land Commission, who assigned a number to each claim, and that number (the Native Register) was used to track the claimant through the entire land claims process. The native tenants registering their *kuleana* were then required to have at least two individuals (typically neighbors) provide testimony to confirm their claim to the land. Those testimonies given in Hawaiian became known as the Native Testimony, and those given in English became known as Foreign Testimony. Upon provision of the required information, the Land Commission rendered a decision, and if successful, the tenant was issued the LCAw. Finally, to relinquish any government interest in the property, the holder of a LCAw. obtained a Royal Patent Grant from the Minister of the Interior upon payment of the commutation fee.

The 1929 *Indices of Awards* identifies the names of two individuals who were awarded *kuleana* lots in Kamehame, however, it does not indicate if the awarded lots were in Kamehamenui (also Kamehame 1) or Kamehameiki (Kamehame 2). Similarly, the names of six individuals are listed as receiving lands in Kealahou, however, the indices does not specify which of the four Kealahou their lands were located in (Commissioner of Public Lands 1929). As such, the information in the indices does not provide us with enough data to determine the

exact location of these *kuleana*. The issue of locating these *kuleana* is further compunded by lack of historical maps that show the location of any *kuleana* awards in both Kamehame and Kealahou. The names of the eight individuals who were reported to have received *kuleana* lands in Kamehame and Kealahou are listed below in Table 3.

Although locational information for the *kuleana* awards in Kamehame and Kealahou is lacking, a review of GIS locational data of *kuleana* awards (found on the Office of Hawaiian Affairs Kīpuka Database), for the adjacent *ahupua'a* in Kula, shows that the *kuleana* awards are distributed between roughly the 2,200-4,000 foot elevation. As such, if there were any *kuleana* in Kamehamenui and Kealahou 3rd and 4th, they may have likely been in the *makai* portion of the project area or extending *makai* to about the present-day Kula Highway.

Table 3. List of *Kuleana* awardees in Kamehame and Kealahou.

Ahupua'a	*'Ili 'Āina*	*Awardee*	*LCAw.*	*Royal Patent Grant*	*Acres*	*No. of parcels awarded*
Kamehame	Helani	Kuapuu	9027	4771	2.68	1
Kamehame	Peeluakolo	Kalaulaula	8816	5145	8.33	2
Kealahou	n/a	Kekapai	8653	5176	10.25	6
Kealahou	Hanamulei		"	4752	0.69	1
Kealahou	Kaopupololu		"	"	0.58	1
Kealahou	Kaulaula		"	"	4.26	2
Kealahou & Waiakoa	n/a	Manaole	10145	6907	7.01	3
Kealahou	Hanamulei		"	"	2.30	1
Kealahou	n/a	Naha	10482	4817	1.40	1
Kealahou	Hanamulei		"	7883	4.78	1
			"	"	2.60	1
Kealahou	Aipuaa	Pii	5488	5510	4.38	2
Kealahou	Pawali		"	"	4.04	2
Kealahou	Hanamulei	Makahiki	10144	3396	2.87	1
Kealahou	Kunanaualii		"	5396	0.84	1
Kealahou	Paliku		"	"	6.71	1
Kealahou	Kaulaula	Kapaole	8654	7967	2.11	1

Government Land Grants and Land Ownership Changes Post-Māhele

In conjunction with the *Māhele*, the King also authorized the issuance of Royal Patent Grants to applicants for tracts of land, larger than those generally available through the Land Commission. The process for applications was clarified by the "Enabling Act," which was ratified on August 6, 1850. The Act resolved that portions of the Government Lands established during the *Māhele* of 1848 should be set aside and sold as grants ranging in size from one to fifty acres at a cost of fifty cents per acre. The stated goal of this program was to enable native tenants, many of whom were not awarded *kuleana* parcels during the *Māhele*, to purchase lands of their own. Despite the stated goal of the land grant program, this provided the mechanism that allowed many foreigners to acquire large tracts of Government Lands. Unlike in the *kuleana* claims, where claimants stated their use of the land, the grant records are silent regarding the grantees' intended use. The Royal Patent deeds and survey notes do contain some limited information about geographical features, vegetation, and survey markers, but they generally do not say anything about improvements to the land or land use. As Kamehamenui and Kealahou 3rd and 4th was an *ali'i* award, no government land grants were sold in these *ahupua'a*. However, several land grants were sold in the adjacent *ahupua'a* of Kamehameiki-Pūlehuiki and Waiakoa.

In November of 1890, John Tamatoa (given name Timoteo) Baker purchased a 268 acres Grant 3502 in Pūlehuiki and Kamehameiki along the northwest boundary of the subject parcel (and the *makai* portion of the project area; see Figure 17) (Office of Hawaiian Affairs 2018). Born on O'ahu in 1852, Baker who was of part Hawaiian, Tahitian, and English descent attended Lahainaluna and shortly after became involved in plantation work on Maui. Baker later became attached to the court of King David Kalākaua and in 1884 became Captain of the king's household guards and a member of the Privy Council. When the statue of King Kamehameha I was commission in 1879, Baker and his brother Robert Hoapili Baker served as models for the sculptor. Between 1887 and 1893, during Baker's acquisition of the 268-acre grant, he was serving as High Sheriff and later Governor of Hawai'i Island. Throughout his lifetime, Baker was a noted scholar in the both the English and Hawaiian languages and was involved in Kingdom politics (The Honolulu Adverstiser 1921).

In the neighboring *ahupua'a* of Waiakoa, sixteen individuals purchsed twenty individual grant parcels. None of the grant parcels sold in Waiakoa were adjacent to the subject parcel. Of the sixteen individuals who purchsed grant parcels, thirteen of them had Hawaiian surnames (Kaai, Kaauwai, Kahoopaki, Kahue, Kaneala, Kaniau, Kapai, Kawaalau, Maia, Napela, Nauliuli & Kahina, Nauliuli & Kamalo) and the remaining three were sold to foreiners including D.P. Eldredge, Antone de Medirsh Pirsh, and Randall von Tempsky. These grants were sold between 1853 and 1892 and ranged in size from 0.84 acres to 113 acres.

According to an unpublished manuscript of the *Kama'āina Carousel* provided to ASM staff by the von Tempsky family (von Tempsky n.d), following the *Māhele*, Kamehamenui and Kealahou 3rd and 4th was placed into estates of Keohokālole, with Charles R. Bishop named as the trustee of the queen's estate. Bishop sold Kamehamenui and Kealahou 3rd and 4th to James Louzada for $800. By September 1864, Louzada sold half of his interest to his brother-in-law William Henry Cornwell for "one dollar and love."

Additional research into the W. Henry Cornwell revealed that he was born in New York in 1842 and sometime around 1857, at the age of fifteen, he arrived in Hawai'i with his father, also named William Henry Cornwell. The Jr. Cornwell married New York native, Adelia Louzada, who was the younger sister of James Louzada. James Loudaza had preceded Henry Cornwell's arrival in Hawai'i and during that time he had helped start the Pu'uloa Sheep Station on Hawai'i Island. After the elder Cornwell arrived in Hawai'i (ca. 1857), the duo, in partnership, started the Waikapu Sugar Plantation and later the Haiku, Makee, and Campbell plantation. In 1876, upon the retiring of the elder Cornwell, the son Henry Cornwell along with G. W. Macfarlane, purchased the Waikapu Sugar Plantation. After selling his share in the plantation, Henry Cornwell leased a large tract of land in Kula, Maui from King David Kalākaua for ranching (The Hawaiian Gazette 1903a). The article does not specify where in Kula, Henry Cornwell conducted his ranching operations, however, it may be within the project area.

The unpublished von Tempsky manuscript (von Tempsky n.d) clarifies that on May 10, 1888, a Kapua Louzada and four of the Cornwell heirs sold their interest in the property to Adelia Louzada Cornwell. In this same year, these lands were sold to Louis von Tempsky for $8,000.

The von Tempsky Legacy and the Tale of Erehwon Cattle Station and Ranch

The legacy of the lands of the project area is steeped in the heritage of brothers Louis and Randal von Tempsky, the sons of Prussian noble Gustavus Ferdinand von Tempsky, and his wife Amelia Ross (Bell). The eldest of the brothers, Randal, was born in 1856 in Bluefields, Nicaragua (von Tempsky 1979). After a short while, the family relocated from Nicaragua to Glasgow, Scotland, where Louis was born two years later in 1858 (Siddall 1917; von Tempsky 1979). In 1879 at the age of 21, Louis (Figure 18) was the first of the brothers to make his way to Maui, stopping on the island while en route to Alaska for the gold rush. A year later in 1880, Randal joined his brother where they both established themselves in ranching. On his arrival, Louis found himself at Captain James Makee's Rose Ranch (now 'Ulupalakua Ranch) which had recently been sold to James Isaac Dowsett a year prior (Taylor 1949a, 1949b; von Tempsky 1979). Here, Louis became involved with cattle and pasturage. As for Randal, he managed Burkhardt's estate and in 1887 became a partner in the Kaho'olawe Ranch Company (Molina 2021; von Tempsky 1979). In 1888, Louis acquired 5,000 acres of Kula lands from Adelia Cornwell for $8,000. With these lands, Louis established Erehwon (nowhere spelled backward) Cattle Company and serve as the manager. In 1891 Louis married Amy Wodehouse (the daughter of Major James H. Wodehouse) and together they had four children; Armine, Gwendolyn, Lorna, and Errol. A year later in 1892, Randal married Dora Dowsett (Figure 19) and the pair had two children of their own; Alexandrea and Robert (Molina 2021; The Hawaiian Star 1898).

Preceding the land purchase, in 1886 Louis formed a ranching partnership with an Australian named William Williams but by 1896, this partnership was dissolved (The Honolulu Advertiser 1922; The Independent 1896). Louis continued to oversee the lands of Erewhon up until 1897, at which point he sold his portion of the shares to Randal and was hired as the manager of Haleakalā Ranch in 1898. Prior to his employment with Haleakalā Ranch, Louis purchased Burchardt Dairy (News 1922). During Louis' management of Erehwon, he leased acreage to truck farmers who grew crops of corn, potatoes, and beans that were shipped to the west coast. These leases remained in effect years after Randal's death and well into Dora's overseeing of the ranch (von Tempsky n.d). In 1889, Louis published his intent to fence off portions of Erehwon Cattle Station situated "along the boundary of Waiakoa and Kealahou 3 and 4 from Puuluoho to the Clinkers" in *The Hawaiian Gazette* newspaper (1889:10). Louis remained at Haleakalā Ranch, improving cattle, cows, horses, pigs, sheep and reforesting the lands until his death in 1922 (Molina 2021).

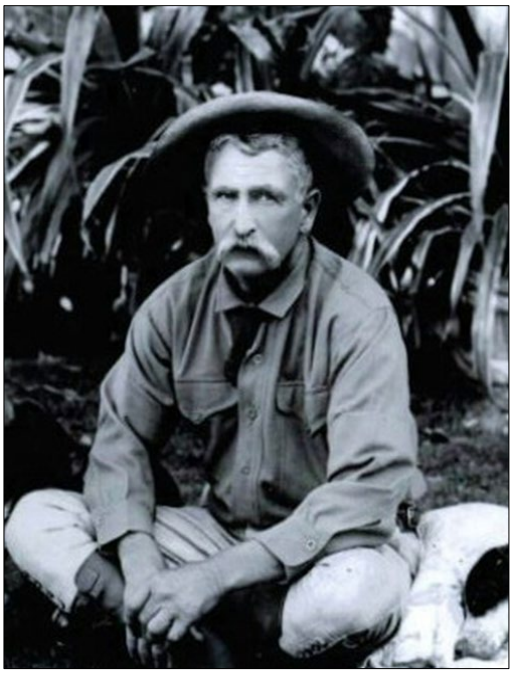


Figure 17. Louis von Tempsky. Photo courtesy of Hawaii Cattlemen's Council.



Figure 18. Dora Dowsett. Photo courtesy of von Tempsky family collection.

Upon the land purchase in 1897, Randal became the sole administrator of Erehwon Cattle Station but was short-lived when he suffered a sudden passing from a brain aneurysm in late 1898 at his home. He was subsequently "buried near a grove of trees above the house" on a hillside on Erehwon Ranch (The Hawaiian Gazette 1898; The Hawaiian Star 1898). Following Randal's death, his wife, Dora Melville Dowsett von Tempsky took over management of the ranch. Dora, being a socialite, was fond of hosting many social events at her Erehwon home, and in 1900, hosted a "big feast to her tenants on the Erehwon Cattle Station in Kula, to which over 100 people" attended (The Hawaiian Star 1900; von Tempsky 1979). The ranch first functioned as a dairy ranch where foreman, Antone Gouveia, would "hookup the wagon and hauled butter to Kahului" that was sold locally at the Maui Soda and Ice Works (Molina 2021; The Maui News 1905). Mrs. von Tempsky began guiding productions at Erehwon Cattle Station to expand from commercial butter production into the realm of diversified agriculture in the early 1900s. It was around that time that potatoes were being cultivated throughout the property, although many were washed away during a large storm that occurred in 1901 (The Independent 1901). During March of the following year, portions of the ranch were set aside by Mrs. von Tempsky to allow for a preliminary study of the Quick Blight disease that had been affecting the success of Irish potato cultivation in the islands since the late 1800s (The Hawaiian Gazette 1903b; United States Department of Agriculture 1903). The experiment was conducted by the United States Department of Agriculture agricultural experimentation station and involved the experimental planting of forty-five potato varieties in three distinct plots throughout Erehwon Cattle Station which were described thusly:

> . . . The land chosen was under the control of Mrs. Randal Von Tempsky and was situated at an elevation of between 3,500 and 4,000 feet. Three plots were laid out for the experiment. Plot 1 was in a gulch partly protected from the wind; the soil was rich and the previous year a crop of beans had been planted there. Plots 2 and 3 were on a ridge unprotected from the wind. The soil was of fair quality and had been planted to corn and potatoes for a number of seasons. Plots 2 and 3 were adjacent. In Plots 1 and 3 the soil was dug to the depth from 5 to 7 inches (the usual depth for this district); that is Plot 2 was dug to the depth of 12 inches bringing up to the surface some of the yellow sub-soil. The 45 varieties of potatoes used in the experiment were Northern Beauty, Gem of Aroostook, Early Harvest, Early Northern, New Queen, the Minister, Carman No. 1, Green Mountain, Beauty of Hebron, Pearl of Savoy, Black Christy, White Elephant, Dakota Red, Early Rose, Early Fortune, Early Six Weeks, L X L, Pride of the South, The June, Acme, Bovee, Breck's Chance, Burpee's Extra Early, Cambridge Russet, Early Ohio, Early Michigan Fillbasket, Honeoye Rose, Hammond's Wonderful, Irish Cobbler, Long Keeper, Carman No. 3, Mill's Banner, Mill's Prize, Maui's Thoroughbred, Manun's Enormous, Nott's Peach, Prolific Rose,

> Rural New Yorker No. 2, Sir Walter Raleigh, Stephens, Steuben, Twentieth Century, Uncle Sam, and Wonderful Clay Rose. (The Hawaiian Gazette 1903b)

In 1906, management of the cattle station transferred from Antone Gouveia to George Copp (The Honolulu Advertiser 1906). Around this time, Erehwon's butter, produced by hand-milking rather than with the aid of a milking machine, fetched "forty-five cents a pound, which was an abnormal price for butter in those days" and they produced roughly 800 pounds of butter per week (von Tempsky 1979:12). In 1911, Mrs. von Tempsky initiated the construction of a dairy barn (Figure 20) to further accelerate the production of butter, the development of which was completed in 1912:

> The dairy barn of Mrs. Dora von Tempsky is completed. It is a large and airy building. The floor is cemented, and the yard is paved with stones to prevent the cows from bringing filth into the barn. The many patrons of this dairy will be pleased to learn that the butter is made in a neat and sanitary condition. (The Maui News 1912)



Figure 19. Erehwon dairy barn situated to the right of fencing ca. 1980s. Photo courtesy of von Tempsky family collection.

By the latter part of 1911, Kula remained immersed in drought, which combined with the spread of blight, resulted in a scarcity of potatoes (The Maui News 1911). At Erehwon, like most of Kula, water was insufficient and a scarce commodity, thus dams were constructed in the gulches to capitalize on water security. As described by Robert "Boy" von Tempsky (Randal and Dora's second child) water catchment efforts in the early part of the 1900s were quite involved:

> We used to dam up these gulches and—small dams, so we wouldn't collect too much silt in each one. And we used to have runs at least three or four times a year. These would run and fill these dams up. And there was only one that was saved for the house. When that went dry, we had to move out. So we had to watch everything, of course, naturally. There wasn't any irrigation of plants or anything else. Just what the Old Man on top gave us, that was all. (laughter) And then the pipeline was put in in 1912. (von Tempsky 1979:10)

Though the pipe lines built in 1912 helped, Mrs. von Tempsky felt there needed to be more done, and in 1913 she had a tunnel constructed in the lands above Erehwon in order to secure a local flow into the ranch:

> Kula is unfortunate in the scarcity of its natural supplies of water. Between the battery of small springs at Polipoli and the Waihou Spring on the boundary of the government land of Makawao, on the Haleakala Ranch, 10 miles or more distant, there is, save for the intermittent flow from a tunnel constructed by Mrs. Dora von Tempsky above Erehwon, no living water anywhere in the district. The local water situation as regards domestic supply has, of course, been relieved in the last two years by the construction of the Kula pipe line, but that does not change the lack of local sources of supply. (Hosmer 1912:277)

Boy von Tempsky was born in 1896. At the time of Randal's passing, he was only two years old, however, like his father, he had a passion for ranching, and around 1914, the management of Erehwon was then transferred to Boy from his mother Dora. At age 17, Boy began working on Erehwon hoping to transform the dairy ranch into a cattle ranch. This was due to the impeding competition of California butter arriving in Hawai'i. Boy continued to diversify the ranching on Erehwon through the cultivation of various corns, beans, cabbage, potatoes, and onions on about 400 acres of land (Molina 2021). By 1916, the ranch was producing prize-winning crops. Placing first and second at the annual Maui County Fair's agronomy competition for Maui red beans, calico type, and white navy beans and taking first place for flint shelled corn and second for their entry in the division of pasture grasses and legumes (The Maui News 1916). In 1917 Boy sold their Jersey-Holstein cross cattle and purchased fifty heads of Hereford stock from Hawai'i Island-based, Parker Ranch (Star-Bulletin 1967). At this point, Boy was able to sufficiently build the beef production at Erehwon and eventually was able to make it rentable (Figure 21). By 1919, Boy married Mary "Mamie" Sophia Scharder, who would follow in her mother-in-law's footsteps and host various people at their Erehwon home (Molina 2021).



Figure 20. Cattle ranching on Erehwon lands in Kamehamenui. Photo courtsey of von Tempsky family collection.

Between 1920-1929, the work on Erehwon focused largely on slaughtering. At this point, Boy was involved with ʻUlupalakua Ranch as an assistant manager and established a slaughtering process on the ranch. By 1931, ʻUlupalakua Ranch was the first to lease land from Erehwon. Under ʻUlupalakua Ranch, Erehwon became a complete ranch, where they would raise, kill, then ship and sell the cattle to markets in Honolulu. Eventually, foreign cattle imports started making its way to Hawaiʻi and began to impede upon the ranch's grass-fed beef. This prompted the conversion of breeding, killing, and selling to a new method of feeding and raising younger animals into the grading of beef under federal standards. At this point, cold storage facilities began to emerge on the ranch (Molina 2021). At some point, the management of ʻUlupalakua was no longer interested in the land Erehwon offered as it was a burden to transport cattle from a detached piece of land to the rest of ʻUlupalakua Ranch. Upon ending this lease, Boy leased Erehwon to Haleakalā Ranch which caused less of a hassle since Haleakalā Ranch surrounded the Erehwon property. Boy would lastly find himself at Kaupo Ranch, where he was contracted for five years to help pull the ranch out of financial troubles (Molina 2021).

The lands of Erehwon were extensively utilized under the management of the von Tempsky family, ranging from dairy and cattle ranching to diverse farming and even to a place of leisure and relaxation. Alexa Zabriskie, Boy's sister, managed the exclusive Puʻu Lani Ranch Hotel which was situated on Erehwon lands on the slopes of Haleakalā (Star-Bulletin 1948). Erehwon was also famed for being a rest stop for the Military men of World War II and housed the infamous wall which memorialized the soldiers who would sign their names and leave headshots (Molina 2021). When Boy died in 1976, management of Erehwon went to his son, Robert Gordon "Ski" von Tempsky Jr, who proposed a tramway through Erehwon lands up to Haleakalā Crater. That was met with strong opposition and the proposal was dropped. Finally, in 1993, Ski put the Erehwon lands up for sale to ease the burden of future estate taxes (Advertiser 1993).

Kula Roads

Ala Hele (a Hawaiian term referring to trails and byways) are the links that connect communities to cultural and natural resources within *ahupuaʻa.* In ancient times, the primary method of travel was by foot on these trails. As society in Hawaiʻi evolved with the introduction of horses and cars, so did the trails. The evolution of trails can be categorized by the use of Russell Apple's trail types (see Table 4) (Apple 1965). Some of these foot trails have since evolved into major roadways. The *ala loa* is a coastal trail encircling most of the island and the *ala nui aupuni* (Government Road) is like the *ala loa* in encircling the island but situated *mauka* (inland) of the coastal area (Apple 1994). Through historical map research, a basic understanding of which trails and roads were utilized within the project area vicinity can be identified.

Table 4. Apple Russell's Trail Types.

Trail Type	*Trail Description*
Type "A"	a. Single-file foot trails, characterized by man turnings and one-man width. If on coast, persistently following configurations of shoreline where passable, skirting inland around major land obstacles, such as cliffs (thus there was a single beach trail around most of the island.) b. Coast-inland trails within each *ahupuaʻa* of this type. c. Taboo areas not crossed by such trails. d. Over soil: a recognizable trace, some places deep. e. Over "clinker" lava *[ʻaʻā]:* steppingstones, usually of smooth, waterworn stones *[ʻalā].* f. Over "billowy" lava *[pāhoehoe]:* usually no trace (followed easiest and shortest route): some cracks filled with small stones; some low spots with causeways of rocks *(kīpaepae);* steppingstones of angular-edged rocks. Occasional piles of rocks to mark trail; perhaps petroglyphs also
Type "AB"	Modification of Type "A" to accommodate horses.
Type "B"	New trails with kerbstones for horses. Built in straight line where possible, thus always inland of coastal Types "A" or "AB." Crossed former taboo areas and *ahupuaʻa* boundaries. Deviated from strict shore-line route. Both one and two horse width. Usually connect with Type "AB" to make short cut.
Type "C"	New two-horse trails built as straight as possible between two major points, cutting off many former coastal settlements.
Type "D"	Modification and minor realignment of Type "C" to accommodate wheeled vehicles.

Hawai‘i Registered Map No. 1268 prepared by surveyor F.S. Dodge in 1885 depicts the “Haleakalā Trail” extending along the *mauka* (easternmost) boundary of the subject parcel (Figure 22). The trail can be seen originating in Makawao where it then ascends the leeward slopes of Haleakalā in a southeasterly direction until it reaches the crater’s edge in Kalialinui Ahupua‘a located to the north of the project area. At this point, the trail continues south where it meanders along the *mauka* boundary of Pūlehunui, Kamehamenui, and Kealahou 3rd and 4th before making an easterly turn into the crater near Pākaoao (also known as White Hill). The 1885 map also shows a secondary branch of the Haleakalā Trail extending to the upper boundary of Kalialinui Ahupua‘a.

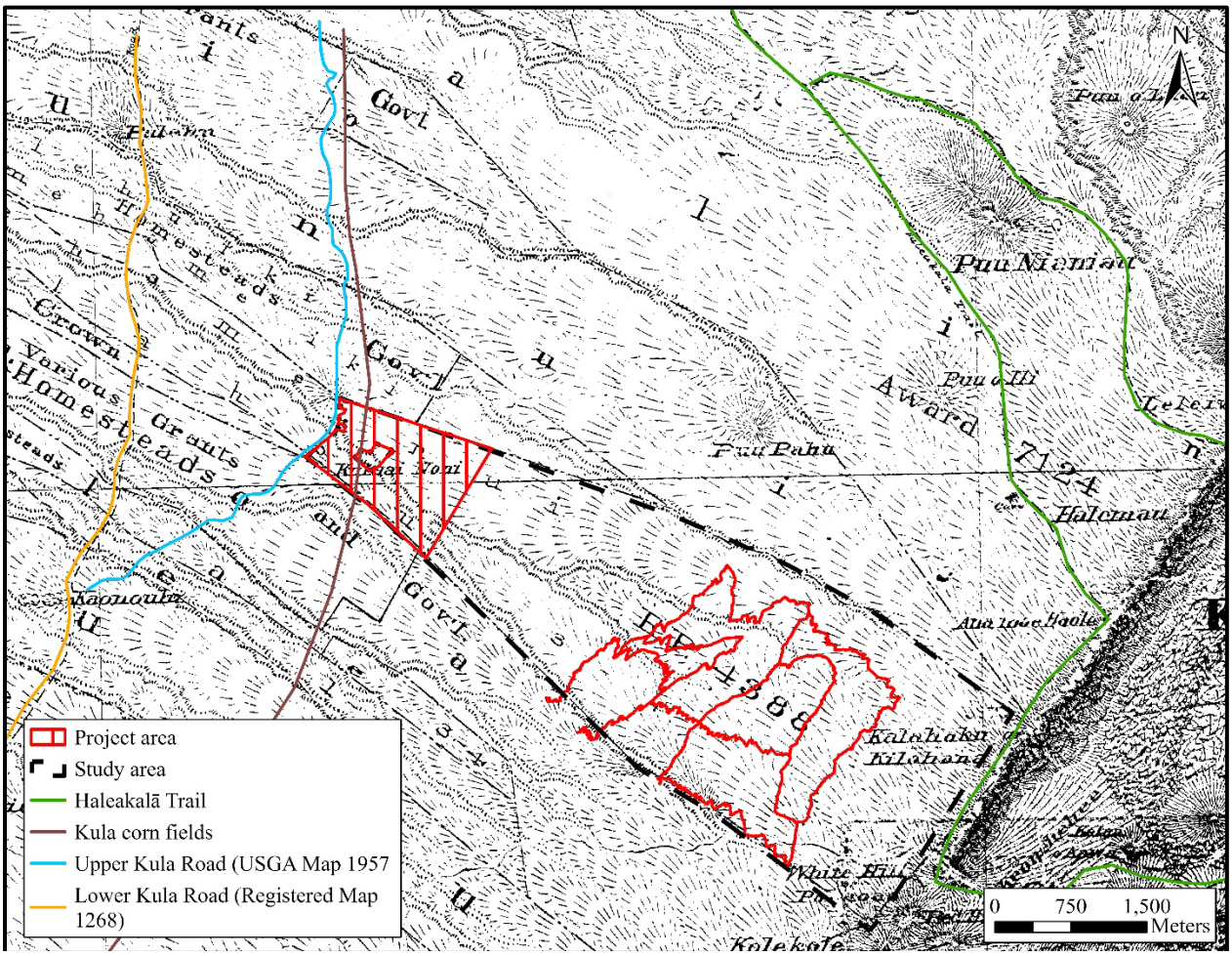


Figure 21. Hawai‘i Registered Map No. 1268 prepared by surveyor F.S. Dodge in 1885 showing location of the “Haleakala Trail” *mauka* of the project area and Government Roads *makai* of the project area.

Dodge’s 1885 map also shows the alignment of the *ala nui aupuni* through the Kula District. This road was known as the Kula Government Road and at that time was the only means of moving resources from Kula across various *ahupua‘a* (see Figure 22). In the early 1890’s, brothers Randal and Louis von Tempsky were heavily involved with government agencies such as the Makawao Road Board, the board of Fence Commissioners, and Louis as a Government agent for Homesteads (Thrum 1892, 1893, 1894). In 1891 correspondence between Randal, as chair of the Makawao Road Board, and the Interior Department proposed to open roads through the Waiakoa Homesteads, thus starting a series of constructing new roads in Kula. In 1893, when Louis joined the Makawao Road Board, the Department of Interior decided to adopt these proposals (HSA 1891, 1893). Various articles were published in newspapers indicating the construction of a new Kula homestead road or the Upper Kula Road. *The Honolulu Advertiser* (1892:6) writes, “The Makawao Road Board have done fine work on the Kula road as far as Pulehu iki.” Construction of roads happened within segments and in 1895, an agent of the Interior Department accompanied members of the Makawao Road Board to examine the roads that intersected Kula homesteads. Unfortunately “he found the grades bad and the roads poor” which would push completion of these roads further back (Advertiser 1895). Finally in 1897, *The Hawaiian Star* recorded a completed section of this road:

> The new government road to run through the Kula corn fields to Makawao is now completed from a point on the old road below Younge Hee's Kaonoulu ranch to a point near R. von Tempsky's house, Waiakoa. This road is much needed and when fully completed will make travel through the cornfields comparatively easy. (Star 1897:1)

Interestingly, the lower and upper Kula roads run parallel to each other through the majority of the Kula Corn Fields (see Figure 22). The upper Kula Road is situated right below the project area and is now known today as Kekaulike Avenue. This name change was designated by road supervisor H. L. Holstein in 1938. *The Honolulu Star-Bulletin* shares the origin of this name:

> The road variously known as the Upper Kula road and the Kula homestead road, from its junction with the crater road to the junction of the upper and lower Kula roads, becomes Kekaulike Ave. Kekaulike was the next to the last Maui king and ancestor of many of Maui's leading chiefs. (1938:9)

Transition from Erehwon Ranch to Forest Reserve

After the von Tempsky family put the Erehwon Ranch lands up for sale in the 1990's, it was purchased by Shizuka Asakawa of Shizuka Asakawa Revocable Trust Agreement. Around 2018, the Asakawa Trust put the property up for sale at which time the DLNR-DOFAW in close partnership with the Trust for Public Lands (TPL), and the National Park Service began fundraising to acquire the 3,276-acre property for public purposes and to protect native sub-alpine ecosystems and formerly forested grasslands. In July of 2020, the TPL purchased the property and conveyed ownership of the property to the DLNR-DOFAW on August 31, 2020. At the time of purchase, an "Amended and Restated Grazing Lease and Hunting License Agreement" was in effect between Asakawa and leasee Brendan Balthazar for the subject parcel (DLNR-DOFAW 2018).

The purpose of this purchase amongst the agencies is to protect the property's tropical mesic forest and subalpine ecosystems. The property management is currently under DOFAW's Forest Reserve system as the Kamehamenui Forest Reserve. Providing a wide range of public benefits from increasing water recharge to aquifers for drinking water, preserving open space, and access to *mauka* recreational opportunities. The authority to administer existing grazing and hunting lease with Balthazar was transferred to DOFAW (DLNR-DOFAW 2018).

SUMMARY OF PREVIOUS ARCHAEOLOGICAL STUDIES

Prior archaeological investigation within the project area are limited to an archaeological literature review and field inspection (Moore 2022) for a proposed fence line as well as an archaeological inventory survey of the current project area (ASM Affiliates, in prep). Both studies were undertaken in 2022 following the acquisition of the subject parcel by DLNR-DOFAW. While archaeological studies within the project area are limited, several studies have been conducted in the area north and south of Kamehamenui at a similar elevation as the subject parcel as well as *makai* of the project area in Kealahou 1st and 2nd. A review of this nature provides a general understanding of the types of resources that can be anticipated within the project area. The location of these studies in relation to the project area is depicted below in Figure 23. The subsequent paragraphs begin with a summary of early archaeological investigations conducted during the early 20th century, followed by a summary of those studies conducted in the project area, and concludes with a presentation of studies conducted in the area's north and south and west in Kamehamenui and Kealahou Ahupua'a.

Summary of Early Archaeological Investigation in Kula

The earliest formal archaeological investigations to occur in Kula was undertaken by Winslow Walker in 1931 during his island-wide survey. In the districts of Kula and Honua'ula, Walker recorded an array of site types located in and around community settlements including fifty-nine *heiau*, three fishponds, eleven abandoned villages, and five ancient villages that were supplanted by modern communities. In Kula, Walker recorded twenty-six *heiau* and identified the names of those located in the uplands: Alae Heiau, Waiakoa Heiau, Rice Camp Heiau, Pulehu Heiau, Kohea Heiau, Molohai Heiau, Papakea Heiau, and Kaumiumimua Heiau. Brown and Haun (1989) who conducted a study on the Waiohuli and Keōkea subdivision located to the southwest of the project area identified three more *heiau*, Ho'ola and Ho'ola Ua in Keōkea and Kaimupeelua in Waiohuli. Morawski and Dega (2003) note that "many petroglyphs and rock art sites have been documented in gulches in and around the area of upcountry Kula" and that "these sites add to the areas cultural significance in traditional and historic times." An example of this is Site 50-50-11-01050 and 01051 located *makai* of the project area along Keahuāiwi Gulch (see Figure 23).

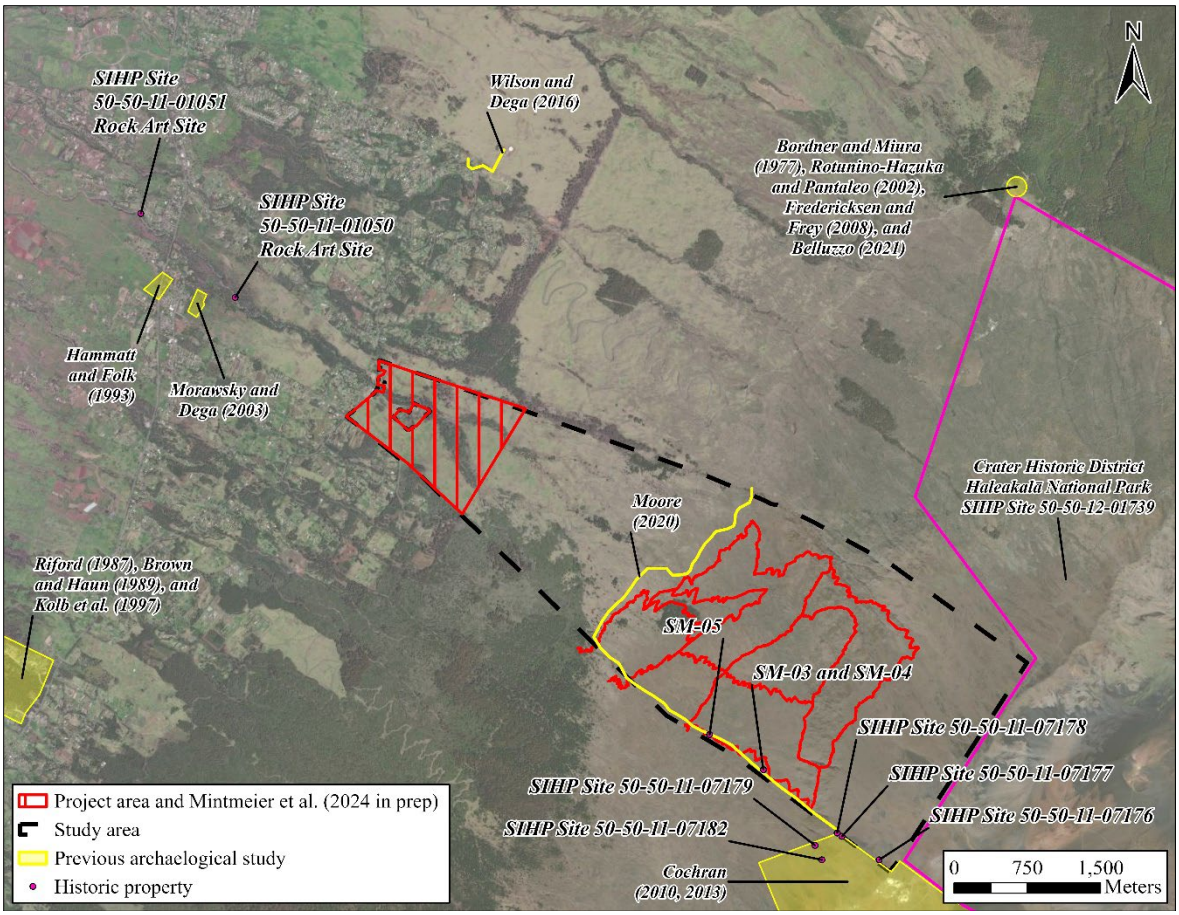


Figure 22. Location of prior survey areas and sites in the project area vicinity.

Summary of Prior Studies Conducted in the Subject Parcel

In October of 2021, International Archaeological Research Institute, Inc. (IARII) completed an archaeological literature review and field inspection (Moore 2022) for a proposed 4.8-mile-long fence; with a 1.90 miles section running along the south boundary of Kealahou 3rd and 4th and another 2.18 miles extending perpendicular to the slope contours within the central portion of the subject parcel (see Figure 23). A total of three archaeological sites were identified along the southern portion of the corridor including two low-lying rock walls (SM-04 and SM-05) both of which were interpreted as an informal windbreak; and a rock pile (SM-05) interpreted as a marker. The proposed fence line was rerouted 10 feet south of the features to avoid impacting the sites. The location of the identified sites are shown above in Figure 23.

In 2022, ASM Affiliates conducted an archaeological inventory survey of approximately 320 acres in the makai portion of Kamehamenui Forest Reserve and a reconnaissance survey of 25 miles of linear trail routes in the mauka portion of Kamehamenui Forest Reserve (Oordt et al. 2024 in prep; see Figure 23). As of the preparation of this report, this study has yet to be completed and reviewed by DLNR-SHPD. The fieldwork associated with the archaeological inventory survey resulted in the identification and documentation of one historic property, labeled Site 50-50-11-T-1. Site 50-50-11-T-1 is Erehwon Cattle Ranch, consisting of 82 features spread throughout the 320 acres that comprise Survey Area 1 (Feature 24). The features consist of a variety of site types (CRM walls, dry-stacked walls, terraces, rock piles, historic structures, enclosures, etc.), which were interpreted as related to the operation of the historic ranch, including water management, livestock management, erosion control, dairy farming, habitation, and agriculture. The reconnaissance survey resulted in the identification of six archaeological sites in the mauka portion of the Kamehamenui Forest Reserve (Feature 24). The sites consist of a modified outcrop (Site T-2), a cairn/ mound (Site T-3), a cairn (Site T-4), two rock walls (SM-03 and SM-04) and a rock pile (SM-05). Three of these sites (Site T-2, Site T-3, and Site T-4) were newly identified and recorded during the reconnaissance survey field work. The remaining three sites (SM-03, SM-04, and SM-5) had been previously identified by Moore (2020) but were not relocated during the field work.

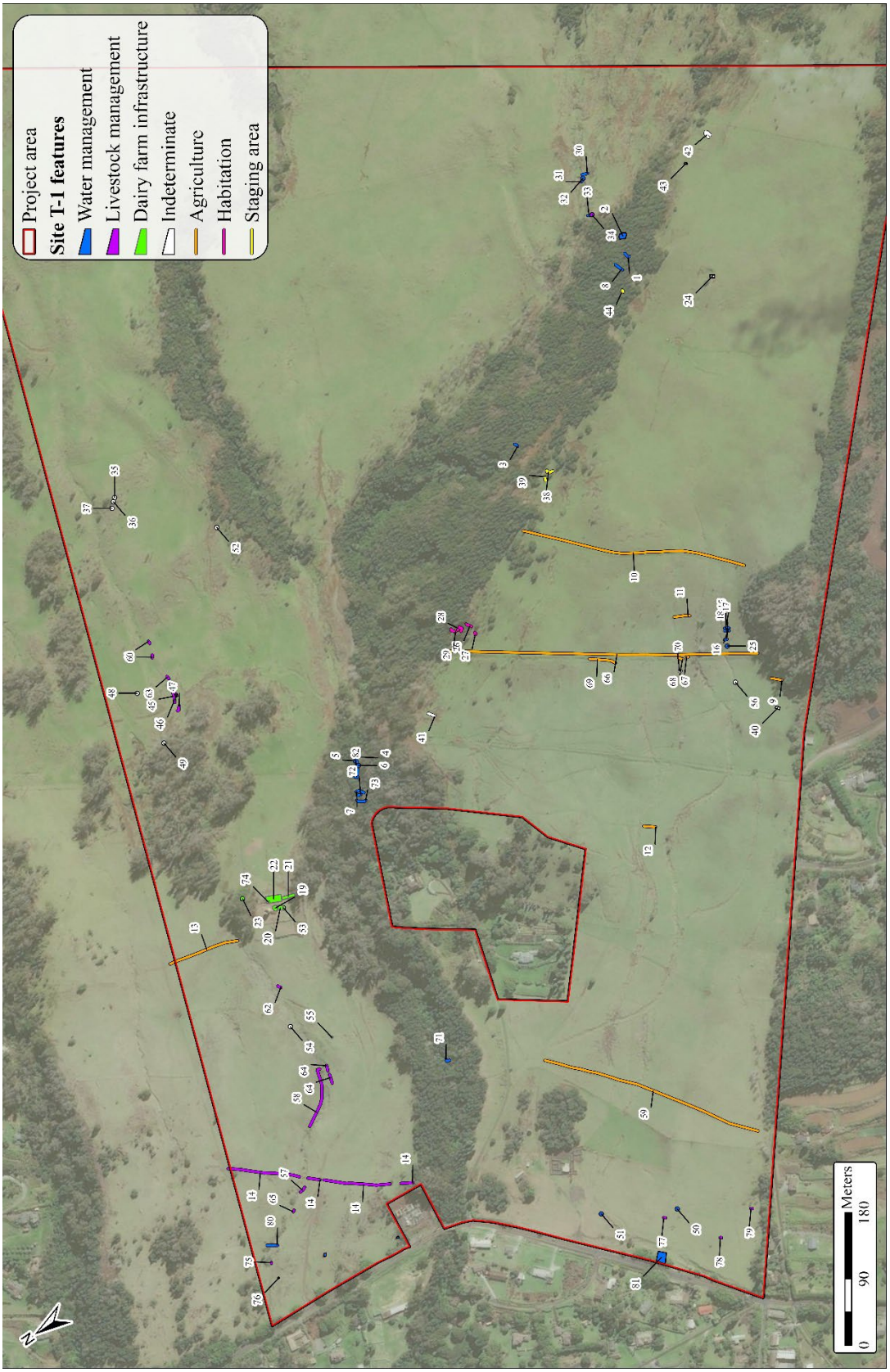


Figure 23. Site 50-50-11-T-1 identified by (Oordt et al. 2024 in prep) in the makai portion of Kamehamenui Forest Reserve.

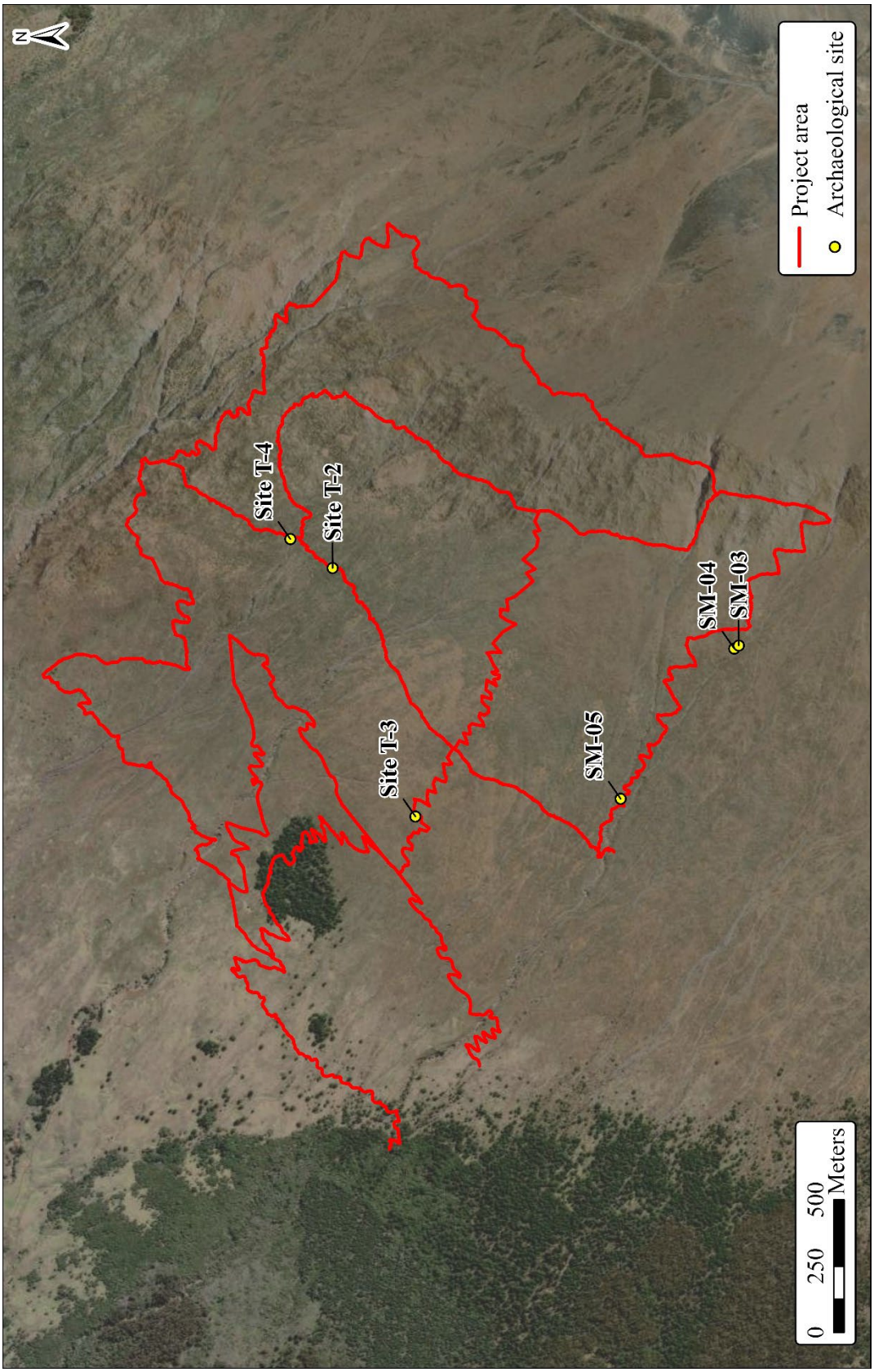


Figure 24. Archaeological sites identified by (Oordt et al. 2024 in prep) in the mauka portion of Kamehamenui Forest Reserve.

Summary of Prior Archaeological Studies Conducted on Adjacent Lands

Beginning in 1977, the Archaeological Research Center Hawaii, Inc. (ARCH) conducted an archeological reconnaissance (and biological) survey (Bordner and Miura 1977) at Puʻunianiau located roughly 2.7 miles northeast of the current project area. This study was conducted as part of an Environmental Impact Assessment for the proposed development of an FAA Air Traffic Control Radar Beacon System (ATCRBS) facility. It was noted that at the time of survey, much of the project area had undergone previous mechanical disturbance, which Bordner and Miura (1977) attributed to earlier road-building activities. Due to this disturbance, no surface features were identified. In 2002, within the same parcel, a State Special Use Permit was approved for the construction of new wireless communications infrastructure, based on the assumption that no historic properties would be affected due to the existing telecommunications facilities (Log No. 21712, Doc No. 9806BD25). Subsequent unmonitored ground-disturbing activities conducted in 2002 in the same parcel, for the installation of a Maui Police Department Radio Station tower resulted in the inadvertent discovery of what was preliminarily identified as a single juvenile burial identified as State Inventory of Historic Places (SIHP) Site 50-50-11-5193 (Log No. 29299, Doc No. 0202MK07). Following the discovery, DLNR-SHPD was contacted, and it was recommended that all work on the project should cease until an archaeological monitoring plan (AMP) was prepared and submitted for the project (Rotunno-Hazuka and Pantaleo 2002). The AMP prepared by Archaeological Services Hawaii, LLC (ASH) (Rotunno-Hazuka and Pantaleo 2002) was to guide the remainder of the project in the wake of the recent find. It was determined that Site 5193 contained seven features including a possible remnant burial rock platform and a burial pit containing the skeletal remains of four sub-adults and two adults (Rotunno-Hazuka and Pantaleo (2002) (Log No. 2008.0980, Doc No. 0807PC21), all of which were indicated to have been subject to previous disturbance. Aside from Site 5193, no additional burial features were identified on the property. A Burial Component of a Data Recovery Plan subsequently prepared by ASH two years later in 2004 (Rotunno-Hazuka and Pantaleo 2004) provided analyses results as well as additional details regarding Site 5193. All skeletal remains associated with Site 5193 were removed and reinterred at a site approximately one hundred feet northwest of the original interment site. In accordance with the long-term protection measures developed by Rotunno-Hazuka and Pantaleo (2002), a fifty-foot buffer was established around the reinterment site and demarked by a rock platform with a bronze plaque affixed indicating the site type and need to respect the site. In 2008, the same parcel was part of archaeological monitoring conducted by Xamanek Researches, Inc. (Fredericksen and Frey 2008) for the improvements to Sprint Nextel Hawaiʻi's existing infrastructure. Subsurface work associated with the project included minimal grading to facilitate the installation of a concrete pad as well as the excavation of two utility trenches to a maximum depth of 90 centimeters (3 feet). No cultural remains were identified during monitoring activities.

Most recently, in 2021, ASM Affiliates (Belluzzo 2021) conducted a field inspection of the same area and prepared a historic properties review and assessment of the direct and visual APE in an effort to determine whether there were any known historic properties that are listed, or have been determined eligible for listing in the National Register of Historic Places (NRHP) or the Hawaiʻi Register of Historic Places (HRHP). As part of the fieldwork, a pedestrian survey was conducted. However, portions of the survey area were not safely accessible due to antenna radiation exposure safety setbacks. As a result of the survey, a single stone structure, possibly a remnant burial platform (see Rotunno-Hazuka and Pantaleo 2002, 2004), and associated bronze plaque were observed near an antenna array within the confines of the safety setback of the previously mentioned telecommunications facility. Due to its location within the setback, the platform remnant was not closely inspected but was determined to be in very poor condition with little trace of the original structure remaining.

As part of the study conducted by Belluzzo (2021), it was determined that a single historic district was listed approximately 5 kilometers *mauka* of the current project area: the Crater Historic District. The Crater Historic District, identified as SIHP Site 50-50-12-01739, is located within the confines of Haleakalā National Park within TMKs: (2) 1-8-001:007 and (2) 2-3-005:001 *mauka* of the project area. It was listed in the National Register of Historic Places (NRHP) on November 1, 1974, and in the Hawaiʻi Register of Historic Places (HRHP) on January 1, 1992 for its significance in Polynesian prehistory and history (National Register of Historic Places n.d.). Despite the limited number of archaeological surveys conducted at the time of nomination, numerous traditional Hawaiian archaeological sites were nonetheless identified, including religious/ceremonial sites, temporary habitation, and sites indicating extensive quarrying and stone working activity, all of which largley centered around the crater (National Park Service 1995:23).

Archaeological investigation to the southwest of the project area in Waiohuli and Keōkea began in 1986 when the Department of Hawaiian Home Lands undertook several archaeological surveys as part of their proposed residential development. Riford (1987), who surveyed roughly 600 acres (of the 1,025 acre subdivision) documented

113 sites, including Papakea, Kaumeheiwa, and Molohai Heiau, and over 252 features. The recorded features included a diversity of prehistoric and historic agricultural, residential, and ceremonial sites. Two years later, (Brown and Haun 1989:ii) returned to the same area and identified "159 sites at which at least 335 features were formally designated." Of the 159 recorded sites, 107 were within Keōkea and fifty-two were in Waiohuli (which had experienced extensive bulldozing). The site types identified were interpreted as ceremonial, animal control (cattle), transportation, storage, burials, intact dryland agricultural fields systems, lithic reduction sites, and residential complexes. In 1992, the Department of Land and Natural Resources (DLNR) State Historic Preservation Division (SHPD) surveyed the same DLLH parcels and identified 1,093 archaeological features which they clustered into 213 sites. More than half of these sites were interpreted as agricultural features while the remaining sites were interpreted as permanent and temporary habitation sites as well as *heiau* (Kolb et al. 1997).

In 1993, Cultural Surveys Hawai'i (Hammatt and Folk 1993) conducted an AIS which included subsurface testing for the proposed Kealahou Switching Station in Kamehamenui on TMK: (2) 2-3-002:003 situated roughly 1.6 miles *makai* of the current project area. Walking transects spaced ten to twenty meters apart covered the entire project area with special attention being paid to the examination of exposed bedrock surfaces for petroglyphs. Two sites were located. The first, a collection of four petroglyphs on a bedrock boulder. The second site was an enclosure consisting of a U-shaped wall and an adjacent paved area on its northeast side. Aside from the single iron barrel strap observed near the center of the second site, no cultural materials were observed. Both sites were deemed significant and site preservation in the form of fencing with a fifteen-meter buffer around both sites during construction and the development of a preservation plan was recommended.

In 2003, Scientific Consultant Services Inc., (Morawski and Dega 2003) conducted an AIS within the Kealahou 3rd and 4th Ahupua'a for the construction of the tennis courts, a parking area, and an addition to the Kula Community Center located 1.4 miles *makai* (west) of the current project area. The AIS consisted of pedestrian transects at five-meter spacings due to the dense vegetation within the parcel with a single test unit excavated in the form of a shovel probe. Two archaeological features were identified during the pedestrian survey within the project area including a single historic cattle wall or boundary wall and a prehistoric agricultural terrace. Within the terrace, a single shovel prove was conducted which resulted in no cultural materials. While it was determined that fieldwork had been completed; the site had supplied all the data it could and was no longer deemed significant. However, it was noted that it is possible that subsurface archaeological features may be present.

The National Park Service (2009) provided a history of the development of Halekalā National Park whose boundary is coterminous with the subject parcel's eastern boundary. With the rise of tourism on Maui in the late 1800s, and at Haleakalā in particular, the first tourism facility was constructed in 1894, the Crater Rest house. In 1916, the Hawaii National Park was established, which included Haleakalā Crater. Much of the subsequent development of the National Park occured in the 1930s, largely conducted by the Civillian Conservation Corps (CCC). The CCC work force at Haleakalā, which numbered up to 50 people at times, primarily constructed and maintained trails but also erected cabins, water tanks, and other infrastructure.

IARII conducted two archaeological surveys *mauka* of the project area near the summit region of Haleakalā. The first, conducted in April of 2010 was for a roughly 46 foot wide and 2.7 mile long fence corridor enclosing approximately 300-acres located along the southeast boundary of the project area (Cochrane 2010). The second was an inventory survey (Cochrane 2013) covered the 300-acres enclosed by the fence as well as resurveying of the fence corridor. A total of 102 archaeological features, seventeen newly identified sites, and three previously identified sites were recorded. Three of these sites (Site 7176, 7177, and 7178) are located near the southeast corner of the subject parcel boundaries while two sites (Site 7179 and 7182) are located further south. Site 7176 consists of two features interpreted as an *'ua'u* trap and a temporary habitation structure; Site 7177, comprised of two features interpreted as a windbreak or temporary habitation structure located within an area containing numerous *'ua'u* nest and rock piles as well as two isolated fine-grained basalt artifacts; and Site 7178 contained several rock walls and rock piles also surrounded by *'ua'u* nest. Site 7179 contained eight rock piles and three upright stones arranged linearly and Site 7182 contained four rock pile features and multiple *'ua'u* nesting sites. Sites 7176, 7177, 7178, and 7179 were assessed as significant under Statr Criteria d and e and Site 7182 was considered not significant. The proposed fence alignment was adjusted in those places where sites were found to avoid all sites.

In 2016, a project to replace a 2-million-gallon water tank in the 'Ōma'opio Ahupua'a, triggered an AIS conducted by Scientific Consultant Services Inc. (Wasson and Dega 2016), for the County of Maui Department of Water. A full pedstrian survey at three meter intervals was conducted with all identified features being recorded and mapped and a single test unit was completed. A single site (Site 50-50-11-8291), consisting of three features were identified. These features consisted of two circular rock mounds and a rectangular rock mound. The single test unit was excavated within Feature 1, a circular rock mound and resulted in no findings which led to no further testing.

The site was in fair condition and considered significant, resulting in the recommendation to have an archaeological monitor present during any gound altering activities within the 0.87 acre project area.

3. CONSULTATION

Gathering input from community members with genealogical ties and long-standing residency or relationships to the project and study area is vital to the process of assessing potential cultural impacts to resources, practices, and beliefs. It is precisely these individuals that ascribe meaning and value to traditional resources and practices. Such individuals often possess traditional knowledge and in-depth understanding that are unavailable elsewhere in the historical or cultural record of a place. As stated in the OEQC (1997) *Guidelines for Assessing Cultural Impacts*, the goal of the oral interview process is to identify potential cultural resources, practices, and beliefs associated with the affected project area. It is the present authors' further contention that the oral interviews should also be used to augment the process of assessing the significance of any identified traditional cultural properties. Thus, it is the researcher's responsibility to use the gathered information to identify and describe potential cultural impacts and propose appropriate mitigation as necessary. This section of the report begins with a description of level of effort undertaken to identify persons believed to have knowledge of the study area, followed by the interview methodology. This section of the report concludes with a presentation of the interview summaries that have been reviewed and approved by the consulted parties.

In an effort to identify individuals knowledgeable about traditional cultural practices and/or uses associated with the current project and study area, a public notice containing (a) locational information about the project area, (b) a description of the proposed project, and (c) contact information, was printed in a newspaper with state-wide readership. The public notice along with a request for confirmation of the notice was submitted to the Office of Hawaiian Affairs (OHA) on May 4th, 2022, with the intent that the notice would be published in the June edition of *Ka Wai Ola*. ASM staff did not receive a reply email from OHA indicating that the notice was successfully received. A follow up email was sent to OHA on May 9th requesting confirmation of the public notice and again no confirmation receipt was received by ASM staff. On June 1st, 2022, ASM staff reviewed the *Ka Wai Ola* newspaper to confirm publication of the notice, however, it was learned that the noticed had not been published. Follow up emails were sent by ASM staff to OHA on June 6th, July 15th, and again on August 16th at which point, OHA responded confirming receipt of the notice and their intent to publish the notice in the September edition of *Ka Wai Ola*. The notice was officially published in the September edition of *Ka Wai Ola* and a copy of the published notice is included in Appendix A of this report. As a result of the public notice, no responded were received.

Additionally, at the recommendation of DLNR-DOFAW, ASM staff contacted Clifton Dodge on April 20th, 2022 who assisted ASM staff with contacting members of the von Tempsky family, namely Brooke von Tempsky and Debbie von Tempsky. With the assistance of Clifton Dodge, a group interview was set up with these three individuals. The approved interview summary from this interview is included below. Additionally, ASM staff attempted to contact, via email, Timothy Bailey in his capacity as the Kula District representative of the Aha Moku council on August 1st, 2022, as well as Keʻeaumoku Kapu also affiliated with the Aha Moku Council on July 28th, 2022. Efforts were also made to contact Huamakahikina, a coalition of Kumu Hula. No responses were received from Huamakahikina. A follow up email was sent to Mr. Bailey and Mr. Kapu on August 18, 2022, which ASM staff received responses from both. Mr. Kapu added Mr. Bailey to his email thread and referred to Mr. Bailey as an appropriate contact. Mr. Bailey wrote back on the thread that he was off island until August 23, 2022, and would reach out to ASM staff after reviewing the project as he grew up around the project area and is an adjacent land owner. On August 10th, 2022, ASM staff contacted Leo "Fuzzy" Tavares, Jr via phone. Mr. Tavares briefly shared that he was long-time friends with some of the von Tempsky family and felt that the ASM staff should contact them as they will likely know more about the history of the project area and the property. Mr. Tavares was appreciative of the request for consultation, but he felt that he would not be able to offer as much assistance as members of the von Tempsky family.

On the evening of August 10th, 2022, ASM staff attended the Kamehamenui Forest Reserve Management Plan Stakeholder Meeting with adjacent landowners that was led by DOFAW forestry manager Lance Nakanelua, and H.T. Harvey & Associates' ecologist Shahin Ansari. The meeting was held in the cafeteria of Kula Elementary School at 5:30 PM. In addition to adjacent landowners, a handful of community members attended this meeting. The purpose of the meeting was to gain input from the surrounding landowners about the project and to address any of their concerns through an open forum. The meeting included a presentation prepared by H. T. Harvey & Associates summarizing the proposed development activities. Much of the concern shared by those in attendance surrounded the idea of commercial activity. It was made clear that commercial activity was not welcomed for fear of the study

area becoming overrun with illegal activities. Several landowners expressed concern with the proposed parking lot and enforcement, especially if parking overflows along Kekaulike Avenue. In further discussion of the proposed plans for the forest reserve, the audience posed the idea of leaving the ranch lands as is and to renew lease extension with the current leasee. They expressed that ranching culture is an important aspect of Kula and the project area is the last remnants of that culture in Kula so they would prefer it to remain as is. Another concern expressed by the landowners centered on the deer population that roams the subject property. The landowners worried that if the deer is driven out of the parcel through fencing and hunting, they would invade the surrounding properties. Aside from maintaining the subject parcel as ranch lands, no explicit comments or concerns were raised regarding archaeological or cultural resources.

In addition to those contacted, ASM staff continued its outreach efforts and on August 24, 2022, via email, Vernon Kalanikau, coordinatior of the Maui Nui Ahupua‘a Project, Cody Nemet Tuivaiti, interim representative of Kula Makai of the Aha Moku council, and Michelle Kamalii-Ligsay, Kamehameha School’s Hawaiian Culture Based Education Coordinator, were all contacted and sent a consultation packet. On August 25, 2022, a response from Cody Nemet was received by ASM staff expressing that he would look the project over and get back to ASM. No further responses or comments were received.

INTERVIEW METHODOLOGY

Prior to the interview, ASM staff provided information about the nature and location of the proposed project and informed the potential interviewees about the current study. The potential interviewees were informed that the interviews were completely voluntary and that they would be given an opportunity to review their interview summary prior to inclusion in this report. With their acknowledgement and consent, ASM staff then asked questions about their background, their knowledge of past land use, and the history of the project area, as well as their knowledge of any past or ongoing cultural practices. The informants were also invited to share their thoughts on the proposed development and offer mitigative solutions. All interviews were conducted in person at locations identified by the consulted parties. Below are the interview summaries that have been reviewed and approved by the consulted parties.

CLIFTON DODGE, BROOKE VON TEMPSKY, AND DEBBIE VON TEMPSKY

On May 5, 2022, ASM staff, Lokelani Brandt met with Clifton Dodge, Brooke von Tempsky, and Debbie von Tempsky in Kula to discuss the proposed project and the scope of the current study. Much of the information shared during this group interview focused on historical land use, land tenure, the history of the von Tempsky family on the property, identification of culturally importance places, and traditional customary practices. Debbie is the great granddaughter of Randal von Tempsky and has lived in the project area property for four years but has been visiting since she was at least six months old. Debbie noted that before age fifteen, she lived on Moloka‘i but would come to Maui regularly. Then at fifteen, she attended Seabury Hall and Maui became her permanent home. After living under the “family roof”, Debbie’s father encouraged her to move, and she eventually built a home on the family land *makai* of the project area where she lived for some twenty or so years. Similarly, Brooke, who is the great-great granddaughter of Randal, also lived on the property for four years. Although Clifton has not resided on the property, he has lived on his family property located to the north of the project area and over the years, has spent time working on and exploring the project area parcel.

In reading from an unpublished manuscript of the *Kama‘āina Carousel* written by Alexa von Tempsky (Alexandra von Tempsky; daughter of Randal von Tempsky), Debbie shared that in June of 1850, the lands comprising Erehwon Ranch were originally given by the Crown to the chiefess Keohokālole and her husband Kapa‘akea and that the taxes for these tracts of land were “the payment of one pig a year to the kind.” The trustee of the Keohokālole’s estate, Charles Bishop, then sold the land to James Lazuda for $800. In May of 1864, Lazuda sold half of his interest to Henry Cornwell. By May 10th, 1888, Kapua Lazuda and four of the Cornwell’s heirs sold their interest to Adelia Cornwell, who during this same year, sold all three *ahupua‘a* (Kamehamenui, Kealahou 3rd and 4th) to Louis von Tempsky for $8,000. Shortly after acquiring the land, Louis went into partnership with William Williams, an Australian. A year after Louis purchased the property, Randal bought out Williams and Brooke shared when Louis became more invested in Haleakalā Ranch where he worked as a manager, he decided to sell his share to his brother Randal for $6,000. Debbie added that according to a memoir written by another family member, the $6,000 used by Randal to buy out Louis came from their ranch on Hawai‘i Island and that the deed assuring full ownership of the three *ahupua‘a* from which Erehwon is comprised arrived the morning of Randal’s funeral. Debbie explained that Randal had an aneurism from lifting a stove and died in 1898 and was buried on the family property.

In describing some of the early uses of the land following the acquisition by Louis von Tempsky as detailed in *Kamaʻāina Carousel*, Louis leased acreage to tenant farmers who grew crops such as corn, potatoes, and beans which were exported to the U.S. west coast. After Randal's death, three leases were still in effect, the income of which went to Dora von Tempsky, the wife of Randal. Debbie clarified that it was Dora who commissioned the construction of the Tudor home as well as the silos. When asked if they knew how the land was cleared for the ranch, both Brooke and Debbie suspected that most of the initial clearing was likely done by the tenant farmers.

Concerning the ranch's formative years, both Brooke and Debbie shared that prior to Dora building the Tudor home in ca. 1928, the von Tempsky family owned and operated Erehwon Ranch. Debbie explained that the name Erehwon is "nowhere" spelled backward because at the time the ranch was started, there were but few people living in the area and was considered by the family to truly be in the middle of "nowhere." Debbie added that during the early 20th century, it would take three days to bring building material from Kahului up to the ranch. When asked if there were any other structure on the property prior to the Tudor home being built, Debbie recalled that there were several small shacks on the property, the first of which was a small house located behind the Tudor home. Brooke added that the first home was taken down and replaced with what Brooke referred to as the small "brown house." Brooke also recalled two smaller shacks on the property that was located on the side of the pasture. Clifton mentioned that one of those shacks was his dad's base yard at one point. Brooke clarified that Gigi's house was built around 1920 then around 1928-29, the Tudor home was built. Clifton inquired about a stone house, which Debbie surmised it likely belonged to Alexa. When talking about the different houses on the property, Debbie noted the house of Manta Isobe who was the family's cowhand. Isobe's house was on the south side of the gulch between the driveway and the corral. She recalled being able to still see, from Kekaulike Avenue, the remnants steps that led to Isobe's house.

When asked about sites or places of significance in the project area, Debbie and Brooke mentioned Puʻu Moho being a place where they scattered the ashes of some of their loved ones. When if there are any other burials on the property, both Debbie and Brooke share that there are at least family members buried on the property, including "Gigi, Paw Paw, and Grandpa". They noted that the burial sites are at the "Big House" and another at what Brooke called "the garden/ front entrance into Gigi's house." They confirmed that the burials are not within the project area or that portion of the property owned by DLNR but are within parcels (2) 2-3-005:007 and 008.

In talking about water features of the project area, Brooke and Debbie described springs located in Keahuaiwi Gulch a little *mauka* of the Tudor home. They shared that this spring was utilized by members of the local Mormon church for baptisms. Debbie shared that the nearby Mormon Church was one of the first on Maui and she recalled how sometime in the 1980s when her dad and uncles would come onto the property, members of this church would stop by and ask if they could come over to access the spring. In talking more about the stream in Keahuaiwi Gulch, Brooke, who lived on the property from birth until the age of four, stated that as a child, she always recalled the stream flowing and that they would go in the stream to play and swim. Clifton recalled seeing old concrete basins within the gulch and Debbie recalled how "Paw Paw" concreted some of the *punawai* (spring) in the gulch.

In talking about some of the out-planting efforts conducted by the von Tempsky family, Debbie shared that during the 1970s it was a trending practice to plant large trees to help with catching rain and improving the water supply. She recalled how her father led some of the out-planting efforts on the property and that, on occasion, other family members would also help with out-planting. Clifton recalled his father also doing out-planting during this time. Both Debbie and Clifton related that at that time, the out-planting efforts focused on large non-native trees like redwoods. While they wished that these early out-planting efforts focused on native species, Debbie, Brooke, and Clifton concurred that they did the best they could with the knowledge that was available at that time. Brooke elaborated that during the early 19th century, much of the land was degraded so to improve the land and increase water, fast growing trees species such as pine, redwoods, and Eucalyptus were preferred. Debbie noted that many of the redwood trees that were once on the property burned in a wildfire, and she related the following story which was shared with her by her father. One day, while her dad was at Palauea Beach, he looked up toward Erehwon Ranch and shouted "Erehwon's on fire." He immediately rushed up to the ranch to extinguish the fire but by that time, the fire had destroyed much of the redwoods. Clifton recalled once while bird hunting and hiking down in the area, he had passed through a field of chaparral and observed how the base of the plants were charred. Debbie noted that there are a few remaining stands of out-planted trees and that for her, these stands are a memorial to her father's legacy. Concerning other planting done by the family, Brooke shared that wattle was also planted and that over the years, these trees have, unfortunately, gone unmanaged. Brooke recalled how her father used to cut the wattle trees, let them dry for at least two years, then he would sell it as firewood. She added that the tannic acid from the wattle trees is what her family used to tan their hides.

Concerning native plant species that once grew in the project area, Clifton spoke about the *māmane* forest. Although they were not sure how far down the *māmane* forest extended, Clifton noted that there used to be a lone *māmane* tree in the Keahuaiwi Gulch which has since been choked out by the Eucalyptus. Clifton also shared his efforts for *māmane* restoration that didn't take at first, but upon reforesting a lower section, the out plantings grew successfully within that area. Clifton also spoke about his efforts with the Haleakalā sandalwood variety. He noted that there are a few trees up at the top of Erehwon Ranch and shared that he has been doing out-plantings for about thirty years. Debbie further shared that in her own efforts with conducting interviews, an old timer, the late Moki Medeiros who lived a little south of the project area, shared that during the early 20th century, *māmane* wood was used for fence posts due to its abundance in the area.

Regarding the pine patch in the upper portion of the parcel, Clifton recalled his dad telling him of a wooden platform they had constructed because there weren't much flat lands up there. Debbie shared that the platform wasn't so much of a historical feature, rather it was something utilized by her father for storing his tools and leaving canned foods "just in case." In sharing more about the upper portion of the property in the vicinity of the pine patch, Clifton opined that the wild pigs have really impacted this area. Brooke added that her dad and other family members used to hunt in the upper portion of the property regularly. Brooke and Debbie explained that they rarely accessed the upper portion of the property from the *makai* section, rather they would drive up from the Polipoli side to about the 6,000-foot elevation and then cross the property. Debbie related that because the terrain is so steep it is difficult to access even for animals like horses.

When asked about the berm structures on the property, Debbie mentioned it was the Chinese laborers who constructed it to level the land enough to grow crops. Debbie and Brooke both shared that there are more berms on the "cornlands" and confirmed that these lands are *makai* of the Kekaulike Avenue. In speaking more of the cornlands, Brooke mentioned a *heiau* that was situated near the gulch but could not recall the name. Debbie recalled only knowing of petroglyphs/pictographs below the project area based on information she obtained from the Bishop Museum. Both Debbie and Brooke confirmed that the von Tempsky's also owned the cornlands *makai* of the project area.

When asked about the pottery and ceramics fragments (Japanese or Chinese style) found on the property during archaeological reconnaissance, Debbie shared that the ceramics may have come from the Japanese cowhands and workers who lived on the property during the ranching period. Debbie explained that during World War II, many Japanese were being sent into internment camps and life was particularly hard for them. However, she added that her family took care of their Japanese workers. During a meeting at the Kula Community Center, Debbie recalled speaking with an individual named Chauncey Munden, whose family had worked for the von Tempsky's. Munden expressed his gratitude towards Boy von Tempsky (Debbie's grandfather and Brooke's great-grandfather), because during World War II, the markets would not prioritize the selling of produce grown by the Japanese farmer which put them at an economic disadvantage. Debbie explained that after seeing the Japanese farmers being treat as such, Boy felt that it was not fair to them, so he helped to establish an agricultural coop to make the selling of crops fair for all farmers. Brooke added that this is how the Kula Agricultural Park started. Debbie commented that there was a real sense of loyalty between the Japanese farmers and their family.

Both Brooke and Debbie shared stories of the many parties that were hosted at Erehwon by Alexa during the World War II era. These parties, Debbie recalled, attracted many military service men who sometimes flew up to the ranch on their military planes and on one such occasion, an intoxicated military pilot ended up crashing his plane on the upper portion of the property. Brooke recalled how she had met with the grandson of the pilot who had crashed his plane at Erehwon. As the story is told, the pilot attended a party at Erehwon and in a drunken stupor, decided to fly his plane but unfortunately crashed it. The pilot survived but the remnants of the plane were left on the ranch. Debbie recalled hearing that two planes had crashed but she was not able to confirm this information. Furthermore, Debbie related that there used to be a flag the flew on the property and when the flag was raised, it indicated "don't come up this weekend" but if the flag was lowered, "it was a symbol for come on up."

Concerning the family selling the ranch, Brooke noted that around the late 1990s after her grandfather passed, the family decided to sell the land to the caretaker, the Zwaanstra's, to relieve the family from potential financial burdens from estate taxes. The family did, however, manage to maintain forty acres adjacent to the northwestern boundary of the project area. Although today, the current project area is no longer owned by the von Tempsky family, Brooke expressed her gratitude that the Tudor house was purchased by her cousins, and that the remainder of the land is designated for conservation. Brooke related that after the family had initially sold the property, there was some worry that the land would be extensively developed.

In discussing the specifics of the proposed project, the group supported the idea of no public vehicular access through the parcel and that if people want to get to the upper trails from the *makai* portion of the parcel, pedestrian access would be best alternative. They did caution that the land is steep and can be difficult to ascend. They expressed their support for reforestation efforts and use of plants species that are native to this environment.

TIMOTHY "TIMMY" BAILEY

On September 29, 2022, ASM staff, Kauʻi Lopes met with Mr. Timmy Bailey via Zoom video call to discuss the proposed project and the scope of the study. Much of the information shared in the interview focused on Maui *moʻolelo* regarding place names and its significance, identification of natural and cultural resources of the broader Kula region, historical use of the lands, and traditional customary practices. Timmy is a Native Hawaiian born and raised in Kula, Maui who currently works with the National Parks Service in Haleakalā as a manager with the feral animal removal management program, aviation program, wild land fire program, and the search and rescue program. He was appointed by Governor Linda Lingle to sit on the ʻAha Kiole advisory committee that established the current ʻAha Moku Advisory council where he sits as the Kula Mauka chair. He is a *mahiʻai* (farmer) and traditional Hawaiian tattoo practitioner. His relationship to the project area is that his family land is directly adjacent to Kamehamenui *ahupuaʻa* situated next to the half of Puʻu Moho that is within the Waiakoa *ahupuaʻa*.

When discussing the lands of Kamehamenui, Timmy shared two possible naming explanations for the *ahupuaʻa*, one explanation being a shortened version of Kamehameha Nui who was a high chief on Maui and the other for the *hame* trees that are found in the Kaupo region. He shares that it is possible for the project parcel to be named after the *hame* trees as Kamehamenui shares the same mesic dry forest climate as Kaupo and was possibly abundant there. As far as the utilization of Kamehamenui lands go, he can only recall the historical usage of open cattle grazing and not much on precontact use. He shares how during the *Māhele*, a lot of the lands were purchased and developed into ranch lands or set aside for homestead lands. The ranch lands would be further sold and developed, as an example Timmy noted how the Kula Nani subdivision was once ranch lands. Timmy also shared that his family land was once owned by the great grandparents of John Mederios, who could provide further *moʻolelo* of the project parcel. He does however suggest possible cultivation of *ʻuala* within the Kula region based on his own farming experiences on his family land when an *ʻuala* patch sprouted after he cleared an area.

In further discussion on the types of plants that could be found in the upper forested regions of Kamehamenui, Timmy implies that Kamehamenui would have been like the Makawao Forest Reserve. In 1980 when the state was doing banana poka surveys, with his permission, trails were cut on his property and when he used those trails, he recalls *pohole* fern that he would harvest for consumption, *ʻamaʻu* fern, *ʻākala* berry, and *maile* being abundant within the region. In his childhood when he would *"kihele"* he shared finding old *māmane* tree remnants within Keāhuaiwi Gulch located in the project area as well as harvesting seeds from the *koa* that was abundant on the von Tempsky parcel. As a traditional Hawaiian tattoo practitioner, he shares the importance of finding the *mauʻu hōʻula ʻili* on an area of his family land. He notes that this grass is usually found on newly disturbed lands that have been saturated with heavy mist, first identifying them in the craters of Haleakalā. Traditionally, he explained the use of this grass is to scar or redden the skin which would later be covered by a traditional tattoo. He implies that perhaps if scarring were to take place in Kamehamenui, coupled with the mist, this grass could pop up on the disturbed area.

Regarding the water resources within the broader Kula vicinity, Timmy notes that the usual wetter season for Kula is during the *kau* or dry season as opposed to the *hoʻoilo* or wet season. He shares that this pattern is due to Kula being colder and clearer in the *hoʻoilo* season meaning no precipitation, whereas in the *kau* season, the *kona* winds bring the *minoʻaka* clouds from Kona and the humidity as well helps bring an abundance of rain. He notes that these rains are important as they feed the springs located in Kula, unfortunately he shared that this water cycle has been less in the past four years putting Kula in a drought and resulting in *punawai* drying out. With this observation in mind, he elaborates on the *punawai* and rock wall structures that are apparent on his lands and related that the rock walls were perhaps utilized in bringing water from the *punawai* to the *ʻuala* patches that were being cultivated in the area during famine times. He emphasized the importance of the mist and how it is a significant water source, especially during a time of famine and that in the upper regions is most likely where cultivation efforts happened. Concerning Keāhuaiwi gulch that runs through the project parcel, Timmy doesn't mention any water flow, however he does note the meaning of its name which is "the bone pile" and reveals that bones washed up at one point, proving the existence of human activity around and in the area.

When asked of any additional archaeological features that could be found within the area, he noted that when the telescope was being built on Haleakalā, he took archaeologists to check out the upper portion of Kamehamenui *ahupuaʻa*. There, he identified significant sites that ranged from shelters to areas where *koʻi* (adze) were made and

even signs of *ma'a* stones, which he believes there must have been battles taken place in the region. He also shared his property having a Portuguese oven that was most likely from the ranching era when the workers lived on the adjacent lands. Timmy also notes that within the upper regions of Kamehamenui he came across small *ahu*.

In talking about hunting practices within the area, Timmy shared how Maui primarily operated free roaming piggeries until the Board of Health declared it a safety issue around the late 1950's and early 1960's, causing the pigs to be driven into the forests thus starting the practice of hunting in Maui. He relayed that traditionally Hawaiians weren't hunters but were gatherers, farmers, and fishers and rather than training dogs to hunt, the animals, that included pigs and dogs, were raised for sustenance. Part of this required the construction of walls, that he speculates might be found in Kamehamenui around 2,000 ft elevation, that would serve as a barrier to keep the pigs out of the *wao kele*.

Concerning *mo'olelo*, Timmy provided extensive information regarding the significance of the Kealahou *ahupua'a.* He translates Kealahou as "the pathway to the new beginning" firstly connecting it to when the islands of Maui, Lāna'i, Moloka'i and Kaho'olawe were all considered one continent. This greater continent, he shared, extended beyond the heavens. The ancestors at the time hiked those lands and could see there was more lands not seen which they considered "the place of the gods" because that was where the thunder and lightning occurred. Eventually a catastrophic event happened with the *kumulipo* and the rising of the black waters, in turn sinking the continent and separating it into the independent islands that we know as Maui County today. This event is signified by the naming of Kealahou *ahupua'a* as the people would have had to adapt to a new way of life. Another *mo'olelo* regarding this *ahupua'a* is the infamous story of Māui and how he ensnares the sun so that Hina, his mother, could dry her *kapa*. Timmy shared that Kealahou could have been the pathway that Māui took to the summit where he continued to share various significant places that tie in to this *mo'olelo.* Lastly, the broader Maui *mo'olelo* he shared regarded the shape of Maui. Noting that he was told Maui resembled the body of a woman and how certain *ahupua'a* and water features were tied to specific anatomy of a woman. The Kula region, he shared, is connected to the umbilical cord which he identified as a place on the summit known as Pōhaku Pālaha.

When asked about his knowledge of Pu'u Moho, he relayed that he knew the *pu'u* as Pu'u Malo. Timmy interpreted Pu'u Malo as being in connection with Waiakoa Ahupua'a, translating the name as the "waters for the warriors," and the spring located on his property as a place where the *koa* (warrior) would come to tighten up their *malo* before battles. In further discussion on the word *moho*, he relayed it could be significant to the flightless bird known as *moho* based on his prior knowledge of finding *moa,* an extinct flightless goose, bones in the Kīpahulu area.

In discussing the project area, Timmy shared his concerns on the traffic and congestion the recreational plans would bring to the Kula community. He feels that the lower portion of Kamehamenui should remain as historical as possible, allowing cattle grazing to still happen through leasing, as well as keeping it historically ranching culture. The preservation of the ranching culture will "keep Kula, Kula" and would provide better sustainable opportunities of providing Hawai'i bred and fed cattle to the community, as Timmy shares. To accommodate the recreational mandate, he believes pushing the recreational activities above the community and houses and off the crater road, would lessen the community impact. He also believes that the hiking trails should be more of a loop trail rather than having it connect with Polipoli trails. As far as providing an archery range, he suggests that the county should provide a designated area in town for those who would otherwise come up from town to access the Kula range, noting that the people who need it more are not Kula natives. As far as hunting in the area goes, he believes Kamehamenui does not allow for a lot of backdrop for hunting to occur, noting that bullet safety is the big concern and if anything Polipoli should remain a designated hunting area.

4. IDENTIFICATION AND MITIGATION OF POTENTIAL CULTURAL IMPACTS

The OEQC guidelines identify several possible types of cultural practices and beliefs that are subject to assessment. These include "...subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs" (OEQC 1997:1). The guidelines also identify the types of cultural resources, associated with cultural practices and beliefs that are subject to assessment. These include other types of historic properties, both man made and natural, submerged cultural resources, and traditional cultural properties. The origin of the concept and the expanded definition of traditional cultural property is found in National Register Bulletin 38 published by the U.S. Department of Interior-National Park Service (Parker and King 1998). An abbreviated definition is provided below:

> "Traditional cultural property" means any historic property associated with the traditional practices and beliefs of an ethnic community or members of that community for more than fifty years. These traditions shall be founded in an ethnic community's history and contribute to maintaining the ethnic community's cultural identity. Traditional associations are those demonstrating a continuity of practice or belief until present or those documented in historical source materials, or both.

"Traditional" as it is used, implies a time depth of at least 50 years, and a generalized mode of transmission of information from one generation to the next, either orally or by act. "Cultural" refers to the beliefs, practices, lifeways, and social institutions of a given community. The use of the term "Property" defines this category of resource as an identifiable place. Traditional cultural properties are not intangible, they must have some kind of boundary; and are subject to the same kind of evaluation as any other historic resource, with one very important exception. By definition, the significance of traditional cultural properties should be determined by the community that values them.

It is however with the definition of "Property" wherein there lies an inherent contradiction, and corresponding difficulty in the process of identification and evaluation of potential Hawaiian traditional cultural properties, because it is precisely the concept of boundaries that runs counter to the traditional Hawaiian belief system. The sacredness of a particular landscape feature is often cosmologically tied to the rest of the landscape as well as to other features on it. To limit a property to a specifically defined area may actually partition it from what makes it significant in the first place. However offensive the concept of boundaries may be, it is nonetheless the regulatory benchmark for defining and assessing traditional cultural properties.

As the OEQC guidelines do not contain criteria for assessing the significance of traditional cultural properties, this study will adopt the state criteria for evaluating the significance of historic properties, of which traditional cultural properties are a subset. To be significant the potential historic property or traditional cultural property must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

a Be associated with events that have made an important contribution to the broad patterns of our history;

b Be associated with the lives of persons important in our past;

c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

d Have yielded, or is likely to yield, information important for research on prehistory or history;

e Have an important value to the native Hawaiian people or to another ethnic group of the state due to associations with cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group's history and cultural identity.

While it is the practice of the DLNR-SHPD to consider most historic properties significant under Criterion d at a minimum, it is clear that traditional cultural properties by definition would also be significant under Criterion e. A further analytical framework for addressing the preservation and protection of customary and traditional native practices specific to Hawaiian communities resulted from the *Ka Pa'akai O Ka 'Āina* v Land Use Commission court case. The court decision established a three-part process relative to evaluating such potential impacts: first, to identify whether any valued cultural, historical or natural resources are present and/or past or ongoing traditional customary practices; and identify the extent to which any traditional and customary native Hawaiian rights are exercised; second, to identify the extent to which those resources and rights will be affected or impaired; and third, specify any mitigative actions to be taken to reasonably protect native Hawaiian rights if they are found to exist.

SUMMARY OF CULTURAL-HISTORICAL BACKGROUND INFORMATION

Through the gathering of cultural-historical background information, a rich and dynamic history is revealed of the Kula region. Kula bears the same name as the ecological zone that is characterized as a plain, field, open country, or pasture and is for the most part considered a dry land. These characteristics are consistent throughout time with the *mo'olelo* of Kiha-a-Pi'ilani revealing the occurrence of seasonal drought in this region. This same *mo'olelo*, along with others, also sheds light on Maui being historically ruled by two chiefdoms; the West Maui chiefdom whose

territory included the lands of Kaʻanapali and Lahaina and the East Maui or Hāna Chiefdom whose domains include Hāmākua Poko, Hāmākua Loa, Koʻolau, Hāna, Kīpahulu, Kaupō, Kahikinui, Honuaʻula, Kula, and Nāpoko or Wailuku. Kiha-a-Piʻilani eventually united the island and became its sole ruler. Prior to Kiha-a-Piʻilani consolidating Maui under his rule, he lived covertly in Makawao where he took Koleamoku, the daughter of East Maui chief Hoʻolaemakua, as his wife and in the time of famine outplanted *ʻuala* (sweet-potato).

Hawaiian historian David Malo supplements the claim of Kula commonly experiencing droughts and famine and reveals that *ʻuala* was the staple crop because it can withstand the environmental limitations of this district. Kula's agricultural history played a key role in the economic and cultural shifts that occurred following the arrival of foreigners in Hawaiʻi. After the unification of the Hawaiian archipelago, Kamehameha from 1810 until his death in 1819 was deeply involved in the *ʻiliahi* (sandalwood) trade and established Maui as the center of the trade by 1820. The customary practice of cultivating land for subsistence purposes, shifted as the *makaʻāinana* worked to fill the *aliʻi's* desires for *ʻiliahi.* This new industry drastically depleted forests and left *aliʻi* in debt, which by 1830 was not profitable, thus leading to its demise and eventual collapse. Despite the industry's downfall, this system of trade opened new pathways for other market industries. With the increase in whalers calling to in Maui's ports, the demand for fuelwood and other provisions led to the expansion of Kula's agricultural lands further upslope into the forests.

By 1840 the Hawaiian Kingdom government shifted from an absolute to a constitutional monarchy which paved the way for a new Euro-American system of private-land ownership in a process historically known as the *Māhele ʻĀina.* The demand from whalers for foreign produce like wheat and potatoes increased which led to an influx in Kula's population. Prior to and shortly after the arrival of foreigners (post-1778), the native *ʻuala* (*ʻuala maoli*) was the only variety of potatoes planted in this region, however, native farmers participating in the market economy shifted their focus to growing foreign produce, particularly wheat and potatoes. Of all the foreign crops, potatoes, namely Irish potatoes became the dominant cash crop and Kula was one of the first places in which Irish potatoes were grown on a large scale. The peak in potato cultivation was also spurred by the neglect of agricultural production in California as a result of the California Gold Rush ca. 1849. Although the cultivation of the Irish potatoes was mostly successful, the demand outpaced production, and Chinese farmers were brough to fulfill the demand. With the arrival of the Chinese, came other vegetables like corn, beans, cabbage, onions, wheat, and cotton. By 1854, the demand for Hawaiian-grown Irish potatoes on the continental U.S. came to an end and agricultural production in Kula shifted mainly to domestic use. In 1859, the Hawaiian Kingdom government went through a process of consolidating districts and redefining their judicial boundaries which resulted in Kula being included as part of the Makawao judicial district.

During the *Māhele,* chiefess Ane Keohokālole was awarded Kamehamenui and Kealahou 3rd and 4th, lands that now comprises the project area. Following the death of chiefess Keohokālole, her lands were placed into her estate in which Charles R. Bishop was the trustee. Kamehamenui and Kealahou 3rd and 4th were then sold to James Louzada, who in 1864, sold half of his interest to his brother-in-law, William Henry Cornwell. These lands then passed to Kapua Louzada and several Cornwell heirs who later sold the land to Adelia Louzada Cornwell in 1888. In this same year, these lands were sold to Louis von Tempsky, the son of Prussian noble, Gustavus Ferdinand von Tempsky and his wife Amelia Ross (Bell).

Louis arrived on Maui in 1879 and a year later, was joined by his elder brother Randal von Tempsky and they became involved in Maui's ranching industry. Following Louis's acquisition of Kamehamenui and Kealahou 3rd and 4th in 1888, he formed Erehwon Cattle Company which later became known as Erehwon Ranch. By 1897, Louis was hired as manager of Haleakalā Ranch and he sold Erehwon to his brother Randal who continued to oversee the day-to-day operations until his untimely death in 1898. Management of the ranch then passed to Randal's wife, Dora Melville Dowsett, who established a dairy at Erehwon and was known for hosting many social gatherings. During the brothers life on Maui, in addition to being involved in ranching, they also served in various capacities including the Makawao Road Board, the Board of Fence Commissioners, and even Louis as a Homestead Agent and founder of polo on Maui. In their capacities as Homestead agents as well as Road Board members, the von Tempskys brothers were pivotal in the infrastructure improvements and development of Kula. Through petitioning, Randal and Louis were able to allocate funds for road improvements that eventually led to the construction of the new Upper Kula Road, known today as Kekaulike Avenue which bounds the project area on its *makai* end.

Although much of the ranch's history has focused largely on cattle ranching, during the Erehwon's early years Louis leased land to truck farmers who cultivated and exported vegetables such as corn, beans, and potatoes. After

Randal's passing, his wife Dora continued the leases that Louis established. Dora took an active role in the ranch activities and she comissioned the construction of a dairy and allowed the United States Department of Agirculture to conduct preliminary studies to combat pest and diseases that were afflicting the local crops. Being that Kula experienced frequent droughts and minimal rainfall, Dora initiated the construction of a diversion tunnel to reroute water to the ranch. According to Debbie von Tempsky, the great granddaughter of Randal and Dora, the von Tempskys in their efforts as foresters, out planted fast growing water capturing trees such as Pine and Redwood to help increase rainfall and alleviate the drought. Some of these patches are still noticeable today in the project area and for the family is a reminder of their great grandfather's legacy.

The ranch lands of Erehwon remained in the von Tempsky family up until the passing of Randal's grandson Robert "Ski" von Tempsky Jr. in 2002. Shortly before Robert's passing, the von Tempsky family put Erehwon Ranch up for sale. The land, according to Brooke, the great-great granddaughter of Randal, was purchased by the caretakers the Zawaanstra's. The proporty was then sold to Shizuka Asakawa and around 2018 was put up for sale again. In July of 2020, the TPL purchased the 3,276-acre property and the following month transferred ownership to the DLNR-DOFAW.

IDENTIFICATION OF TRADITIONAL AND CUSTOMARY PRACTICES, VALUED CULTURAL RESOURCES

The information from the culture-historical background information in conjunction with the results of the consultation process revealed the following with respect to traditional and customary practices and valued cultural resources.

Agriculture

Kula's open country and dry climate allowed for only certain crops to flourish in an area that is sometimes prone to prolonged periods of drought as well as famine, as reveled in some of Kula's *mo'olelo*. Despite the perceived harsh environmental conditions, Kula's native inhabitants utilized traditional practices like *kilo* (astute observation of the natural world) to developed unique place-based agriculture techniques. Several planting methods, including *malo'eka* (lit. dirty loin cloth) and *ha'aheo* (lit. proud), are identified by Kamakau (1976) as *'uala* planting methods that were employed on the *kula* lands. The *malo'eka* method required farmers to build large bonfires so that the smoke cloud would shelter the patch from the heat of the sun. This method was known to make the planters exceptionally dirty (*'eka*), covering them with dirt and smoke. In the wetter areas, native planters utilized a method known as *ha'aheo* (proud), likely a reference to the ease of cultivation in areas with ample rainfall (Kolb and O'Claray in Kolb 1997). In addition to the methods described above, the native planters also constructed features such as terraces to help with soil retention, channel and absorb water run-off, or to delineate individual plots (Handy et al. 1991; Kamakau 1992; Kuykendall 1938).

In the centuries before the arrival of Westerners in the islands, Kula's native farmers were primarily engaged in cultivating native varieties of *'uala* (often referred to in the historical record as *'uala maoli*) for subsistence purposes. However, after the arrival of Westerners and the with the growth of whaling and other historic industries, farming in Kula shifted to accommodate the market economy.

Aside from the project area being utilized for *'uala maoli*, it was revealed in the interview that the Chinese laborers of the von Tempskys built berms for further cultivation of crops within the project area. Some of the crops introduced by the Chinese were corn, beans, cabbage, onions, wheat and cotton. Historically this is significant as wheat became abundant in Kula and Hawaiians who cultivated these crops within Kula were amongst the first to be sold to the foreigners.

Cultural Value of the Forest

Kamehame Ahupua'a derives its name from the endemic *Antidesma sp*. tree. This tree was also known by other Hawaiian names including *hame*, *hamehame*, *mehamehame*, *ha'a*, and *ha'āmaile*. Culturally, this tree is valued for its medicinal properties, its use in creating natural dyes, as well as its hardwood. The *hamehame* plant is an ingredient used to treat ailments such as nausea, vomiting, ulcers, and scrofulous sores. The fruit and bark were utilized to create *kapa* dyes in shades of reds and purples and the hardwood used for framing homes and *kua* (anvils) used for *kapa* making.

Furthermore, the background information revealed that *'iliahi* and *māmane* were once present within the area. Although the exact extent of how far these forests came down the slopes of Haleakalā is not entirely known, however, we know that it was abundant enough to supply the *'iliahi* trade that took place in the 1820s as well as the

use of *māmane* wood as fence post during the ranching era. It was also revealed through the consultation process that the *mauʻu hōʻula ʻili*, which is traditionally used in *kākau uhi* (tattooing), may be found in the *ma uka* regions of the *ahupuaʻa*. The forest that once existed in this area would have also been home to a variety of native birds but, the depletion of the forest beginning with early historic industries and later ranching depleted the birds' native habitat. The overall cultural significance of the forests is that it is a place in which the myriad of gods in their plant, animal, and elemental forms dwell. Traditionally, access to the upland forest and its resources was limited to those who had a particular responsibility and who carried out appropriate protocols to enter.

Water Sources

Water is considered one of the most valuable resources in Hawaiʻi. It is a *kino lau* (many body forms) of Kāne and is the very resource upon which all forms of life depend upon. Despite Kula's dry characteristic, during the von Tempsky interview, it was revealed that the Keāhuaiwi gulch that runs through the project area flowed consistently. Brooke's childhood and they would swim and play there as well. Within this same gulch, multiple *punawai* (springs) were present some of which were used by the Mormon Church for baptisms.

Through consultation with Timmy Bailey, he spoke about existing *punawai* on his property (located adjacent to the project area) as well as rockwall structures in the *ma uka* regions. He believed these walls were utilized to divert water from *punawai* to potential *ʻuala* patches that were once cultivated in this area.

Pig Husbandry, Hunting, and Ranching

Though *moʻolelo* making explicit reference to Kamehamenui or Kealahou are few, the broader region of Kula is more frequently mentioned. One such story tells of a petty chief, Kukeawe, who was the friend of the chief Kahekili. Kukeawe was put in charge of Kahekili's pigs that roamed the slopes of Haleakalā and Kula. Although this account is brief, it does suggest pig husbandry as a practice that occurred in this region. Timmy, shared how Maui operated free roaming piggeries until the late 1950s and early 1960s, noting that traditionally, pigs were domesticated and raised until it was needed. He added that the "hunting" of pigs using dogs, guns, or bow and arrow for subsistence purposes is a more modern method. Through the consultation with the von Tempsky family, they too spoke about hunting wild game in the *ma uka* portion of the project area.

Ranching was another historical practice that for occurred in the project area beginning in 1888 when Louis von Tempsky purchased the property from Adelia Cornwell. Since then, the von Tempsky family operated Erehwon Ranch where they raised cattle, grew vegetables, and ran a dairy. It was here that they built their home and business, along with raised and burying their family. Though the von Tempsky's historic Tudor home and family graves lies just beyond the boundaries of the project area, their family legacy is rooted in the lands comprising the project area.

Puʻu Moho and Burial Traditions

Regarding Puʻu Moho, half of this hill sits within the project area parcel on the boundary between the *ahupuaʻa* of Kealahou and Waiakoa. Timmy, shared how he believes the *puʻu* was a gathering place for *koa* to tie their *malo* as they prepared for battle as well as it being associated with the *moho*, an extinct flightless bird. In the interview with the von Tempsky family, they recalled spreading the cremated remains of some family members on Puʻu Moho.

In addition to the use of Puʻu Moho as a place for spreading the ashes of members of the von Tempsky family, and as noted earlier, family burials were also identified near the Tudor home (outside of the project area). No additional information on known burial sites in the project area was discovered.

Findings, Recommendations, and Conclusion

The following recommendations and mitigative measures are provided to ensure the above customary practices, and valued cultural resources, and beliefs are protected from being adversely impact by the proposed project.

Forest Restoration

It is strongly recommended that the State undertake forest restoration as part of the proposed activities using plants that are ecologically appropriate to the area. Reforestation efforts should also involve the community. In this way, the community will have a hand in restoring the forest and the activities will help to foster a relationship with the place. A community outreach program should be developed as part of any future management efforts. The environmental benefits of forest restoration are significant and far reaching, particularly for natural processes such as boosting rainfall, improving the water resources, attracting native biota, and mitigating wildfires.

In the context of forest restoration, it is understood that fencing of certain areas and the eradication of ungulates are crucial steps to ensuring successful forest restoration efforts. However, regarding ungulate eradication, it is recommended that the State avoid using aerial eradication methods and instead seek the assistance of local subsistence hunters to help reduce the ungulate population. For example, a subsistence hunting program can be developed as part of future management efforts that could outline details such as hunting seasons, rules, etc. Though ungulates create serious environmental destruction, they are nonetheless an important food source for many local families who rely on subsistence hunting as a source of nutrition and to offset their household food costs.

Restoration of Traditional Agricultural Practices

As part of the future management of the Kamehameha Nui Forest Reserve, it is recommended that the State give some thought to restoring some of the region's traditional agricultural practices. Select areas within the *ma kai* portion of the project area can be set aside and used by local school or community groups to experiment with agricultural methods that was traditionally used to grow crops such as *ʻuala*. Such projects could lend to improving our understanding of traditional food production in this region but also its nuances such as soil science, seasonal patterns, and understanding modern day challenges as it related to food production. If school or community program are planned endeavors, it is also recommended that a *hālau* or open-air pavilion-type structure be built to accommodate small groups. This will give volunteers and groups a place to gather for program purposes.

Historic Resources and Burials

Efforts should be made to preserve all extant ranching and historic resources that are within the project area. Oordt et al. (2024 in prep) identified Site 50-50-11-T-1, the Erehwon Cattle Ranch, within the makai portion of Kamehameha Nui Forest Reserve and an additional six sites, consisting of rock mounds, cairns and walls, along the route of the proposed trail in the mauka portion of the project area. Oordt et al. (2024 in prep) recommend that a preservation plan be prepared for Site 50-50-11-T-1 and recommends that the mauka sites be avoided during the construction of the trails and camp sites. These recommendations should be heeded. Furthermore, if certain historic structures are viewable from the trails, interpretive signage could be installed to educate users about the resources. It is also recommended that signage restricting hiking off the established trail be installed to lessen the impact to historic resources.

As there are known historic resources in the project area, no subsurface testing was conducted to determine the presence of subsurface resources. If the State plans to construct amenities that require subsurface ground disturbance, it is recommended that archaeological monitoring be conducted during such activities.

Ranching

With regards to ranching, members from the community have spoken in favor of ensuring that ranching continues within the project area. Ranching is an important part of the history of these lands and should not be excluded from the future use of the project area. Though ranching may need to be downsized given the nature of the proposed activities, it should not be eliminated. Hawaiʻi's ranching industry is a vital part of ensuring a diverse economy, supports food sustainability, and is lifeway for Maui's paniolo. It is imperative that the State strike a balance that allows for both the continuation of ranching and conservation.

Community First Approach

While the overarching goal of the proposed project is to develop recreational opportunities for Maui, it is strongly recommended that the State take a 'community first approach' to ensure the needs of the local community are prioritized. As it is likely that the recreational activities proposed for the project area will draw the interest of out-of-state visitors, it is recommended that attention be paid to balancing visitor use with that of the community and that any planned recreational opportunities is not done at the expense of the community. Out-of-state visitors should also be encouraged to participate in restoration efforts. In this way, they too will be able to learn about the history of the place and have an opportunity to give back to the host island in a way that is both meaningful and has long-term positive impacts.

In summary, the recommendations provided above are intended to ensure that activities associated with the proposed infrastructure improvements in the Kamehamenui Forest Reserve do not adversely impact the identified valued cultural resources and customary practices. Conversely, failure to consider and or implement the recommendations described above may result in adverse impacts to the above-identified resources and customary practices.

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APPENDIX A. KA WAI OHA PUBLIC NOTICE

CULTURAL IMPACT ASSESSMENT:
KAMEHAMENUI FOREST RESERVE

On behalf of the Department of Land and Natural Resources (DLNR) Division of Forestry and Wildlife (DOFAW), ASM Affiliates is preparing a Cultural Impact Assessment to inform an Environmental Assessment (EA) being prepared for the Kamehamenui Forest Reserve located on Tax Map Key (TMK) (2) 2-3-005:002, Kamehamenui Ahupua'a, Kula District, Maui Island. Part of the vision for this forest reserve is to provide access to mauka recreational opportunities. As such, DOFAW is proposing to construct roughly 25 miles of public access trails (a portion of which will connect with the existing trails in the Kula Forest Reserve), vehicular parking areas, and an archery range.

To identify and develop strategies to prevent or mitigate potential impacts on culturally valued resources or traditional customary practices, ASM Affiliates is seeking consultation with community members that have long-standing cultural connections to this area; might know about traditional cultural uses of the project area; or who are involved in any ongoing cultural practices that may be occurring within or in the general vicinity of the project area. If you have and are willing to share any such information, please contact Lokelani Brandt lbrandt@asmaffiliates.com, phone (808) 969-6066, mailing address ASM Affiliates 507A E. Lanikaula Street, Hilo, HI 96720. Mahalo.

APPENDIX C. SOILS OF KAMEHAMENUI FOREST RESERVE–NATURAL RESOURCE CONSERVATION SOILS

United States Department of Agriculture

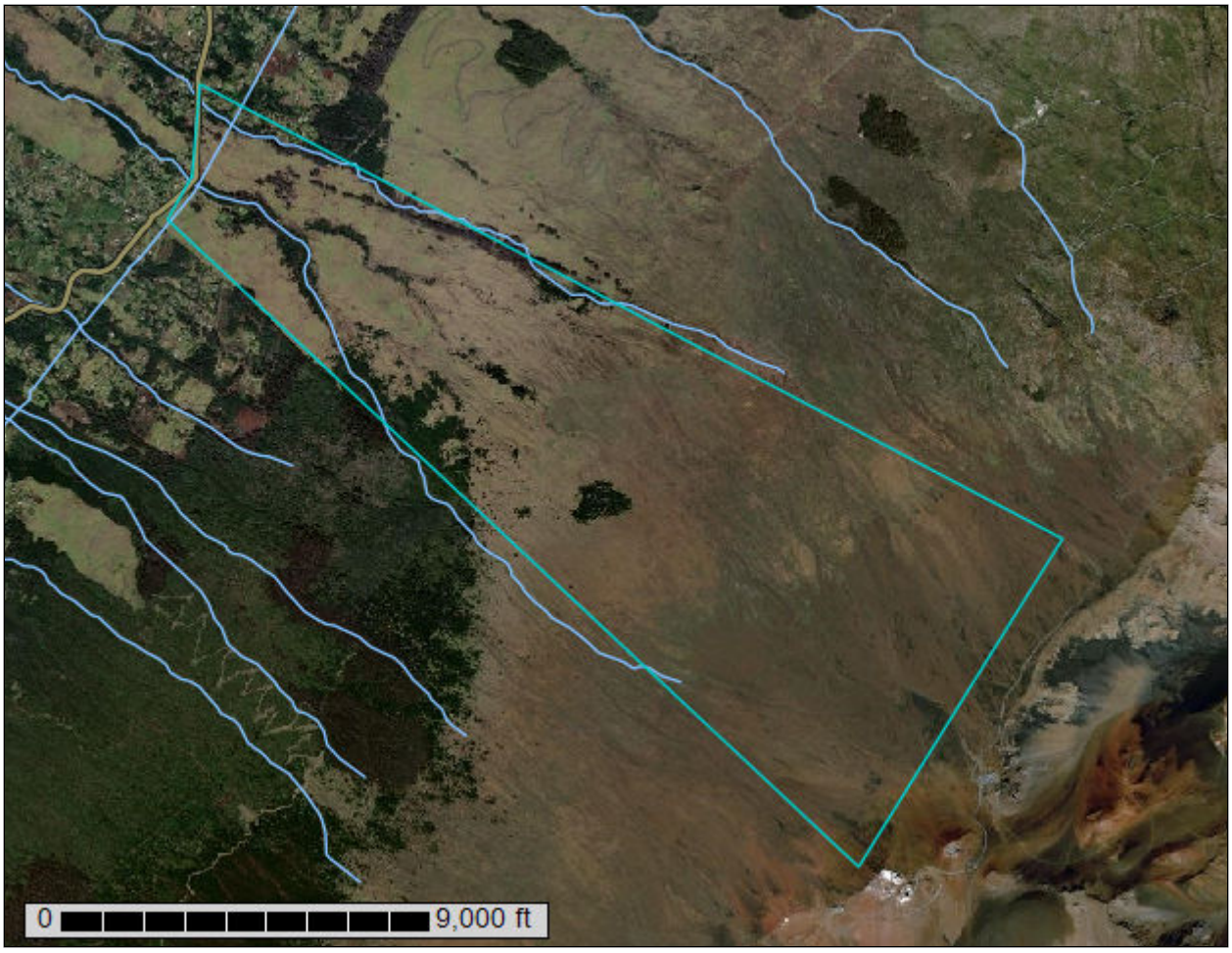
NRCS

Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

Custom Soil Resource Report for Island of Maui, Hawaii

Soils of Kamehamenui Forest Reserve



May 7, 2023

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (https://offices.sc.egov.usda.gov/locator/app?agency=nrcs) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

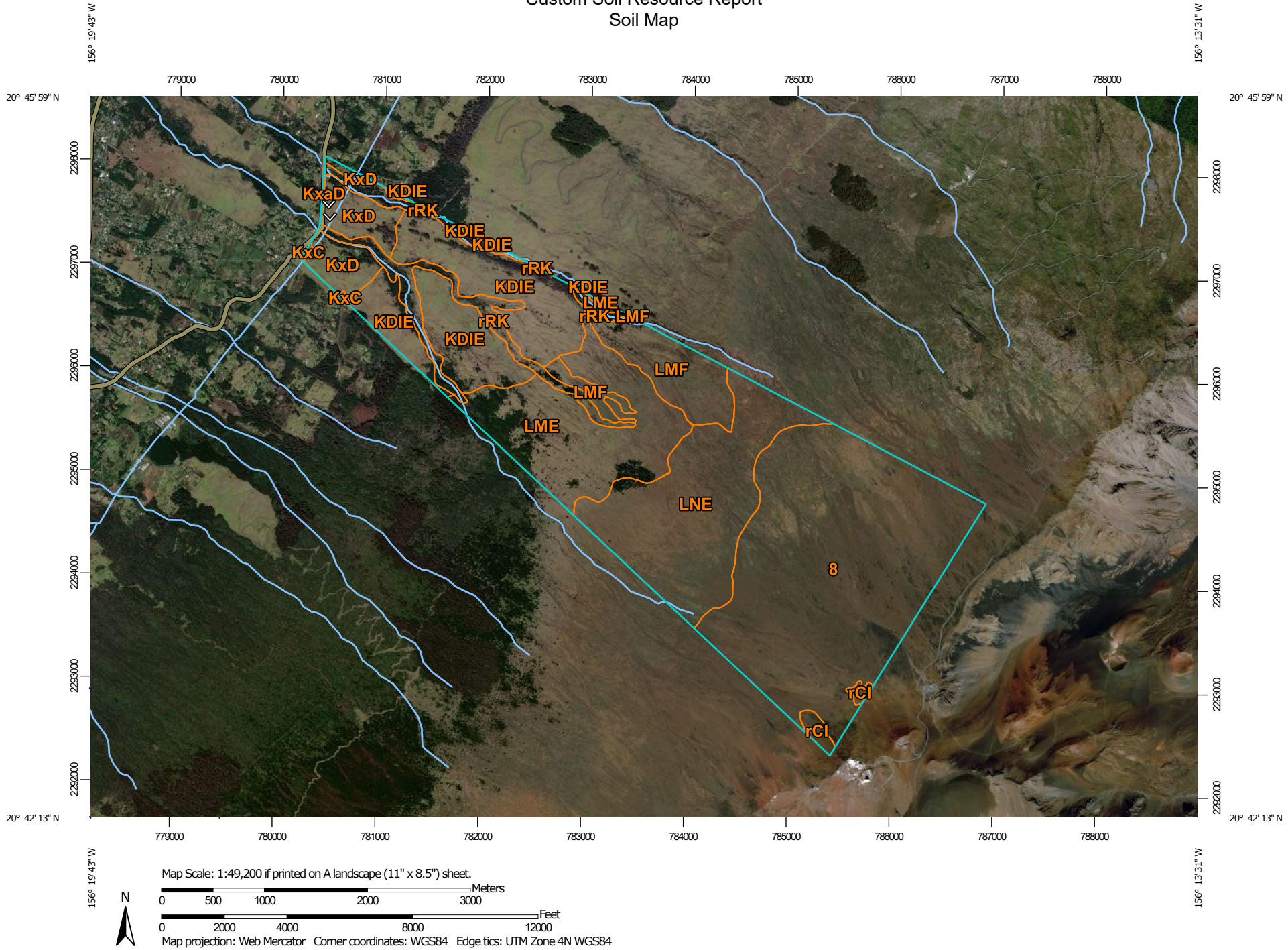
After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report
Soil Map



MAP LEGEND

Area of Interest (AOI)
- Area of Interest (AOI)

Soils
- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features
- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features
- Streams and Canals

Transportation
- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background
- Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Island of Maui, Hawaii
Survey Area Data: Version 20, Aug 30, 2022

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Jan 29, 2017—Oct 11, 2020

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
8	Lava flows-Cinder land complex, 2 to 40 percent slopes, MLRA 161A	1,186.3	35.6%
KDIE	Kaipoioi loam, 7 to 40 percent slopes	522.3	15.7%
KxaD	Kula cobbly medial loam, 12 to 20 percent slopes, MLRA 160	0.5	0.0%
KxC	Kula loam, 4 to 12 percent slopes	3.6	0.1%
KxD	Kula loam, 12 to 20 percent slopes	164.0	4.9%
LME	Laumaia loam, 7 to 40 percent slopes	470.2	14.1%
LMF	Laumaia loam, 40 to 70 percent slopes	211.5	6.3%
LNE	Laumaia extremely stony loam, 7 to 40 percent slopes	569.2	17.1%
rCI	Cinder land	25.2	0.8%
rRK	Rock land	181.5	5.4%
Totals for Area of Interest		**3,334.7**	**100.0%**

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different

management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Island of Maui, Hawaii

8—Lava flows-Cinder land complex, 2 to 40 percent slopes, MLRA 161A

Map Unit Setting

National map unit symbol: 2km0y
Elevation: 6,560 to 13,680 feet
Mean annual precipitation: 15 to 30 inches
Mean annual air temperature: 37 to 57 degrees F
Frost-free period: 60 to 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Lava flows, `a`a: 50 percent
Cinder land: 40 percent
Minor components: 10 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Lava Flows, `a`a

Setting

Landform: Aa lava flows
Down-slope shape: Linear
Across-slope shape: Linear, convex
Parent material: Aa lava

Typical profile

C - 0 to 39 inches: cobbles
R - 39 to 49 inches: bedrock

Properties and qualities

Slope: 2 to 40 percent
Surface area covered with cobbles, stones or boulders: 45.0 percent
Depth to restrictive feature: 20 to 60 inches to lithic bedrock
Drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.4 inches)

Interpretive groups

Land capability classification (irrigated): 8
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Description of Cinder Land

Setting

Landform: Cinder cones
Down-slope shape: Linear
Across-slope shape: Convex, linear
Parent material: Cinders

Typical profile

C - 0 to 79 inches: gravel

Interpretive groups

Land capability classification (irrigated): 8s
Land capability classification (nonirrigated): 8
Hydric soil rating: No

Minor Components

Rubble land

Percent of map unit: 5 percent
Landform: Moraines
Down-slope shape: Linear
Across-slope shape: Linear, convex
Hydric soil rating: No

Pohakulehu, dry

Percent of map unit: 5 percent
Landform: Aa lava flows, ash fields
Down-slope shape: Linear
Across-slope shape: Linear, convex
Hydric soil rating: No

KDIE—Kaipoioi loam, 7 to 40 percent slopes

Map Unit Setting

National map unit symbol: hq8l
Elevation: 3,500 to 6,000 feet
Mean annual precipitation: 30 to 45 inches
Mean annual air temperature: 52 to 61 degrees F
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Kaipoioi and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kaipoioi

Setting

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Volcanic ash

Typical profile

H1 - 0 to 10 inches: loam
H2 - 10 to 60 inches: silty clay loam

Properties and qualities

Slope: 7 to 40 percent

Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: High
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.20 to 2.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Sodium adsorption ratio, maximum: 5.0
Available water supply, 0 to 60 inches: Moderate (about 8.4 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: B
Hydric soil rating: No

KxaD—Kula cobbly medial loam, 12 to 20 percent slopes, MLRA 160

Map Unit Setting

National map unit symbol: 2xn0t
Elevation: 2,000 to 3,500 feet
Mean annual precipitation: 25 to 40 inches
Mean annual air temperature: 64 to 68 degrees F
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Kula, cobbly, and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kula, Cobbly

Setting

Landform: Ash fields
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Concave, linear
Across-slope shape: Linear, convex
Parent material: Volcanic ash

Typical profile

A - 0 to 8 inches: cobbly medial loam
Bw - 8 to 54 inches: medial silty clay loam
Cr - 54 to 64 inches: bedrock

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: 45 to 60 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Medium

Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.5 inches)

Interpretive groups
Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Hydric soil rating: No

KxC—Kula loam, 4 to 12 percent slopes

Map Unit Setting
National map unit symbol: hq98
Elevation: 2,000 to 3,500 feet
Mean annual precipitation: 25 to 40 inches
Mean annual air temperature: 64 to 68 degrees F
Frost-free period: 365 days
Farmland classification: All areas are prime farmland

Map Unit Composition
Kula and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kula

Setting
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Volcanic ash

Typical profile
H1 - 0 to 8 inches: loam
H2 - 8 to 54 inches: silty clay loam
H3 - 54 to 64 inches: bedrock

Properties and qualities
Slope: 4 to 12 percent
Depth to restrictive feature: 45 to 60 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 3e
Hydrologic Soil Group: A
Ecological site: R160XY007HI - Isothermic Ustic Naturalized Grassland
Hydric soil rating: No

KxD—Kula loam, 12 to 20 percent slopes

Map Unit Setting

National map unit symbol: hq99
Elevation: 2,000 to 3,500 feet
Mean annual precipitation: 25 to 40 inches
Mean annual air temperature: 64 to 68 degrees F
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Kula and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Kula

Setting

Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Volcanic ash

Typical profile

H1 - 0 to 8 inches: loam
H2 - 8 to 54 inches: silty clay loam
H3 - 54 to 64 inches: bedrock

Properties and qualities

Slope: 12 to 20 percent
Depth to restrictive feature: 45 to 60 inches to paralithic bedrock
Drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 8.1 inches)

Interpretive groups

Land capability classification (irrigated): 4e
Land capability classification (nonirrigated): 4e
Hydrologic Soil Group: A
Ecological site: R160XY007HI - Isothermic Ustic Naturalized Grassland

Hydric soil rating: No

LME—Laumaia loam, 7 to 40 percent slopes

Map Unit Setting

National map unit symbol: hq9d
Elevation: 5,500 to 8,000 feet
Mean annual precipitation: 35 to 70 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Laumaia and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Laumaia

Setting

Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Volcanic ash

Typical profile

H1 - 0 to 13 inches: loam
H2 - 13 to 36 inches: paragravelly silt loam
H3 - 36 to 60 inches: fine sand

Properties and qualities

Slope: 7 to 40 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 6e
Hydrologic Soil Group: A
Hydric soil rating: No

LMF—Laumaia loam, 40 to 70 percent slopes

Map Unit Setting

National map unit symbol: hq9f
Elevation: 5,500 to 8,000 feet
Mean annual precipitation: 35 to 70 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Laumaia and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Laumaia

Setting

Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Volcanic ash

Typical profile

H1 - 0 to 13 inches: loam
H2 - 13 to 36 inches: silt loam
H3 - 36 to 60 inches: fine sand

Properties and qualities

Slope: 40 to 70 percent
Depth to restrictive feature: More than 80 inches
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Moderately high to high (0.60 to 5.95 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 7.8 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: A
Hydric soil rating: No

LNE—Laumaia extremely stony loam, 7 to 40 percent slopes

Map Unit Setting

National map unit symbol: hq9g
Elevation: 5,500 to 8,000 feet
Mean annual precipitation: 35 to 70 inches
Mean annual air temperature: 50 to 57 degrees F
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Laumaia, extremely stony, and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Laumaia, Extremely Stony

Setting

Landform position (two-dimensional): Shoulder
Landform position (three-dimensional): Upper third of mountainflank
Down-slope shape: Linear
Across-slope shape: Convex
Parent material: Volcanic ash

Typical profile

H1 - 0 to 13 inches: extremely stony loam
H2 - 13 to 36 inches: paragravelly silt loam
H3 - 36 to 55 inches: fine sand
H4 - 55 to 65 inches: bedrock

Properties and qualities

Slope: 7 to 40 percent
Surface area covered with cobbles, stones or boulders: 8.5 percent
Depth to restrictive feature: 40 to 60 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Medium
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Moderate (about 6.3 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Hydric soil rating: No

rCl—Cinder land

Map Unit Setting

National map unit symbol: hqck
Elevation: 8,000 to 10,000 feet
Mean annual precipitation: 20 to 100 inches
Mean annual air temperature: 43 to 73 degrees F
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Cinder land: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Cinder Land

Setting

Landform: Cinder cones
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank
Down-slope shape: Linear
Across-slope shape: Convex

Typical profile

H1 - 0 to 60 inches: paragravel

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s
Hydric soil rating: No

rRK—Rock land

Map Unit Setting

National map unit symbol: hqcq
Elevation: 0 to 6,000 feet
Mean annual precipitation: 15 to 60 inches
Mean annual air temperature: 57 to 75 degrees F
Frost-free period: 365 days
Farmland classification: Not prime farmland

Map Unit Composition

Rock land and similar soils: 55 percent
Rock outcrop: 45 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Rock Land

Setting

Landform: Pahoehoe lava flows
Landform position (two-dimensional): Backslope
Landform position (three-dimensional): Mountainflank, side slope, riser, rise
Down-slope shape: Linear
Across-slope shape: Concave
Parent material: Basalt

Typical profile

H1 - 0 to 4 inches: silty clay loam
H2 - 4 to 8 inches: silty clay
H3 - 8 to 20 inches: bedrock

Properties and qualities

Slope: 0 to 70 percent
Depth to restrictive feature: 4 to 10 inches to lithic bedrock
Drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Available water supply, 0 to 60 inches: Very low (about 1.1 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Hydric soil rating: No

Description of Rock Outcrop

Typical profile

H1 - 0 to 60 inches: bedrock

Properties and qualities

Slope: 10 to 70 percent
Depth to restrictive feature: 0 inches to lithic bedrock
Capacity of the most limiting layer to transmit water (Ksat): Low to moderately low (0.00 to 0.06 in/hr)
Available water supply, 0 to 60 inches: Very low (about 0.0 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 8s

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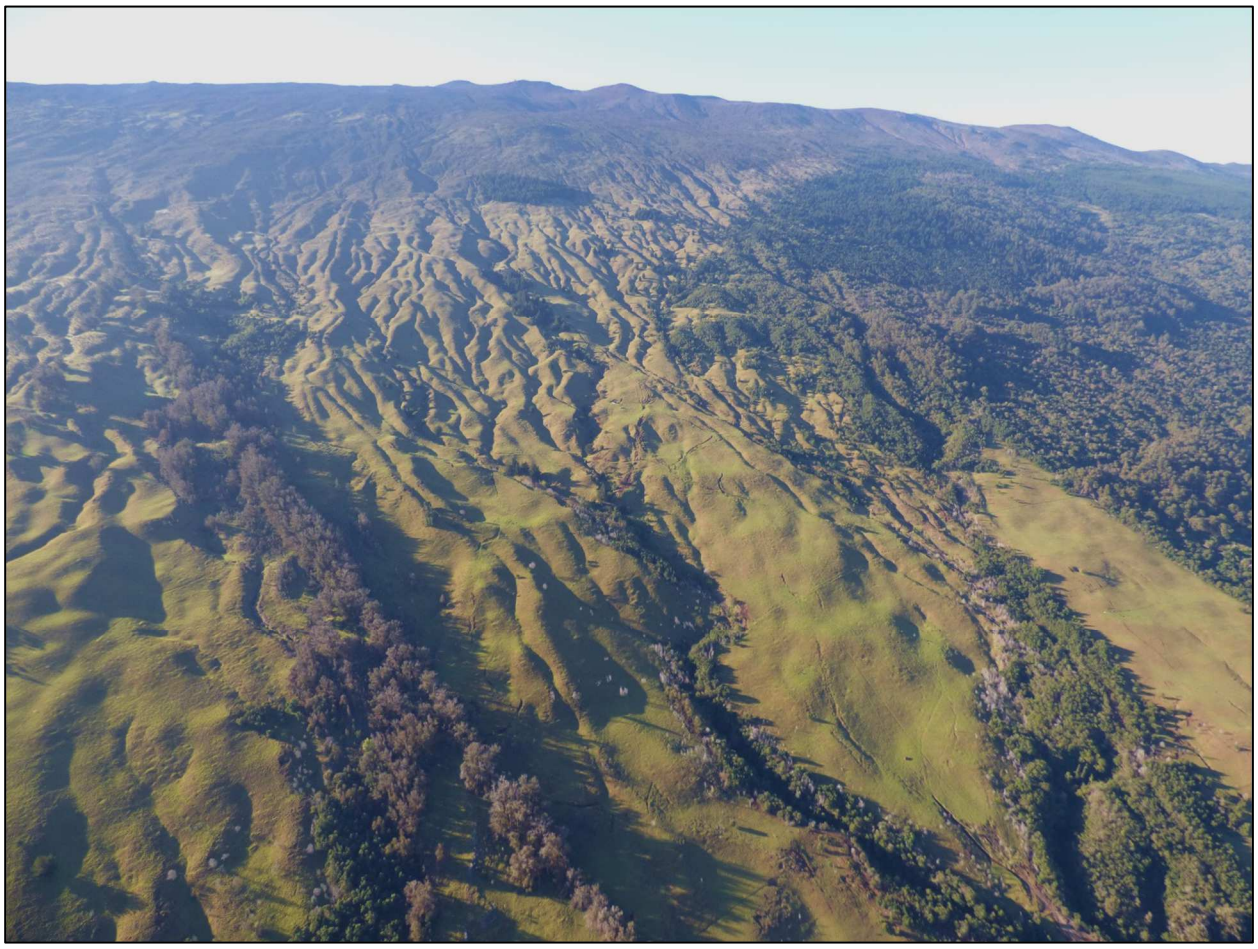
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APPENDIX D. FLORA AND FAUNA SURVEY, KAMEHAMENUI FOREST RESERVE

FLORA AND FAUNA SURVEY
KAMEHAMENUI FOREST RESERVE, MAUI



Prepared By:
FOREST & KIM STARR

Prepared For:
DIVISION OF FORESTRY AND WILDLIFE
DEPARTMENT OF LAND AND NATURAL RESOURCES

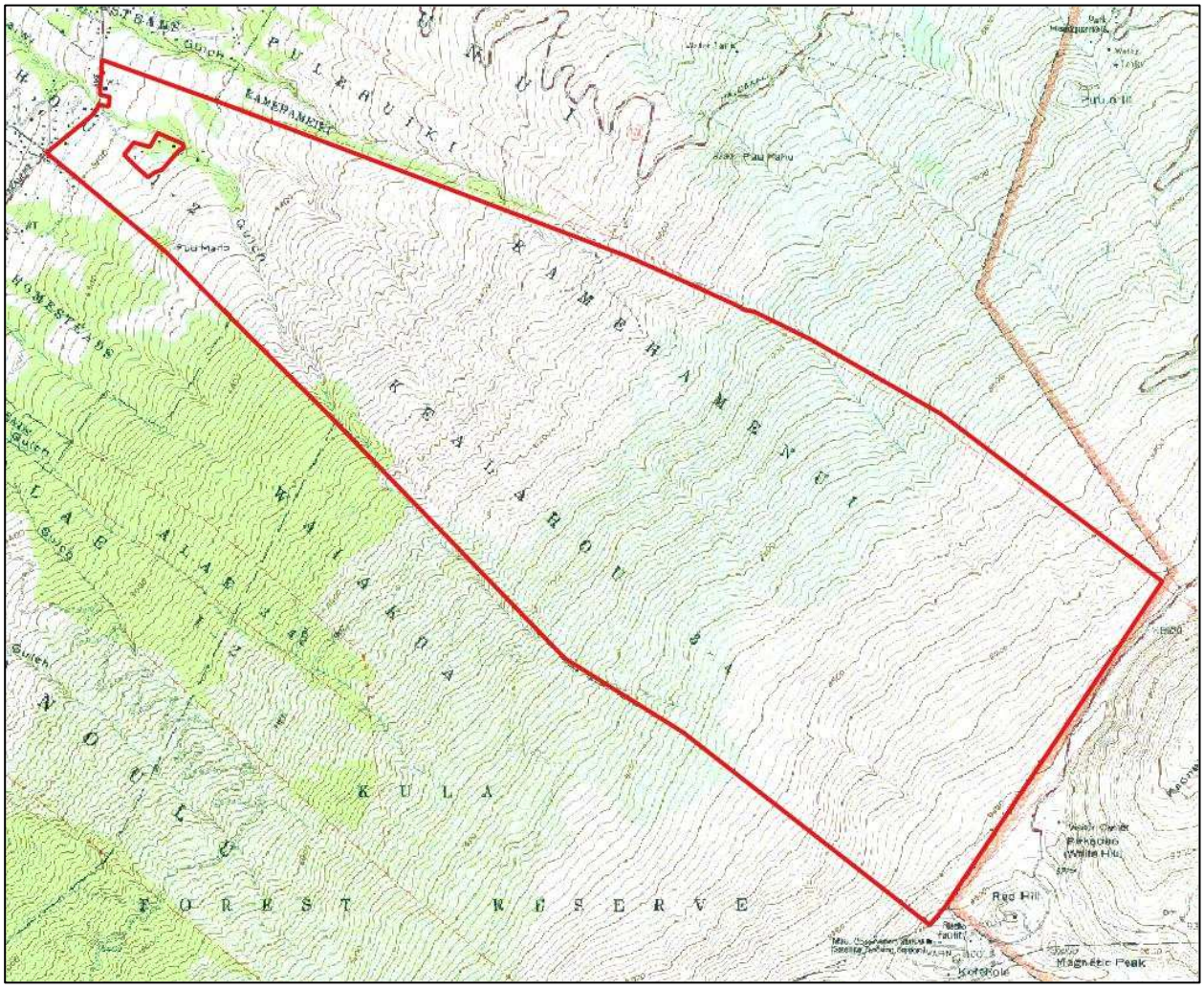
2021

INTRODUCTION

The Kamehamenui Forest Reserve encompasses about 3,434 acres (TMK 230050020000) on the west slope of East Maui. The goal of this survey was to inventory the flora and fauna in the area, to provide current information to be included in a management plan for the reserve.

SITE DESCRIPTION

The land is steep, and there are many small gullies. Much of the area is pasture, with short-statured shrubland up high, and scattered forest areas in the pastures, gulches, and along the property margins. The elevation ranges from 3,700 to 9,800 feet above sea level. Annual rainfall averages 27-40 inches. Annual air temperature averages 44-61 degrees Fahrenheit.



Project area, Kamehamenui Forest Reserve, Maui.

SURVEY OBJECTIVES

The main objectives of the survey were to:

- Document what plant (terrestrial vascular flora) and animal (birds, bats, mammals, insects) species occur in the reserve or may likely occur in the existing habitat.

- Write up findings in a report that includes checklists of species, along with images and discussion of some of the more conspicuous and noteworthy elements of the flora and fauna.

SURVEY METHODS

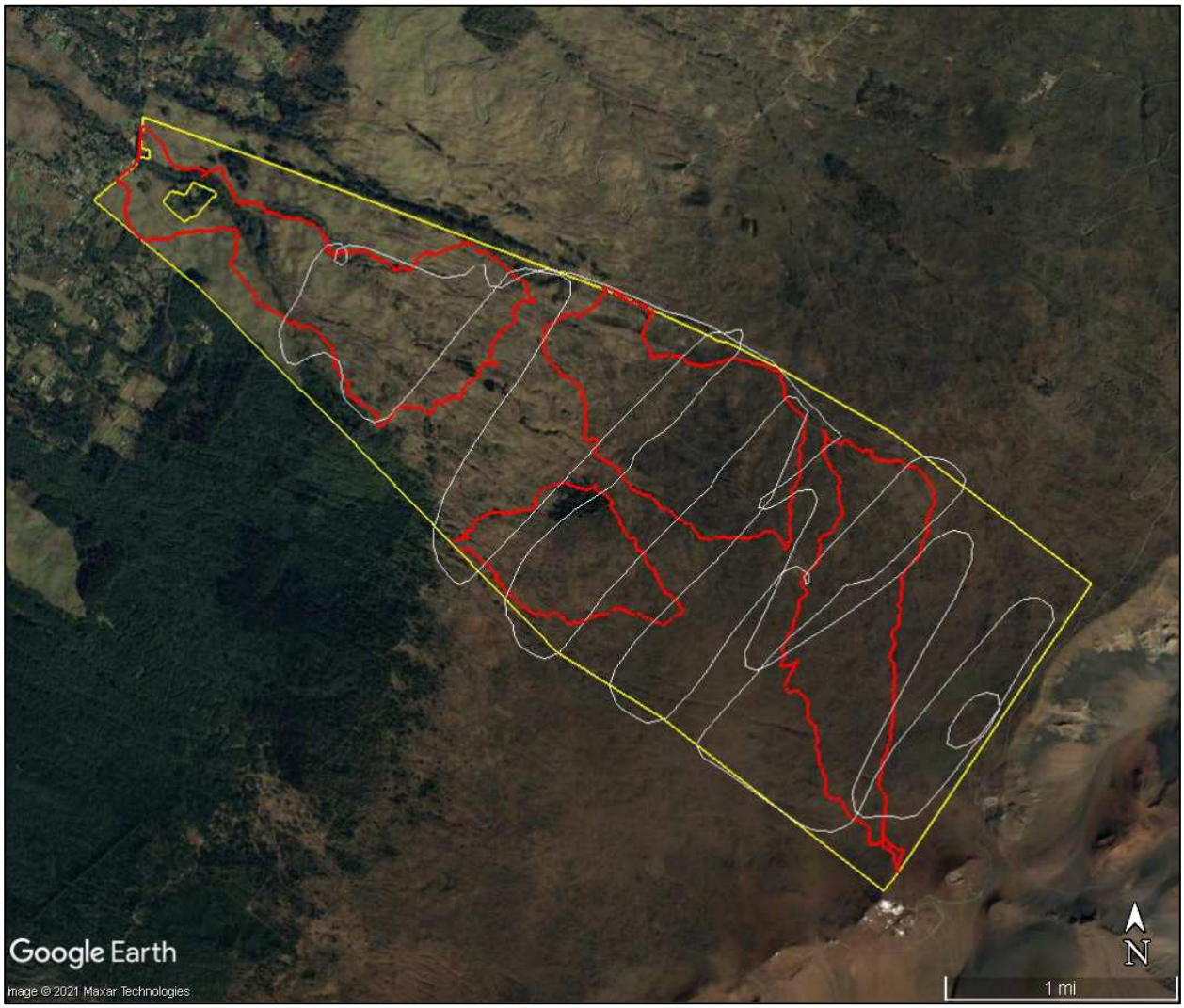
A walk-through survey method was used over representative areas of the reserve in April-June, 2021. Extra emphasis was placed on areas with potential for high diversity, such as gullies and remnant native plants. Notes were made on plant and animals species encountered. In addition, a sweep net was used to get closer looks at insects. A helicopter overflight was also done to get a big picture overview, look at areas we didn't get to, and get images for this report.



Taking notes on flora and fauna.



Sweeping for insects in subalpine vegetation.



Area surveyed. Red lines are ground survey, white lines are aerial survey.

RESULTS

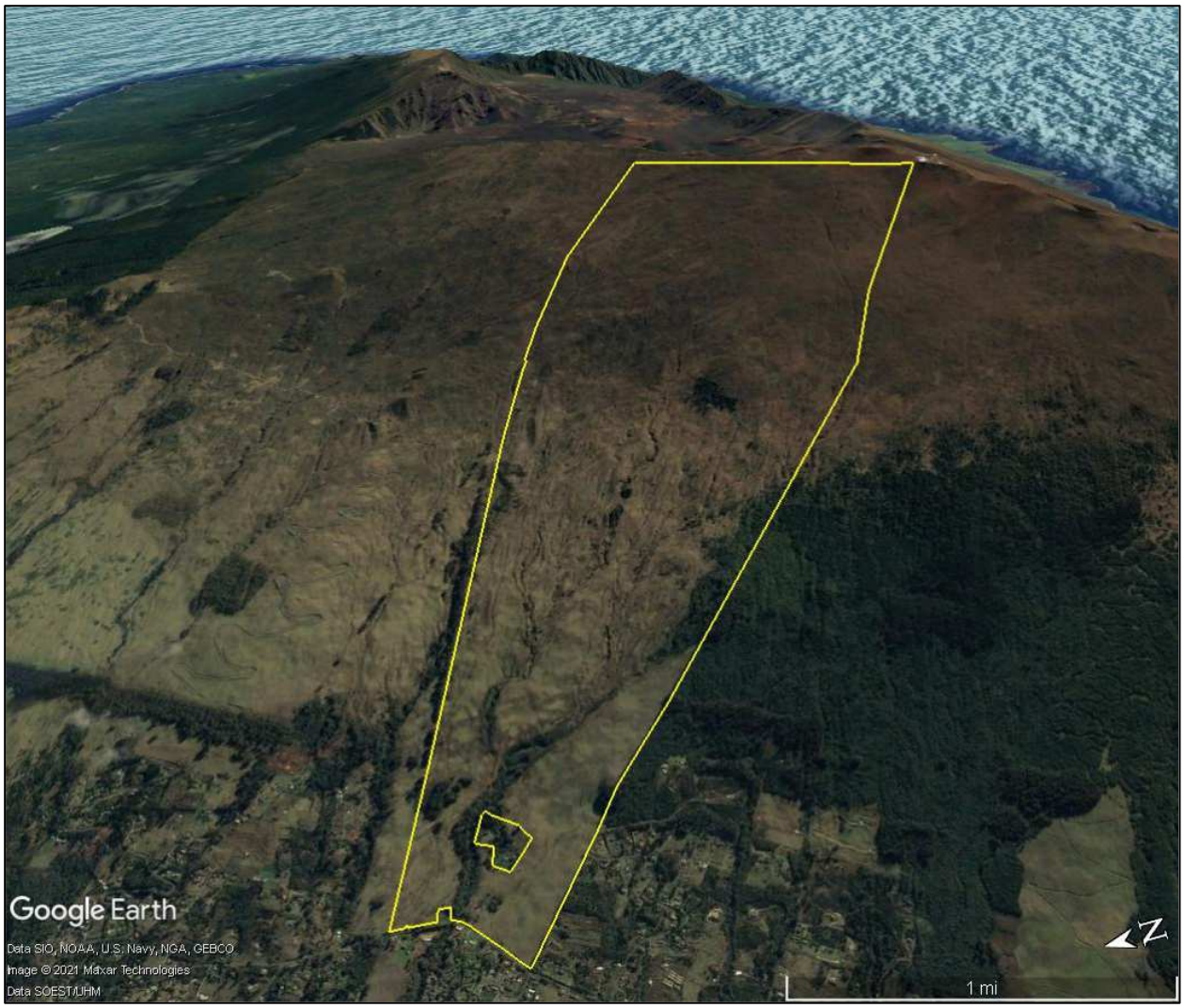
VEGETATION

There are three main vegetation types in Kamehamenui:

Grassland/Pasture: The bulk of the area below 6,500 ft. is dominated by pasture. This section is characterized by vast areas of open grassland and non-native species.

Mesic Forest: Scattered about the grassland are groves of mostly non-native trees, especially in and near gullies. Pockets of native trees persist, especially above 5,500 ft.

Subalpine Shrubland: Above 6,500 ft. native shrubs dominate, along with sparse grasses and ferns. At the top of the reserve, the vegetation is very sparse with large areas of no vegetation.



Kamehamenui Forest Reserve.

SUBALPINE SHRUBLAND



Upper Subalpine shrubland, Kamehamenui Forest Reserve.

The highest elevations of the Kamehamenui Forest Reserve, 6,500-9,800 ft. are comprised of mostly the shrub kupaoa (*Dubautia menziesii*). Just below the summit area, the dominant vegetation quickly becomes pūkiawe (*Leptecophylla tameiameiae*) shrubs. Most of the vegetation in this zone is native.

The upper reaches of the reserve have sparse and short vegetation. As one descends in elevation, the vegetation becomes taller, thicker, and more diverse. The vegetation is heavily browsed.

Pūkiawe is by far the most common plant in this zone. Other native shrubs in this area include kūpaoa (*Dubautia menziesii*), ʻōhelo (*Vaccinium reticulatum*), and kukaenēnē (*Coprosma ernodeoides*).

ʻAʻaliʻi (*Dodonaea viscosa*) is the most common tree in this zone, often found in small groves. Other trees in this zone include māmane (*Sophora chrysophylla*), Haleakalā sandalwood (*Santalum haleakalae*), and hōʻawa (*Pittosporum confertiflorum*). All of these are in poor health due to intense ungulate pressure.

Haleakalā silverswords or hinahina (*Argyroxiphium sandwicense* subsp. *macrocephalum*) are found in the upper most reaches of the subalpine zone, as is the native pamakani or Haleakalā tetramolopium (*Tetramolopium humile* subsp. *haleakalae*).

Non-native herbs and low growing plants in the subalpine shrubland include evening primrose (*Oenothera stricta* subsp. *stricta*), sheep sorrel (*Rumex acetosella*), hairy horseweed (*Conyza bonariensis*), fireweed (*Senecio madagascariensis*), and hairy cat's ear (*Hypochoeris radicata*).

Native grasses are predominantly hairgrass (*Deschampsia nubigena*) and pili uka (*Trisetum glomeratum*).

Non-native grasses include Sweet vernal grass (*Anthoxanthum odoratum*), Yorkshire fog (*Holcus lanatus*), rattail (*Vulpia* sp.), and cheatgrass (*Bromus tectorum*).

By far the most common native fern in this zone is kīlau or bracken fern (*Pteridium aquilinum* subsp. *decompositum*). This hardy fern is one of the only plants growing over vast sections of the reserve with the heaviest ungulate pressure.

Other native ferns in this zone include kalamoho (*Pellaea ternifolia*), ʻiwaʻiwa (*Asplenium adiantum-nigrum*), and maidenhair spleenwort (*Asplenium trichomanes* subsp. *densum*). The most common non-native fern in this zone is the golden fern (*Pityrogramma austroamericana*).



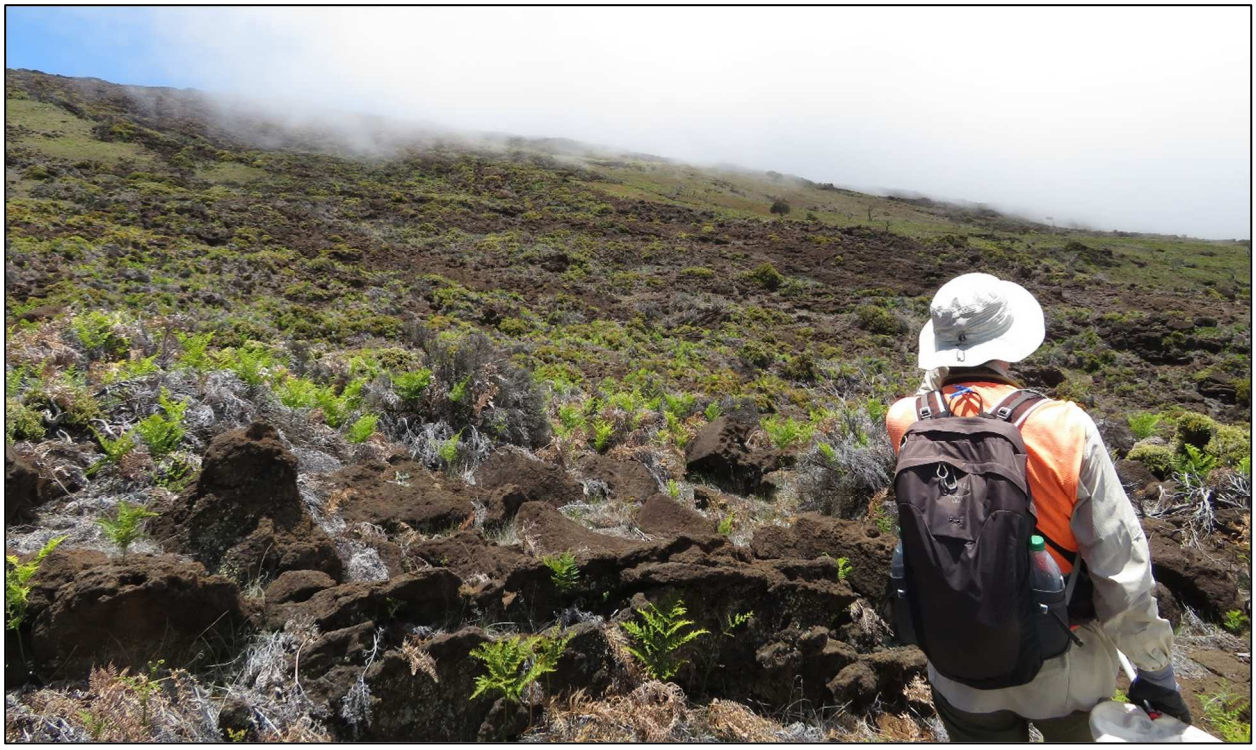
There are many areas of the subalpine shrubland at Kamehamenui where all other vegetation has been destroyed by ungulates, and only kīlau or bracken fern is able to survive.



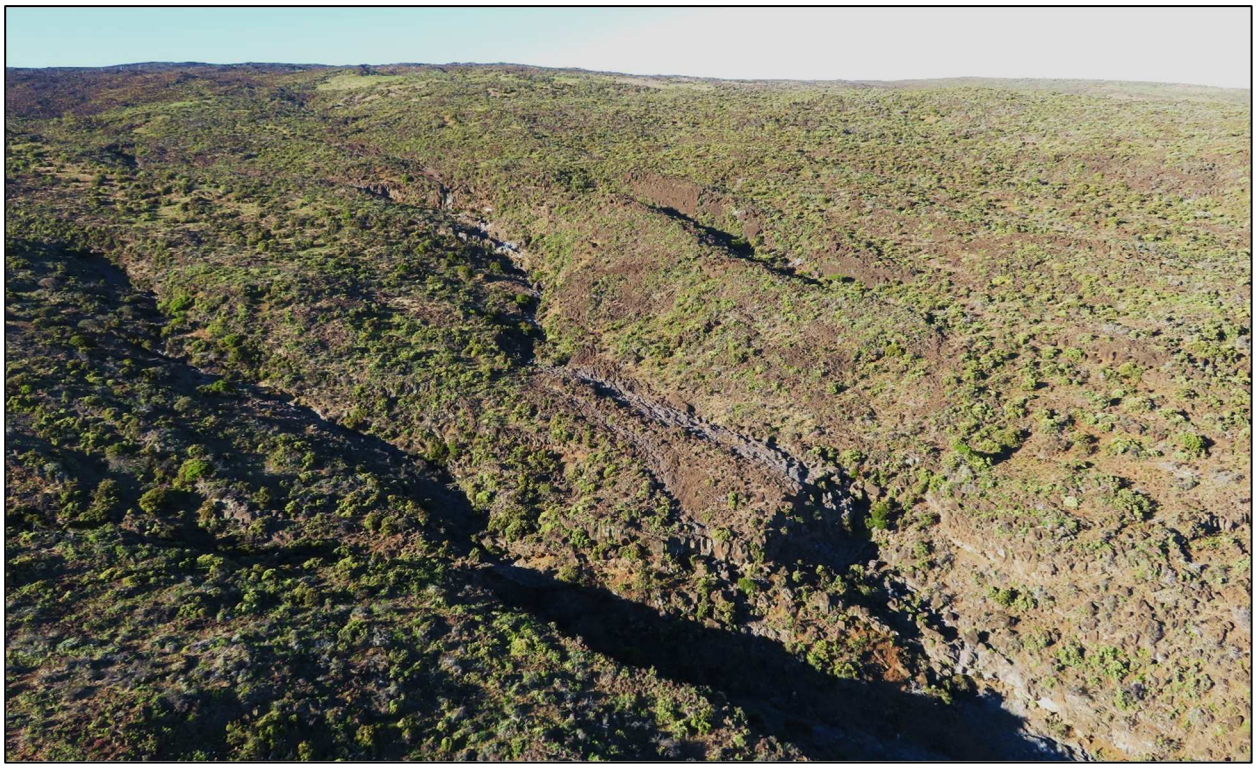
Vegetation is naturally sparse in the highest elevations of the reserve due to the cold, dry, windy environment.



Virtually all the plants in the highest elevations of the reserve are native. Pūkiawe (*Leptecophylla tameiameiae*) is by far the most common plant, able to survive ungulates and the harsh environment.



Lower down the mountain, there is much more subalpine vegetation. It remains native dominated, though the diversity is low given the heavy ungulate pressure in the area.



The northern portion of the reserve near Hapapa Gulch has the most remnant subalpine vegetation diversity. The bulk of the sandalwood (*Santalum*) we came across were in this area, as was the hō‘awa (*Pittosporum*).



Pūkiawe shrubs remain the dominant plant in the subalpine zone, along with occasional ʻaʻaliʻi trees.



In areas where ungulate pressure is greatest, most of the vegetation has been taken down to dirt.



In some areas there are "māmane graveyards", with scores of dead tree skeletons and a handful of remnant trees on the cusp of death. Bracken fern often dominates in these areas.



A remnant sandalwood tree, the largest of about a dozen we came across. This tree was in decline, it's trunk and foliage heavily browsed, and the roots undermined. On the horizon is a similarly browsed ʻaʻaliʻi.



Pūkiawe is the dominant plant within the subalpine shrubland.



Tetramolopium humile **is locally abundant in the highest elevations of the reserve, often tucked next to stones.**



A few Haleakalā silverswords or hinahina (*Argyroxiphium sandwicense* subsp. *macrocephalum*) reside in the highest elevations of the subalpine zone.



Vast areas of bracken fern occur in the subalpine shrubland, making it almost more of a fernland in places.



Hairgrass (*Deschampsia nubigena*) is present in the subalpine shrubland. As with many other species, this clumping native grass will likely become more prevalent if ungulates are removed.



Haleakalā sandalwoods or ʻiliahi occur as scattered individuals and small groves in the reserve. Most are in decline or near death, due to the heavy ungulate pressure.

MESIC FOREST



Native ʻōhiʻa trees in the mesic forest portion of Kamehamenui Forest Reserve.

Below 6,500 ft. trees become more prevalent. The dominant native tree in this zone is ʻōhiʻa (*Metrosideros polymorpha*), which persists on steep gulch walls as small groves, mostly between 5,500-7,500 ft. Perhaps it would be a stretch to call it a forest today, but not long ago, that's what it was. Both "varieties" of ʻōhiʻa (*M. polymorpha*) are present, occasionally on the same tree, though the glabrous form (*M. p.* var. *glaberrima*) is most common.

We only came across a handful of koa (*Acacia koa*) trees, perhaps a half dozen, clinging to gulch walls near the 4,500 ft. level. The ranchers have been controlling black wattle (*Acacia mearnsii*) near the koa trees to help protect them from being overrun.

Black wattle is the most common non-native tree in the reserve. It is especially abundant below 6,000 ft. on the southern boundary of the reserve and in gulches. Not long ago, much of the area this wattle forest occupies was open pasture.

There are a few conifer plantings in the reserve. The largest and most mauka (6,700 ft.) is predominantly Monterey pine (*Pinus radiata*) with some redwood (*Sequoia sempervirens*). Other conifers encountered include Maritime pine (*Pinus pinaster*).

A long line of blue gum eucalyptus (*Eucalyptus globulus*) marks the northern boundary of the reserve. These trees are in decline due to multiple new insects and pathogens. Eucalyptus is also spreading from these plantings into nearby areas.

Fire tree (*Morella faya*) is present on both boundaries between 5,000-7,000 ft. as incipient groves and scattered trees. This tree seems to prefer areas where ʻōhiʻa also likes to grow.

Pūkiawe (*Leptecophylla tameiameiae*) is the most common shrub in this zone. Other native shrubs present in much lower numbers include ʻakala berry (*Rubus hawaiensis*), hinahina (*Artemisia mauiensis*), pilo (*Coprosma montana*), and ʻaʻaliʻi (*Dodonaea viscosa*).

Non-native shrubs include Canary Island St. John's wort (*Hypericum canariense*), pamakani (*Ageratina adenophora* and *A. riparia*), and Mysore raspberry (*Rubus niveus*).

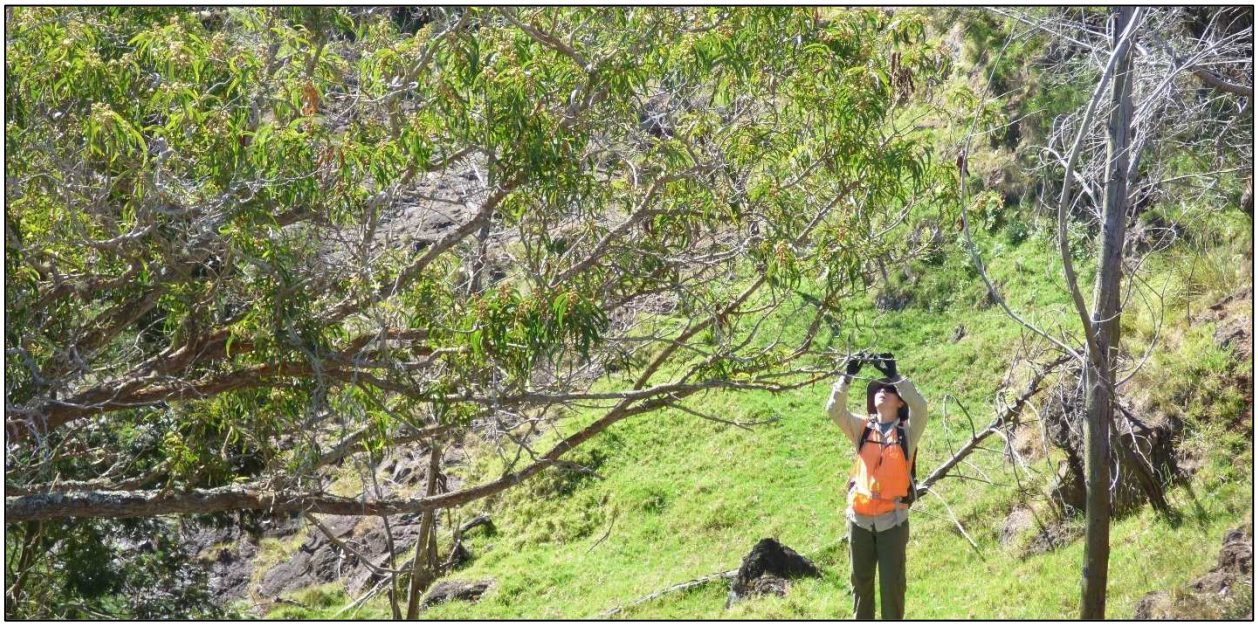
The dominant grass in this zone is Kikuyu (*Cenchrus clandestinus*), though the understory beneath all these non-native trees is mostly barren.

Native sedges include *Carex macloviana* subsp. *subfusca* and *Carex wahuensis* and wood rush (*Luzula hawaiiensis*).

Non-native herbs include daisy fleabane (*Erigeron karvinskianus*), fireweed (*Senecio madagascariensis*), and bull thistle (*Cirsium vulgare*). Banana poka (*Passiflora tarminiana*) is the most prevalent non-native vine.

In steep sites protected from ungulates with some sun, ferns and shrubs are able to eke out a living. Native ferns encountered include ʻamaʻu (*Sadleria cyatheoides*), polystichum (*Polystichum haleakalense*), mākuʻe (*Elaphoglossum paleaceum*), laukahi (*Dryopteris wallichiana*), palapalai (*Microlepia strigosa*), and pohole (*Diplazium sandwichianum*).

Non-native ferns include blechnum (*Blechnum appendiculatum*), Australian brake (*Pteris tremula*), and downy wood fern (*Cyclosorus dentatus*).



One of a handful of remnant native koa trees in Kamehamenui.



Small patches of remnant ‘ōhi‘a forest can still be found in steep, rocky gulches, such as Hapapa Gulch.



The remnant ‘ōhi‘a able to survive ungulate pressure are growing mostly on cliff walls.



The largest patch of koa we came across in the reserve was just a handful of trees growing on cliff walls. Ranchers have been controlling black wattle nearby to help keep the koa from being overtaken.



The handful of koa trees left in the reserve survived the ungulate pressure by growing on cliffs. These were the largest koa trees we came across in the reserve.



Black wattle forest dominates much of the southern portion of reserve. This forest is relatively young, having recently over taken what used to be mostly pasture.



The wattle forest understory is mostly barren.



There are multiple pine/conifer groves planted in the reserve. Pines are also spreading from the plantings into nearby shrubland and creating new groves.



The conifers can get quite large, with an understory of virtually no other plants.



A long line of blue gum eucalyptus in poor health marks the northern boundary of the reserve. The bright green trees are fire tree, which is beginning to dominate in areas with remnant ʻōhiʻa.



Many of the eucalyptus trees are massive.



Small local sites in the mesic zone gulches where ungulates have a hard time reaching are able to support lush vegetation, both native and non-native, such as this fern grotto.



In similar areas where the non-native trees have started to fill in to the point of a closed canopy, fern grottos still exist, but the vegetation is less lush.



‘Ōhi‘a is the most common native forest tree in Kamehamenui.



This hinahina (*Artemisia mauiensis*) growing out of a crack on a cliff wall was the only one we came across.



Native parasitic mistletoe or hulumoa (*Korthalsella complanata*) growing on a pūkiawe shrub.



Pohole fern (*Diplazium sandwichianum*) found in grottos where ungulates can't easily reach.



***Polystichum haleakalense*, a locally common fern in the area.**



Cliff brake fern (*Pteris cretica*) growing out of a cliff.

PASTURE / GRASSLAND



Pasture/grasslands in the Kamehamenui Forest Reserve.

Much of the reserve below 7,000 ft. is dominated by non-native grasses. The most common grass is Kikuyu (*Cenchrus clandestinus*). Other grasses encountered include Natal red top (*Melinis repens*), sweet vernal (*Anthoxanthum odoratum*), weeping lovegrass (*Eragrostis curvula*), and Yorkshire fog (*Holcus lanatus*).

Pūkiawe shrubs are scattered about the pastures in the highest elevations, but are mostly absent below 5,500 ft. In the lowest elevations, incipient non-native shrubs are taking hold, including Canary Island St. John's wort (*Hypericum canariense*), cotoneaster (*Cotoneaster pannosus*), and firethorn (*Pyracantha* spp.).

Non-native herbs in this zone include red clover (*Trifolium pratense* var. *sativum*), fireweed (*Senecio madagascariensis*), black medic (*Medicago lupulina*), scarlet pimpernel (*Anagalis arvensis*), common dandelion (*Taraxacum officinale*), and bitter herb (*Centaurium erythraea subsp. erythraea*).

Moa (*Psilotum nudum*) and a few other native ferns are tucked into rocks including kalamoho (*Pellaea ternifolia*) and ʻiwaʻiwa (*Asplenium adiantum-nigrum*).



Mauka portion of the grasslands.



The pastures are heavily grazed, resulting in low-growing non-native grass over vast areas.



Makai portion of the grasslands.



Corral, fences, and water tank in makai pastures.



Kikuyu is the dominant grass over much of the area. Other than grass, only small weedy herbs such as fireweed are able to survive ungulate browsing in the most open areas.



Low numbers of ferns and other more delicate vegetation is present in small pockets of the open pastures, but is restricted to areas protected by steep terrain.



Natal Red Top (*Melinis repens*).



Sweet Vernal Grass (*Anthoxanthum odoratum*)



Moa (*Psilotum nudum*).



Pānini (*Opuntia ficus-indica*).



Weeping lovegrass (*Eragrostis curvula*).



Red Clover (*Trifolium pratense* var. *sativum*).

RARE PLANTS

Many plants considered common in other areas are "rare" in the reserve given the heavy ungulate pressure, such as koa (*Acacia koa*), mamane (*Sophora chrysophylla*) and kūpaoa (*Dubautia menziesii*). If ungulates are removed, these species will likely once again become common, especially with additional plantings.

Another subset of species currently in the reserve are rare even in the best areas of East Maui and will likely require additional care to thrive in the reserve, such as Haleakalā sandalwood or ʻiliahi (*Santalum haleakalae*) and hōʻawa (*Pittosporum confertiflorum*).

Rare plants not encountered in the reserve that could be a focus of future restoration activities include nohoanu (*Geranium arboreum*), a native mint *Stenogyne microphylla*, a rare fern *Diplazium molokaiense*, and many more.

Nearby Haleakalā National Park has a greenhouse with many of the rare plants found within the subalpine region of East Maui, and would be a good propagule source for restoration plantings of rare plants at Kamehamenui, including Haleakalā silverswords.



Hōʻawa (*Pittosporum confertiflorum*) flowers on the lone tree we came across in the reserve. Hōʻawa would be a good species to include in restoration plantings, along with sandalwood and other increasingly rare plants.

INCIPIENT PLANTS

Though many non-native plants are already well established in the reserve. There are other invasive plants that are just starting get a foothold in the reserve. Below are some of them. Most are located in the lowest reaches of the reserve, especially in and near gulches.

Early detection and rapid response efforts to address these invasive species while they are still in low numbers will be most successful. Efforts will also be much more effective if undertaken while ungulates are still present, as the ungulates are doing just as much to damage to the non-native species as they are the native plants. And once ungulates are removed, these plants will be released from that pressure and will shift to a much faster rate of expansion through the area.

- Banana poka (*Passiflora tarminiana*)
- Canary Island St. John's Wort (*Hypericum canariense*)
- Coast banksia (*Banksia integrifolia*)
- Cotoneaster (*Cotoneaster pannosus*)
- Firethorn (*Pyracantha* spp.)
- Japanese honeysuckle (*Lonicera japonica*)
- Mock orange (*Pittosporum undulatum*)
- Pampas grass (*Cortaderia* spp.)
- Night blooming jasmine (*Cestrum nocturnum*)
- Smoke bush (*Buddleia* spp.)
- Tree poppy (*Bocconia frutescens*)



Canary Island St. John's Wort (*Hypericum canariense*) is establishing in the lower gulches of the reserve.

PLANT SPECIES LIST

Following is a checklist of all vascular plant species inventoried during field studies.

Abundance of each species within the project area:

- Dominant = Forming a major part of the vegetation within the project area.
- Common = Widely scattered throughout the area or locally abundant within a portion.
- Occasional = Scattered sparsely throughout the area or occurring in a few small patches.
- Rare = Only a few isolated individuals within the project area.

Family	Scientific Name	Common Name	Nativity	Abundance
Fabaceae	*Acacia koa*	Koa	Endemic	Rare
Fabaceae	*Acacia mearnsii*	Wattle	Non-native	Common
Pteridaceae	*Adiantum hispidulum*	Rough maidenhair fern	Non-native	Occasional
Asparagaceae	*Agave attenuata*	Swan's neck agave	Non-native	Rare
Asteraceae	*Ageratina adenophora*	Maui pamakani	Non-native	Occasional
Asteraceae	*Ageratina riparia*	Hamakua pamakani	Non-native	Occasional
Primulaceae	*Anagalis arvensis*	Scarlet pimpernel	Non-native	Occasional
Poaceae	*Anthoxanthum odoratum*	Sweet vernal grass	Non-native	Common
Asclepiadaceae	*Asclepias physocarpa*	Balloon plant	Non-native	Occasional
Asparagaceae	*Asparagus asparagoides*	Bridal creeper	Non-native	Rare
Aspleniaceae	*Asplenium adiantum-nigrum*	ʻIwaʻiwa	Indigenous	Occasional
Aspleniaceae	*Asplenium trichomanes* subsp. *densum*	Maidenhair spleenwort	Endemic	Occasional
Asteraceae	*Artemisia mauiensis*	Hinahina	Endemic	Rare
Poaceae	*Axonopus fissifolius*	Narrow-leaved carpetgrass	Non-native	Occasional
Proteaceae	*Banksia integrifolia*	Coast banksia	Non-native	Rare
Blechnaceae	*Blechnum appendiculatum*	Blechnum	Non-native	Rare
Papaveraceae	*Bocconia frutescens*	Tree poppy	Non-native	Occasional
Poaceae	*Bromus catharticus*	Rescue grass	Non-native	Rare
Poaceae	*Bromus diandrus*	Ripgut	Non-native	Rare
Poaceae	*Bromus tectorum*	Cheat grass	Non-native	Occasional
Scrophulariaceae	*Buddleja davidii*	Butterfly bush	Non-native	Rare
Scrophulariaceae	*Buddleja madagascariensis*	Smoke bush	Non-native	Rare
Cyperaceae	*Carex macloviana subsp. subfusca*	Carex	Indigenous	Rare
Cyperaceae	*Carex wahuensis*	Carex	Endemic	Rare
Poaceae	*Cenchrus clandestinus*	Kikuyu grass	Non-native	Common
Asteraceae	*Centaurium erythraea* subsp. *erythraea*	Bitter herb	Non-native	Rare
Valerianaceae	*Centranthus ruber*	Valerian	Non-native	Rare

Family	Scientific Name	Common Name	Nativity	Abundance
Caryophyllaceae	*Cerastium fontanum* subsp. *vulgare*	Mouse-ear chickweed	Non-native	Rare
Solanaceae	*Cestrum nocturnum*	Night blooming cestrum	Non-native	Occasional
Pteridaceae	*Cheilanthes viridis*	Green cliff brake	Non-native	Rare
Poaceae	*Chloris gayana*	Rhodes grass	Non-native	Rare
Asteraceae	*Cirsium vulgare*	Bull thistle	Non-native	Rare
Commeliniaceae	*Commelina diffusa*	Honohono	Non-native	Rare
Asteraceae	*Conyza bonariensis*	Hairy horseweed	Non-native	Rare
Rubiaceae	*Coprosma ernodeoides*	Kukaenene	Endemic	Rare
Rubiaceae	*Coprosma montana*	Pilo	Endemic	Rare
Poaceae	*Cortaderia jubata*	Pampas grass	Non-native	Rare
Rosaceae	*Cotoneaster pannosus*	Cotoneaster	Non-native	Occasional
Thelypteridaceae	*Cyclosorus dentatus*	Downy wood fern	Non-native	Occasional
Poaceae	*Cynodon dactylon*	Bermuda grass	Non-native	Rare
Cyperaceae	*Cyperus stoloniferus*	Cyperus	Non-native	Rare
Dryopteridaceae	*Cyrtomium caryotideum*	Kaapeape	Indigenous	Rare
Poaceae	*Dactylis glomerata*	Cocksfoot	Non-native	Occasional
Asteraceae	*Delairea odorata*	Cape ivy	Non-native	Occasional
Poaceae	*Deschampsia nubigena*	Hairgrass	Endemic	Occasional
Convolvulaceae	*Dichondra micrantha*	Dichondra	Non-native	Rare
Athyriaceae	*Diplazium sandwichianum*	Pohole	Endemic	Rare
Sapindaceae	*Dodonaea viscosa*	ʻAʻali'i	Indigenous	Occasional
Dryopteridaceae	*Dryopteris wallichiana*	Laukahi	Indigenous	Occasional
Asteraceae	*Dubautia menziesii*	Kūpaoa	Endemic	Common
Dryopteridaceae	*Elaphoglossum paleaceum*	Mākuʻe	Indigenous	Rare
Geraniaceae	*Erodium cicutarium*	Pin clover	Non-native	Occasional
Myrtaceae	*Eucalyptus globulus*	Blue gum	Non-native	Common
Myrtaceae	*Eucalyptus robusta*	Swamp mahogany	Non-native	Rare
Poaceae	*Eragrostis curvula*	Weeping love grass	Non-native	Occasional
Asteraceae	*Erigeron karvinskianus*	Daisy fleabane	Non-native	Occasional
Poaceae	*Festuca rubra*	Red fescue	Non-native	Common
Apiaceae	*Foeniculum vulgare*	Fennel	Non-native	Occasional
Asteraceae	*Gamochaeta* sp.	Gamochaeta	Non-native	Occasional
Geraniaceae	*Geranium homeanum*	Cranesbill	Non-native	Occasional
Proteaceae	*Grevillea robusta*	Silky oak	Non-native	Rare
Asteraceae	*Heterotheca grandiflora*	Telegraph weed	Non-native	Rare
Poaceae	*Holcus lanatus*	Yorkshire fog	Non-native	Common
Hypericaceae	*Hypericum canariense*	Canary Islands St. John's wort	Non-native	Occasional

Family	Scientific Name	Common Name	Nativity	Abundance
Asteraceae	*Hypochoeris radicata*	Hairy cat's ear	Non-native	Occasional
Convolvulaceae	*Ipomoea indica*	Koali ʻawa	Indigenous	Rare
Bignoniaceae	*Jacaranda mimosifolia*	Jacaranda	Non-native	Rare
Juncaceae	*Juncus* sp.	Juncus rush	Non-native	Rare
Santalaceae	*Korthalsella complanata*	Hulumoa	Indigenous	Rare
Poaceae	*Lachnagrostis filiformis*	Heʻupueo	Indigenous	Rare
Asteraceae	*Lapsana communis*	Nipplewort	Non-native	Rare
Ericaceae	*Leptecophylla tameiameiae*	Pūkiawe	Indigenous	Common
Caprifoliaceae	*Lonicera japonica*	Japanese honeysuckle	Non-native	Rare
Juncaceae	*Luzula hawaiiensis*	Wood rush	Endemic	Rare
Lythraceae	*Lythrum maritimum*	Lythrum	Non-native	Rare
Fabaceae	*Medicago lupulina*	Black medic	Non-native	Occasional
Poaceae	*Melinis minutiflora*	Molasses grass	Non-native	Occasional
Poaceae	*Melinis repens*	Natal red top	Non-native	Occasional
Myrtaceae	*Metrosideros polymorpha* var. *glaberrima*	ʻŌhiʻa	Endemic	Rare
Myrtaceae	*Metrosideros polymorpha* var. *incana*	ʻŌhiʻa	Endemic	Rare
Dennstaedtiaceae	*Microlepia strigosa*	Palapalai	Indigenous	Rare
Myricaceae	*Morella faya*	Firetree	Non-native	Common
Solanaceae	*Nicandra physalodes*	Apple of Peru	Non-native	Occasional
Onagraceae	*Oenothera laciniata*	Cut-leaved evening primrose	Non-native	Rare
Onagraceae	*Oenothera stricta subsp. stricta*	Evening primrose	Non-native	Rare
Oleaceae	*Olea europaea subsp. cuspidata*	African olive	Non-native	Occasional
Cactaceae	*Opuntia ficus-indica*	Pānini	Non-native	Rare
Oxalidaceae	*Oxalis corniculata*	Yellow wood sorrel	Non-native	Rare
Passifloraceae	*Passiflora tarminiana*	Banana poka	Non-native	Occasional
Pteridaceae	*Pellaea ternifolia*	Kalamoho	Indigenous	Occasional
Polygonaceae	*Persicaria capitata*	Pink knotweed	Non-native	Rare
Solanaceae	*Physalis peruviana*	Poha	Non-native	Occasional
Phytolaccaceae	*Phytolacca octandra*	Pokeweed	Non-native	Occasional
Pinaceae	*Pinus pinaster*	Maritime pine	Non-native	Rare
Pinaceae	*Pinus radiata*	Monterey Pine	Non-native	Common
Pittosporaceae	*Pittosporum confertiflorum*	Hōʻawa	Endemic	Rare
Pittosporaceae	*Pittosporum undulatum*	Victorian box	Non-native	Rare
Pteridaceae	*Pityrogramma austroamericana*	Golden fern	Non-native	Rare
Plantaginaceae	*Plantago lanceolata*	Narrow-leaved plantain	Non-native	Occasional
Dryopteridaceae	*Polystichum haleakalense*	Polystichum	Endemic	Rare
Rosaceae	*Prunus campanulata*	Taiwan cherry	Non-native	Occasional

Family	Scientific Name	Common Name	Nativity	Abundance
Asteraceae	*Pseudognaphalium sandwicensium var. sandwicensium*	ʻEnaʻena	Endemic	Rare
Psilotaceae	*Psilotum nudum*	Moa	Indigenous	Rare
Hypolepidaceae	*Pteridium aquilinum* subsp. *decompositum*	Kīlau, bracken fern	Indigenous	Common
Pteridaceae	*Pteris cretica*	Cretan brake	Indigenous	Occasional
Pteridaceae	*Pteris tremula*	Australian brake	Non-native	Rare
Rosaceae	*Pyracantha angustifolia*	Firethorn	Non-native	Occasional
Rosaceae	*Pyracantha koidzumii*	Formosa firethorn	Non-native	Occasional
Rosaceae	*Rubus argutus*	Black berry	Non-native	Rare
Rosaceae	*Rubus hawaiensis*	ʻAkala	Endemic	Rare
Rosaceae	*Rubus niveus*	Mysore raspberry	Non-native	Common
Rosaceae	*Rubus rosifolius*	Thimbleberry	Non-native	Occasional
Polygonaceae	*Rumex acetosella*	Sheep sorrel	Non-native	Occasional
Blechnaceae	*Sadleria cyatheoides*	ʻAmaʻu	Endemic	Rare
Santalaceae	*Santalum haleakalae var. haleakalae*	ʻIliahi, Haleakalā sandalwood	Endemic	Rare
Asteraceae	*Senecio madagascariensis*	Fireweed	Non-native	Common
Taxodiaceae	*Sequoia sempervirens*	Redwood	Non-native	Rare
Rubiaceae	*Sherardia arvensis*	Blue fieldmadder	Non-native	Rare
Solanaceae	*Solanum americanum*	Pōpolo	Indigenous	Rare
Solanaceae	*Solanum linnaeanum*	Apple of Sodom	Non-native	Occasional
Fabaceae	*Sophora chrysophylla*	Māmane	Endemic	Rare
Poaceae	*Sporobolus indicus*	Smut grass	Non-native	Occasional
Caryophyllaceae	*Stellaria media*	Common chickweed	Non-native	Rare
Asteraceae	*Taraxacum officinale*	Common dandelion	Non-native	Occasional
Asteraceae	*Tetramolopium humile subsp. haleakalae*	Haleakalā tetramolopium	Endemic	Occasional
Bignoniaceae	*Thunbergia alata*	Black-eyed Susan vine	Non-native	Rare
Fabaceae	*Trifolium pratense var. sativum*	Red clover	Non-native	Occasional
Fabaceae	*Trifolium repens*	White clover	Non-native	Occasional
Poaceae	*Trisetum glomeratum*	Pili uka	Endemic	Occasional
Ericaceae	*Vaccinium reticulatum*	ʻŌhelo	Endemic	Rare
Verbenaceae	*Verbena litoralis*	Vervain	Non-native	Rare
Plantaginaceae	*Veronica arvensis*	Corn speedwell	Non-native	Rare
Fabaceae	*Vicia sp.*	Vetch	Non-native	Occasional
Apocynaceae	*Vinca sp.*	Vinca	Non-native	Rare
Poaceae	*Vulpia sp.*	Fescue	Non-native	Rare
Iridaceae	*Watsonia borbonica*	Watsonia	Non-native	Rare
Asteraceae	*Youngia japonica*	Oriental hawksbeard	Non-native	Occasional

BATS

We did not survey for Hawaiian Hoary Bats or ʻŌpeʻapeʻa (*Lasiurus cinereus semotus*), as a year-long monitoring program with an array of ultrasonic bat detectors is being done by others.

Anecdotally, bats are present over all of East Maui, and some of their highest numbers occur in forested sections of the mid-elevations.

Our guess is there will be low levels of transiting bats anywhere within the reserve, with the most down by Kekaulike Ave., and the least up high near the summit where there is no vegetation.

The bats will likely follow gulches and forage in and near there. And any groves of trees will also likely be utilized, even non-native, especially the leeward sides out of the weather where insects would seek refuge, those sorts of locations attract foraging bats.

Hawaiian Hoary Bats tend to roost in large trees in sheltered locations. We anticipate most of the bat roosting sites will be in the lowest elevations of the reserve.

Very little is known about this nocturnal native, but many bats likely call Kamehamenui home.



Hawaiian Hoary Bat or ʻŌpeʻapeʻa (*Lasiurus cinereus semotus*), Olinda, Maui.

NON-NATIVE MAMMALS

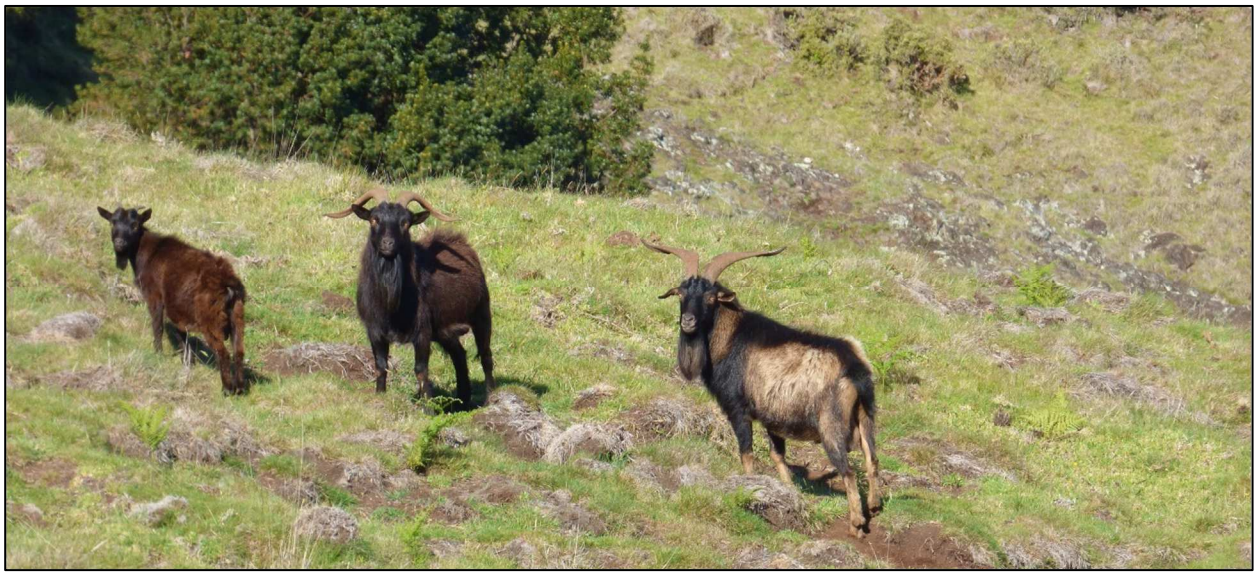
The Kamehamenui Forest Reserve is currently an active ranch with numerous cows (*Bos taurus*), goats (*Capra hircus*), pigs (*Sus scrofa*), axis deer (*Axis axis*), and sheep (*Ovis aries*). Ungulate signs are evident over the entire reserve, though are markedly less in the highest elevations.

There are some nice looking pastures down low. However, damage to the native plants from the ungulates is severe, with vast areas completely denuded and taken down to dirt and stone.

Other mammals likely to utilize this property, but which were not observed or heard include rats (*Rattus* spp.), mice (*Mus domesticus*), cats (*Felis domesticus*), dogs (*Canis lupus familiaris*), and mongooses (*Herpestes javanicus*).



Cattle (*Bos taurus*).



Goats (*Capra hircus*).



Pig (*Sus scrofa*).



Axis Deer (*Axis axis*).



Sheep (*Ovis aries*).



Many previously vegetated areas of the reserve have been grazed and grubbed down to dirt by ungulates.



Bleached skeletons are all that remain of the native subalpine shrubland that one called this area home. Vast areas of the reserve are currently like this.



Pig damage is severe over much of the reserve.



Pigs are even able to uproot pūkiawe bushes.



Wool caught on barbed wire as sheep duck under the fence. ʻŌhiʻa trees in the background.



Sheep wool at the base of an ʻōhiʻa tree being used as a rubbing post.



Sandalwood tree heavily damaged by ungulates. All the sandalwood trees we encountered in the reserve are near death as a result of ungulate damage.



The base of another sandalwood tree. It's amazing the tree is still alive given the damage.



Newly installed fence adjacent to the reserve. Mostly ungulate free on the left, outside the reserve.



Same fence on the ground. Less vegetation and more pig digging visible on the right, inside the reserve.

BIRDS

There are a variety of habitats and elevational range in the reserve, resulting in a variety of birds. Of the native birds, the Maui ʻAmakihi (*Chlorodrepanis virens* var. *wilsoni*) is the most common, found in forested or densely vegetated shrubland from 4,000-7,500 ft.

ʻApapane (*Himatione sanguinea*) are also locally prevalent, but appeared less widespread, they were encountered in heavily forested areas from 5,500-7,500 ft. As with ʻAmakihi, they were present in both native and non-native forest.

Though not encountered in the reserve, ʻIʻiwi (*Vestiaria coccinea*) and Maui Creeper or ʻAlauahio (*Paroreomyza montana newtoni*) occur in nearby Kula Forest Reserve.

A Hawaiian Owl or Pueo (*Asio flammeus sandwichensis*) was observed gliding over open areas around 6,000 ft. They could occur over the entire range of the reserve. Though not encountered, Hawaiian Geese or Nēnē (*Branta sandvicensis*) likely also occur in the reserve at times.

Pacific Golden-Plovers or Kōlea (*Pluvialis fulva*) were regularly encountered on our first field day in late April. However, by the next week in early May, they had all left for Alaska. As a result, our bird distribution map does not convey the actual distribution, which is that Kōlea likely seasonally occur in all open areas from the bottom of the reserve to 8,500 ft.

Hawaiian Petrels or ʻUaʻu (*Pterodroma sandwichensis*) nest in burrows dug in the ground in the higher elevations of the reserve. Though no live petrels were observed or heard, one dead petrel was found below powerlines near the summit, and we came across many recently active burrows.

Though seemingly barren and empty during the day, once darkness arrives, the night sky at the summit fills with seabirds and their raucous calls. With protection, the highest elevations of the reserve have the potential to support a huge number of seabirds.

Along with the Hawaiian Petrel, the Band-rumped Storm-Petrel (*Oceanodroma castro*) and Newell's Shearwaters (*Puffinus newelli*) may be able to utilize the habitat, especially as the area is further protected and restored.



Looking and listening for birds.

Eurasian Skylarks (*Alauda arvensis*) were omni-present over much of the reserve, given the vast open areas. There was almost constant singing by one to a few skylarks in many areas.

Non-native passerines found in forested areas in the reserve include Red-billed Leiothrix (*Leiothrix lutea*), Japanese Bush-warbler (*Cettia diphone*), Warbling White-eye (*Zosterops japonicus*), House Finch (*Haemorhous mexicanus*), Common Myna (*Acridotheres tristis*), Northern Mockingbird (*Mimus polyglottos*), and Northern Cardinal (*Cardinalis cardinalis*).

Game birds and doves heard or seen were Ring-necked Pheasant (*Phasianus colchicus*), Chukar (*Alectoris chukar*). Mourning Dove (*Zenaida macroura*), Zebra Dove (*Geopelia striata*), and Rock Pigeon (*Columba livia*).

A Barn Owl (*Tyto alba*) flushed from a rock cave in a cliff in the pasture zone as we approached.

Many birds are only found in the lowest parts of the reserve, including Chestnut Munia (*Lonchura atricapilla*), House Sparrow (*Passer domesticus*), and Junglefowl (*Gallus gallus*).



Chestnut Munia (*Lonchura atricapilla*) resting in a wattle snag on the edge of a pasture.



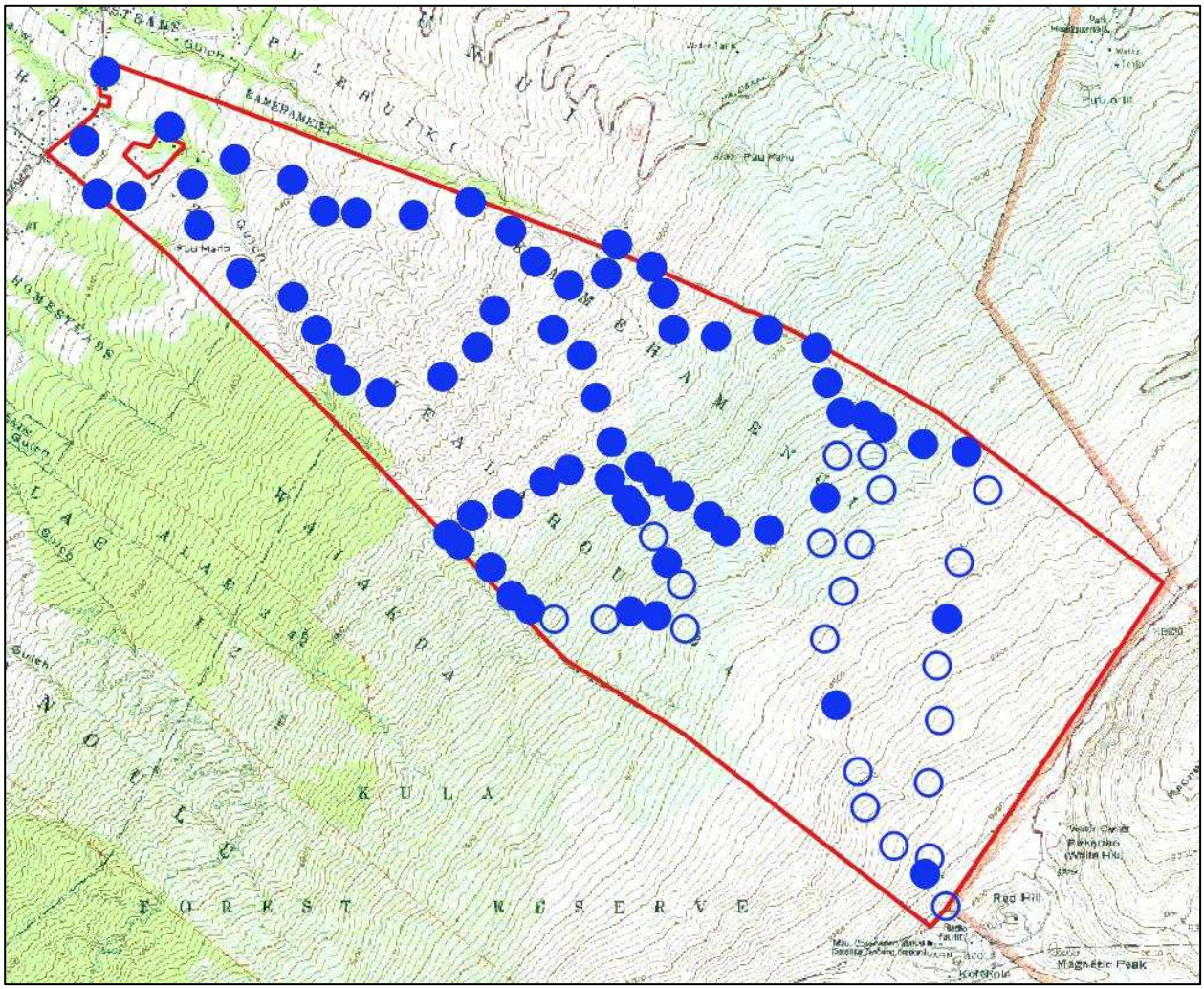
Hawaiian Petrel or ʻUaʻu burrow dug under a stone outcrop in the summit region, with burrow number.



Dead Hawaiian Petrel or ʻUaʻu under powerlines in the summit region. The vast and mostly barren summit region has the potential to support huge numbers of seabirds.

BIRD COUNTS

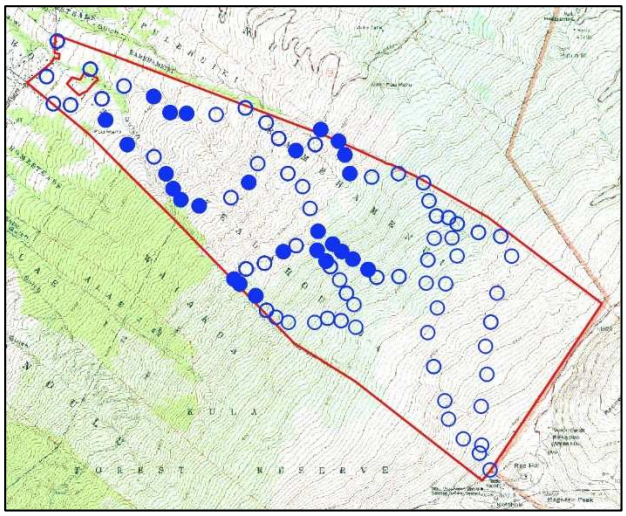
Travelling counts of variable time and length were done across a range of habitat types and elevations. The average distance travelled for each count was 280 meters, and the average duration was 18 minutes. All birds observed or heard for an unlimited distance were recorded. Solid blue circles indicate detection, open blue circles indicate no detection.



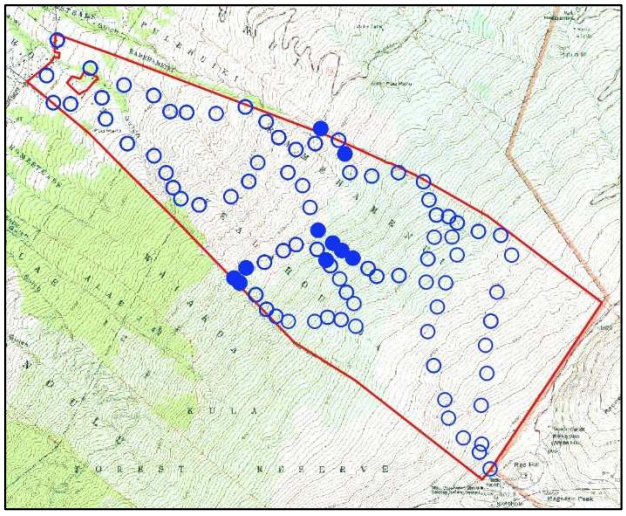
All bird count locations.



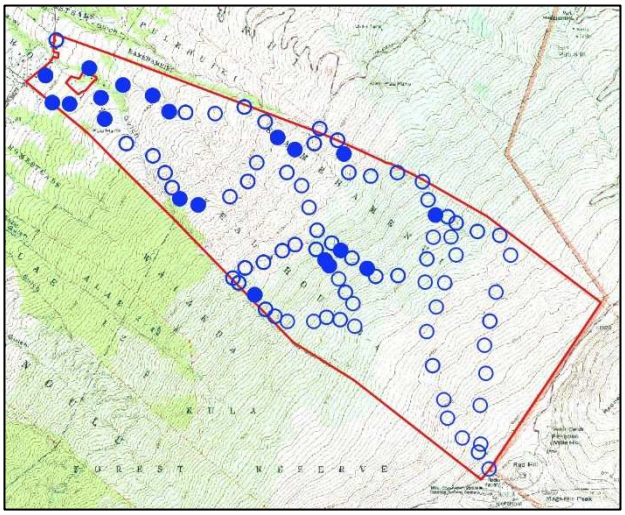
Looking and listening for birds.



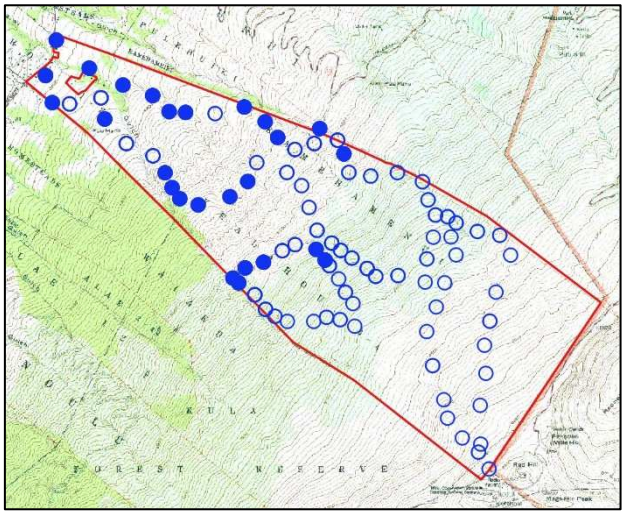
Maui ʻAmakihi



ʻApapane



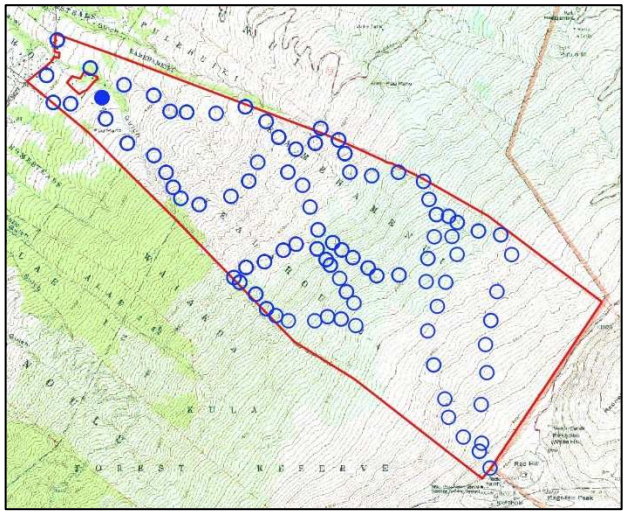
Warbling White-eye



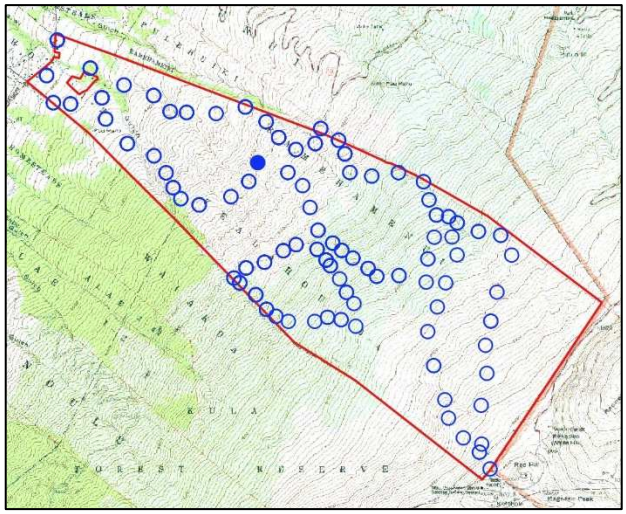
Red-billed Leiothrix



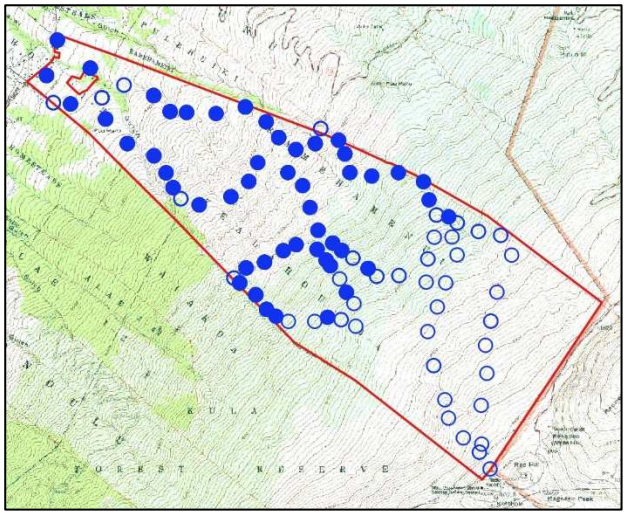
ʻApapane calling in ʻōhiʻa canopy, Kahikinui Forest Reserve.



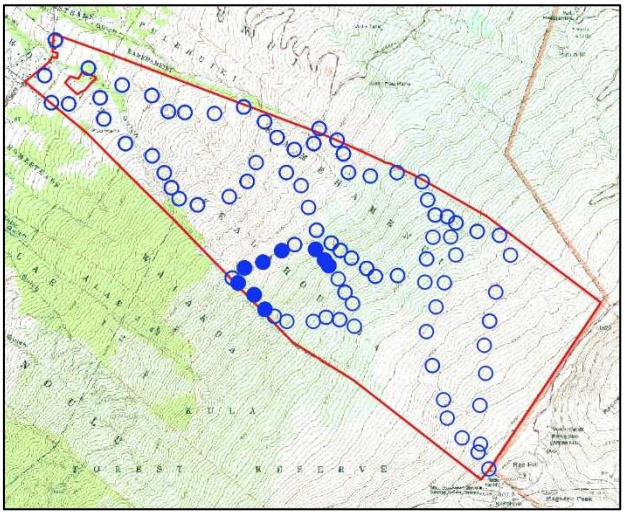
Hawaiian Owl or Pueo



Barn Owl



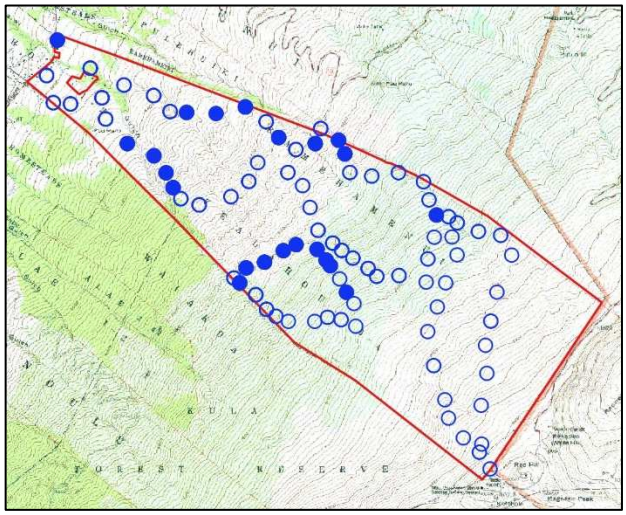
Eurasian Skylark



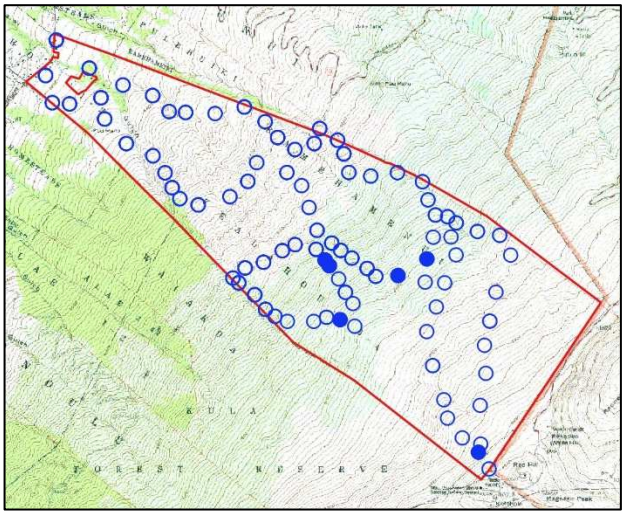
Pacific Golden-Plover or Kōlea



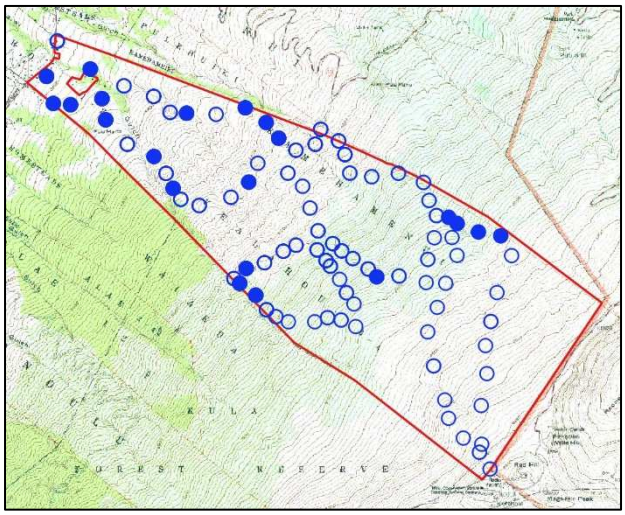
Hawaiian Owl or Pueo chick, Kula.



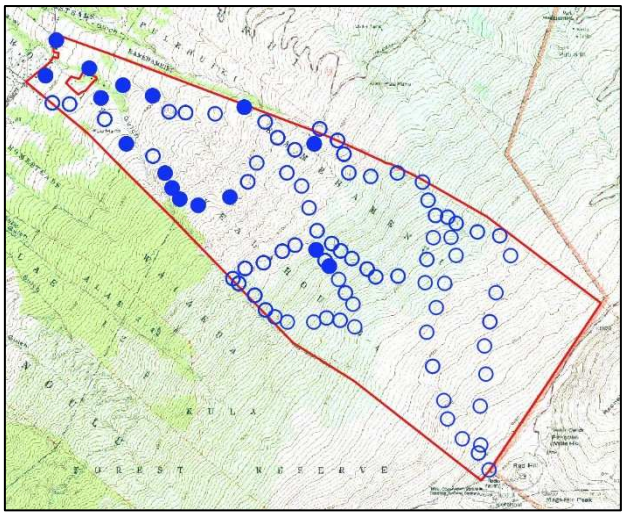
Ring-necked Pheasant



Chukar



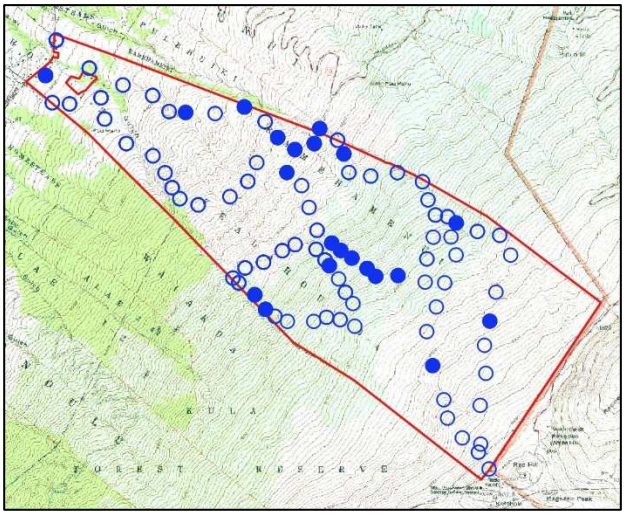
House Finch



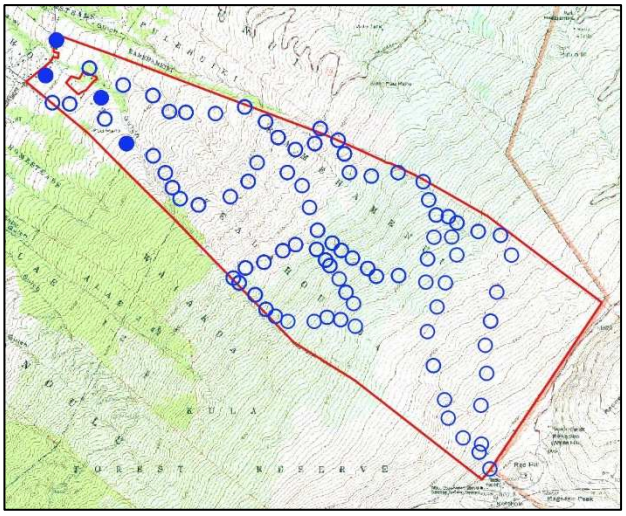
Northern Cardinal



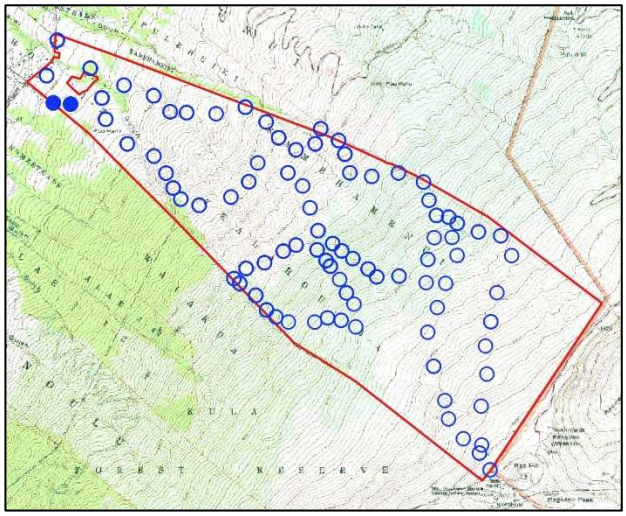
Ring-necked Pheasant, ʻUlupalakua.



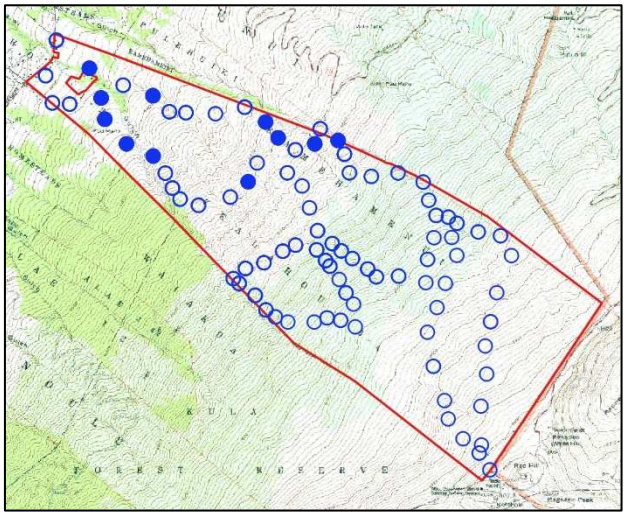
Northern Mockingbird



Red Junglefowl



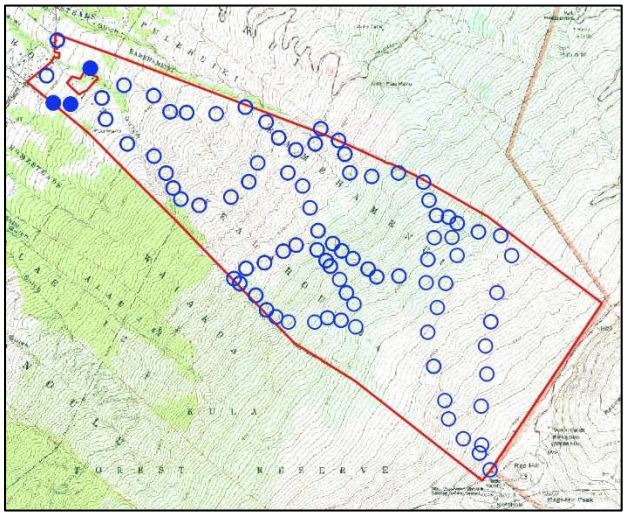
Chestnut Munia



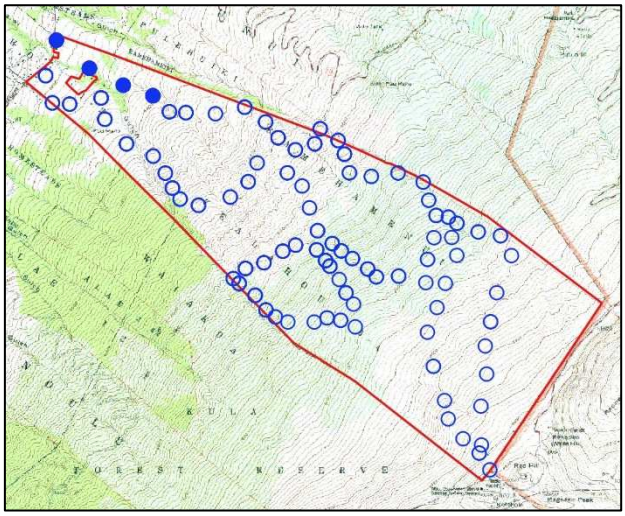
Common Myna



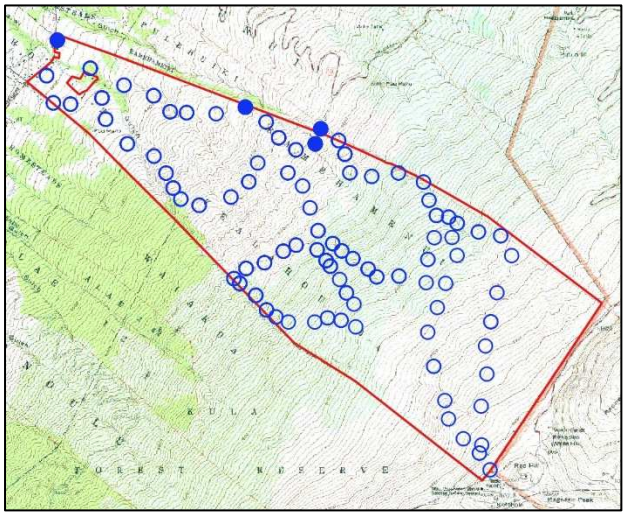
Common Myna birds, Midway Atoll.



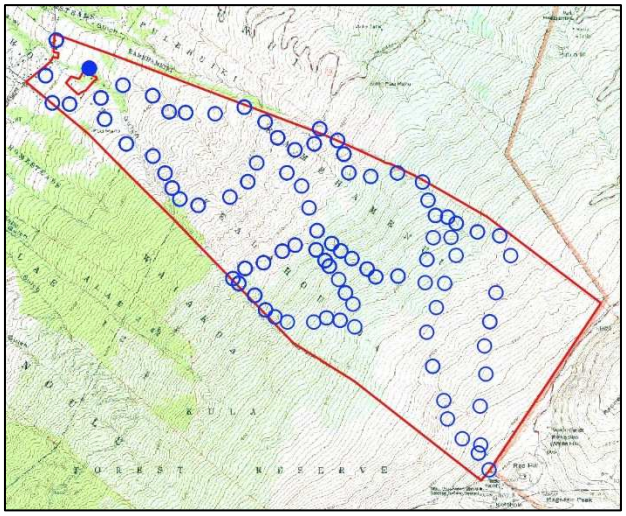
House Sparrow



Mourning Dove



Rock Pigeon



Zebra Dove



A lost Rock Pigeon at the Haleakalā summit visitor center parking lot.

BIRD SPECIES LIST

Following is a checklist of the bird species inventoried during the field work.

Abundance of each species within the project area:

- Abundant = Many flocks or individuals seen throughout area at all times of day.
- Common = A few flocks or well scattered individuals throughout the area.
- Uncommon = Only one flock or several individuals seen within the project area.
- Rare = only one or two seen within the project area.

Common name	**Scientific name**	**Nativity**	**Abundance**
ʻApapane	*Himatione sanguinea*	Endemic	Occasional
Barn Owl	*Tyto alba*	Non-native	Rare
Chestnut Munia	*Lonchura atricapilla*	Non-native	Rare
Chukar	*Alectoris chukar*	Non-native	Occasional
Common Myna	*Acridotheres tristis*	Non-native	Occasional
Eurasian Skylark	*Alauda arvensis*	Non-native	Common
Hawaiian Owl	*Asio flammeus sandwichensis*	Endemic	Rare
Hawaiian Petrel	*Pterodroma sandwichensis*	Endemic	Rare
House Finch	*Haemorhous mexicanus*	Non-native	Common
House Sparrow	*Passer domesticus*	Non-native	Occasional
Maui ʻAmakihi	*Chlorodrepanis virens wilsoni*	Endemic	Occasional
Northern Cardinal	*Cardinalis cardinalis*	Non-native	Occasional
Northern Mockingbird	*Mimus polyglottos*	Non-native	Occasional
Pacific Golden-Plover	*Pluvialis fulva*	Migratory	Occasional
Red Junglefowl	*Gallus gallus*	Non-native	Rare
Red-billed Leiothrix	*Leiothrix lutea*	Non-native	Common
Ring-necked Pheasant	*Phasianus colchicus*	Non-native	Common
Rock Pigeon	*Columba livia*	Non-native	Occasional
Warbling White-eye	*Zosterops japonicus*	Non-native	Common
Zebra Dove	*Geopelia striata*	Non-native	Occasional



Maui ʻAmakihi visiting ʻōhiʻa flowers in Kahikinui Forest Reserve.

INSECTS

A complete inventory of the insects was beyond the scope of this survey. Conspicuous insects were noted and special effort was made to look for insects of conservation concern. Very little survey work has been done on insects in the Kamehamenui Forest Reserve, and there is still much to be discovered, including new undescribed species. Some of the more conspicuous and noteworthy insects we came across are noted below.

YELLOW-FACED BEES

Native yellow-faced bees (*Hylaeus* spp.) (Hymenoptera: Colletidae) are abundant in the subalpine shrubland of the reserve, especially near pūkiawe and ʻaʻaliʻi plants in bloom. These black bees with yellow markings are important pollinators of the Haleakalā Silversword and other plants. Once common across all Hawaiʻi, subalpine East Maui is now one of the only places these native bees are still abundant. The upper reaches of the reserve, 7,500-9,500 ft. have some of the highest numbers of yellow-faced bees we've encountered.



Yellow-faced bee (*Hylaeus nivicola*), an important pollinator of native plants such as silverswords.



Kleptoparasitic yellow-faced bee (*Hylaeus volatilis*). Instead of visiting flowers to collect pollen and nectar, these native bees lay their eggs in the nests of other native bees while they are out foraging, like cuckoo birds.

KOA BUTTERFLY

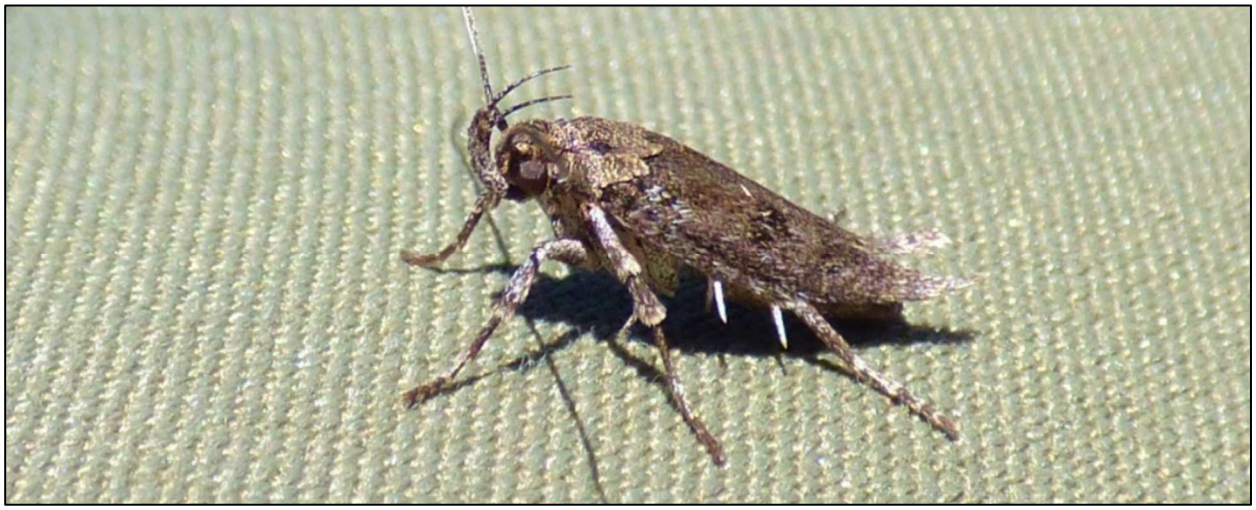
Native native koa butterflies (*Udara blackburni*) (Lepidoptera: Lycaenidae) are locally abundant in the reserve. The larvae of this species feed on koa, ʻaʻaliʻi, and perhaps black wattle. As these species become more common, so too should this small but showy native butterfly.



Koa butterfly (*Udara blackburni*) in the koa/wattle forest of Kamehamenui Forest Reserve.

FLIGHTLESS MOTHS

The highest elevations of the reserve are home to the native Haleakalā flightless moth (*Thyrocopa apatela*). This brown moth can occasionally be seen hopping around the cinders and stones in the summit region. The moths are largely diurnal, being more active in the day, though they sometimes come to light. The larva is likely a generalist, feeding on plant debris. These ground bound moths benefit from no invasive ants in the highest elevations of the reserve.



Haleakalā flightless moth (*Thyrocopa apatela*) in the summit region of Kamehamenui Forest Reserve.

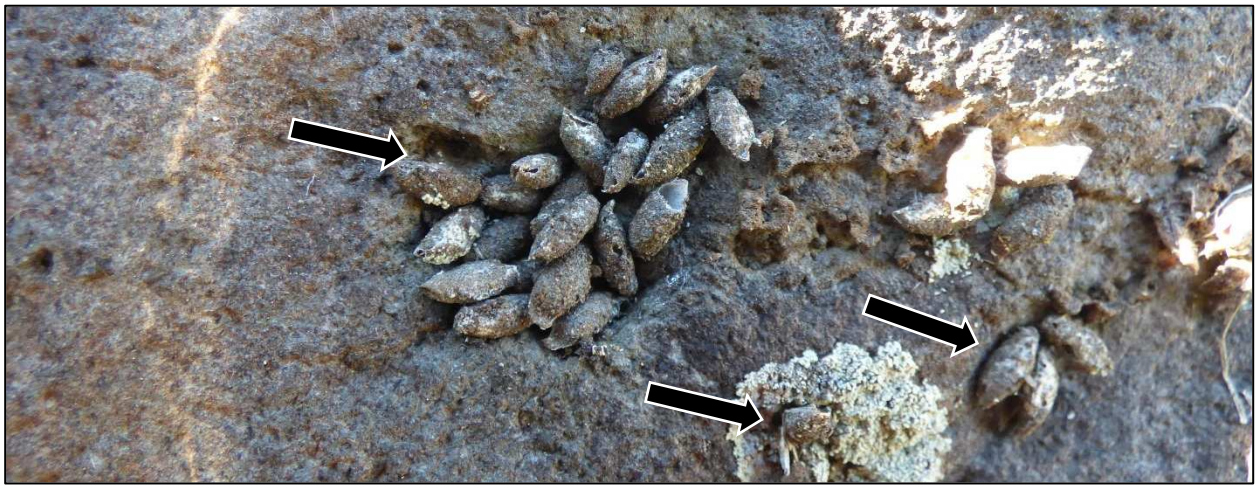
FANCY-CASED MOTHS

Able to survive in some of the least hospitable areas of Hawai‘i, native fancy-cased moths (*Hyposmocoma* spp.) (Lepidoptera: Cosmopterigidae) are abundant over much of Kamehamenui. Most prevalent to our eyes were the "burrito" shaped larvae/pupae that were common in sheltered areas on large stones and cliff faces across the entire reserve. We also came across larvae with cases of the "cigar/carnivorous" types. In most places in the reserve, *Hyposmocoma* were the most common moths in our sweep net.

The larvae of the "burrito" moths create a sleeping bag type structure they stick bits of mud and lichen to while they crawl around and graze on lichen and fungi. Larvae pupate in the cases. Adults emerge as small moths. The "carnivorous" larvae eat snails or possibly other *Hyposmocoma* larvae. There is still much to learn about these moths. Many of the *Hyposmocoma* moths encountered in the reserve are new undescribed native species.



***Hyposmocoma* spp. habitat in sheltered areas on stones and cliff faces.**



***Hyposmocoma* sp. "burrito" shaped larvae/pupae adorned with bits of soil.**



Hyposmocoma **sp. "carnivorous" larva / caterpillar adorned with white lichen.**



Adult *Hyposmocoma* moths showing some of the diversity found in Kamehamenui Forest Reserve.



Looking for native *Hyposmocoma* moths, which are super abundant in Kamehamenui Forest Reserve.

NATIVE TEPHRITID FLIES

Once common over much of Hawai‘i, native tephritid or fruit flies (Diptera:Tephritidae) have now become restricted to the least disturbed habitats of Hawai‘i. Subalpine East Maui is one of the last significant refugia for these flies. Though less diverse than it once was, the Kamehamenui Forest Reserve still contains multiple species of native tephritid flies.

Most abundant is *Trupanea cratericola*, which lays eggs on flowers of kūpaoa (*Dubautia* spp.) and Haleakalā silverswords. The larvae eat the seeds and pupate within them. *T. limpidapex* lays eggs in the shoot tips of *Dubautia*. Pupal cases and characteristic damage to *Dubautia* from both of these species was observed in the subalpine shrubland.

Though no adults or pupae were observed, *T. artemisae* is likely utilizing the flowers of hinahina (*Artemisia mauiensis*) within the reserve. Additionally, *T. crassipes*, which utilizes the flowers and seeds of the non-native Spanish needle (*Bidens pilosa*) may episodically become abundant.



Tephritid fly (*Trupanea cratericola*) swept from vegetation in subalpine region.



Tephritid fly (*Trupanea cratericola*) pupal case in seedhead of kūpaoa (*Dubautia menziesii*).



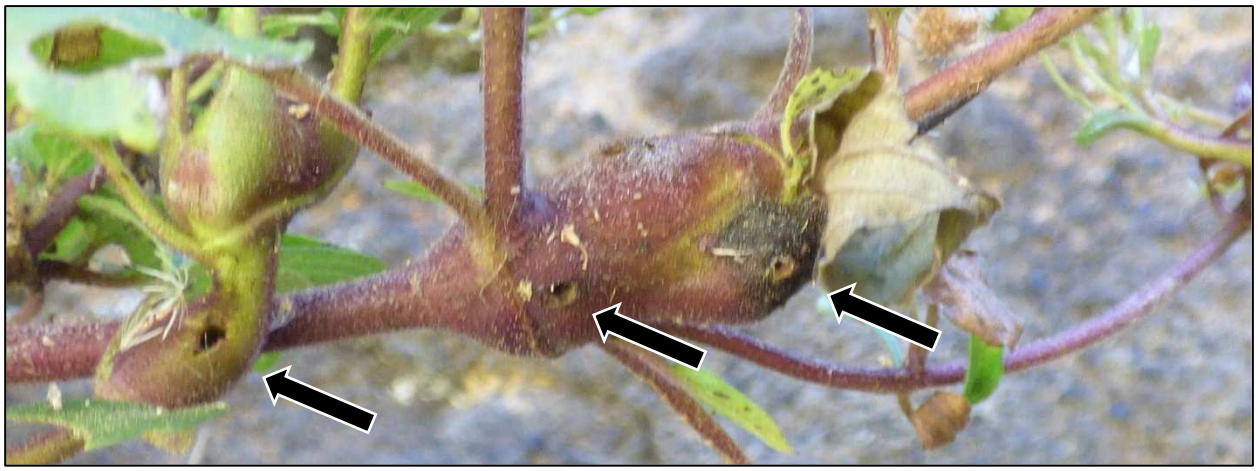
Remnants of tephritid fly (*Trupanea limpidapex*) pupa in shoot tip of kūpaoa (*Dubautia menziesii*).

NON-NATIVE TEPHRITID FLIES

A number of non-native tephritid flies (Diptera: Tephritidae) have been introduced to Hawai‘i for biocontrol of weeds

When pamakani (*Ageratina* spp.) became a serious pest in agriculture and forestry in Hawai‘i, the gall forming tephritid flies, *Procecidochares utilis* and *P. alani* were imported. Within a few years of introduction, they dramatically reduced populations of pamakani.

P. utilis is present within the reserve virtually everywhere Maui pamakani is.



Gall and exit holes of stem galler (*Procecidochares utilis*) in Maui pamakani (*Ageratina adenophora*).

ANTS

Hawai‘i has no native ants (Hymenoptera: Formicidae). Just two species were encountered in the reserve, Argentine ant (*Linepithema humile*) and glaber ant (*Ochetellus glaber*), both were in the lowest elevations. Anecdotally, the reserve appears to have vast areas mostly devoid of invasive tramp ants, which bodes well for the native insects, which can be heavily impacted by ants.

Detailed ant surveys including baiting were not done for this project and more ant species likely exist within the reserve. An ant survey of part of the reserve in 2008 found small numbers of three additional species *Cardiocondyla kagutsuchi*, big-headed ant (*Pheidole megacephala*), and *Hypoponera opaciceps*. Again the tramp ants were only found in the lowest elevations.



Argentine ants (*Linepithema humile*) at bait card at nearby Waipoli Rd.

PLANTHOPPERS

Native planthoppers (*Nesosydne* sp.) (Hemiptera: Delphacidae) are present within the reserve. The *Nesosydne* genus is an adaptive radiation of host-specialized Hawaiian planthoppers. It has been said that each species of native Hawaiian plant likely has its own species of *Nesosydne* that evolved to feed on it. The Haleakalā silversword even has its own, *N. argyroxiphii.* As the native plants within the reserve become more abundant, so too will these native planthoppers.



Native planthopper (*Nesosydne* sp.) swept from subalpine vegetation.

SPIDERS

Spiders are present in small numbers over the entire reserve. Of note are the native wolf spiders (*Lycosa hawaiiensis*) (Araneae: Lycosidae), which hunt for prey in the subalpine shrubland. These spiders live under stones, and at times carry dozens of live young baby spiders on their backs. Other native spiders observed include predatory crab spiders (*Mecaphesa* sp.) (Araneae: Thomisidae), which wait in flowers or vegetation to ambush their prey, and long-jawed spiders *Tetragnatha acuta* (Araneae: Tetragnathidae) which were swept from the subalpine vegetation.



Hawaiian wolf spider (*Lycosa hawaiiensis*) on silversword, Haleakalā National Park.



Long-jawed spider *(Tetragnatha acuta)*, swept from subalpine vegetation of Kamehamenui.

INSECT SPECIES LIST

Following is a checklist of the insect species inventoried during the field work.

A more thorough arthropod inventory was done in similar shrubland in nearby Haleakalā National Park by Paul Krushelnycky (2007). Many of the insects identified in that survey likely also occur in Kamehamenui. Groups he found most diverse include Hemiptera (Bugs), Diptera (Flies), Lepidoptera (Moths and Butterflies), Coleoptera (Beetles), and Araneae (Spiders).

Order	Family	Scientific Name	Common Name	Nativity
Araneae	Araneidae	*Gasteracantha mammosa*	Asian spiny back crab spider	Non-native
Araneae	Lycosidae	*Lycosa hawaiiensis*	Wolf spider	Endemic
Araneae	Salticidae	*?*	Jumping spider	Non-native
Araneae	Theriidae	*Tetragnatha acuta*	Hawaiian long-jawed spider	Endemic
Araneae	Thomisidae	*Mecaphesa* sp.	Crab spider	Endemic
Coleoptera	Chrysomelidae	*Chrysophtharta m-fuscum*	Eucalyptus tortoise beetle	Non-native
Coleoptera	Coccinellidae	*Coccinella septempunctata*	Seven-spotted ladybird	Non-native
Coleoptera	Coccinellidae	*Cryptolaemus montrouzieri*	Mealybug destroyer	Non-native
Coleoptera	Coccinellidae	*Olla v-nigrum*	Ashy gray lady beetle	Non-native
Coleoptera	Curculionidae	*Gonipterus scutellatus*	Eucalyptus snout beetle	Non-native
Diplopoda	?	*?*	Millipede	Non-native
Diptera	Muscidae	*?*	House fly	Non-native
Diptera	Sepsidae	*?*	Dung fly	Non-native
Diptera	Syrphidae	*?*	Syrphid flies	Non-native
Diptera	Tephritidae	*Procecidochares utilis*	Pamakani stem gall	Non-native
Diptera	Tephritidae	*Trupanea cratericola*	Hawaiian fruit fly	Endemic
Diptera	Tephritidae	*Trupanea limpidapex*	Hawaiian fruit fly	Endemic
Diptera	Tipulidae	*?*	Crane fly	?
Hemiptera	Cicadellidae	*?*	Cicadellid	?
Hemiptera	Cixiidae	*Oliarus* sp.	Planthopper	Endemic
Hemiptera	Delphacidae	*Nesosydne* spp.	Planthopper	Endemic
Hemiptera	Lygaeidae	*Nysius* spp.	False chinch bugs	Endemic
Hemiptera	Miridae	*?*	Mirid bugs	?
Hemiptera	Psyllidae	*?*	Psyllids	?
Hemiptera	Tingidae	*Corythucha morrilli*	Lace bug	Non-native
Hemiptera	Tingidae	*Teleonemia scrupulosa*	Lantana lace bug	Non-native
Hymenoptera	Apidae	*Apis mellifera*	Honey bee	Non-native
Hymenoptera	Braconidae	*?*	Braconid wasp	?
Hymenoptera	Colletidae	*Hylaeus nivicola*	Yellow faced bee	Endemic
Hymenoptera	Colletidae	*Hylaeus volatilis*	Yellow faced bee	Endemic
Hymenoptera	Formicidae	*Linepithema humile*	Argentine ant	Non-native
Hymenoptera	Formicidae	*Ochetellus glaber*	Glaber ant	Non-native

Order	Family	Scientific Name	Common Name	Nativity
Hymenoptera	Vespidae	*Odynerus* sp.	Potter wasp	Endemic
Lepidoptera	Cosmopterigidae	*Hyposmocoma* spp.	Fancy cased moths - "burrito"	Endemic
Lepidoptera	Cosmopterigidae	*Hyposmocoma* spp.	Fancy cased moths - "carnivore"	Endemic
Lepidoptera	Erebidae	*Secusio [Galtara] extensa*	Fireweed biocontrol moth	Non-native
Lepidoptera	Lycaenidae	*Udara blackburni*	Koa butterfly	Endemic
Lepidoptera	Nymphalidae	*Danaus plexippus*	Monarch butterfly	Non-native
Lepidoptera	Nymphalidae	*Vanessa virginiensis*	American painted lady butterfly	Non-native
Lepidoptera	Pieridae	*Abaeis nicippe*	Sleepy orange butterfly	Non-native
Lepidoptera	Pieridae	*Pieris rapae*	Cabbage looper	Non-native
Lepidoptera	Schreckensteiniidae	*Schreckensteinia festaliella*	Rubus biocontrol moth	Non-native
Lepidoptera	Xyloryctidae	*Thyrocopa apatela*	Haleakalā flightless moth	Endemic
Neuroptera	Hemerobiidae	*?*	Brown lacewing	Non-native
Odonata	Libellulidae	*?*	Skimmer	?
Orthoptera	Gryllidae	*?*	Cricket	Non-native



Searching for native *Hyposmocoma* moths. These cryptic native moths, many of which are new undescribed species, are abundant and diverse in Kamehamenui.

MOLLUSKS

Native tornatellid snails (*Tornatellides* sp.) (Gastropoda: Achatinellidae) were encountered on foliage and stones. This genus of snails is found in a variety of habitats from the Northwestern Hawaiian Islands to the main Hawaiian Islands. Tornatellid snails are known to be eaten by some species of native *Hyposmocoma* moths, which capture snails with silk and eats them alive.

Also observed were non-native garlic snails (*Oxychilus alliarius*). This invasive snail is a predator of small snails, and negatively impacts native snail communities where introduced.

We looked for, but did not find, the rare native ground snail (*Vitrina tenella*). It was previously known from Kamehamenui, where it was collected on ferns, shrubs, and the ground (6,000-8,500 ft.). However, it is currently only known from one site on Mauna Kea. It could have possibly been wiped out in Kamehamenui by the garlic snail (*Oxychilus*).

Further surveys would undoubtedly turn up more species of snails in the reserve. Native amber snails (*Succinea* spp.) are able to utilize both native and non-native dominated habitat, and are likely in parts of the reserve. And perhaps *Vitrina* is still present and just overlooked.



Non-native garlic snail (*Oxychilus alliarius*).



Native tornatellid snail (*Tornatellides* sp.).

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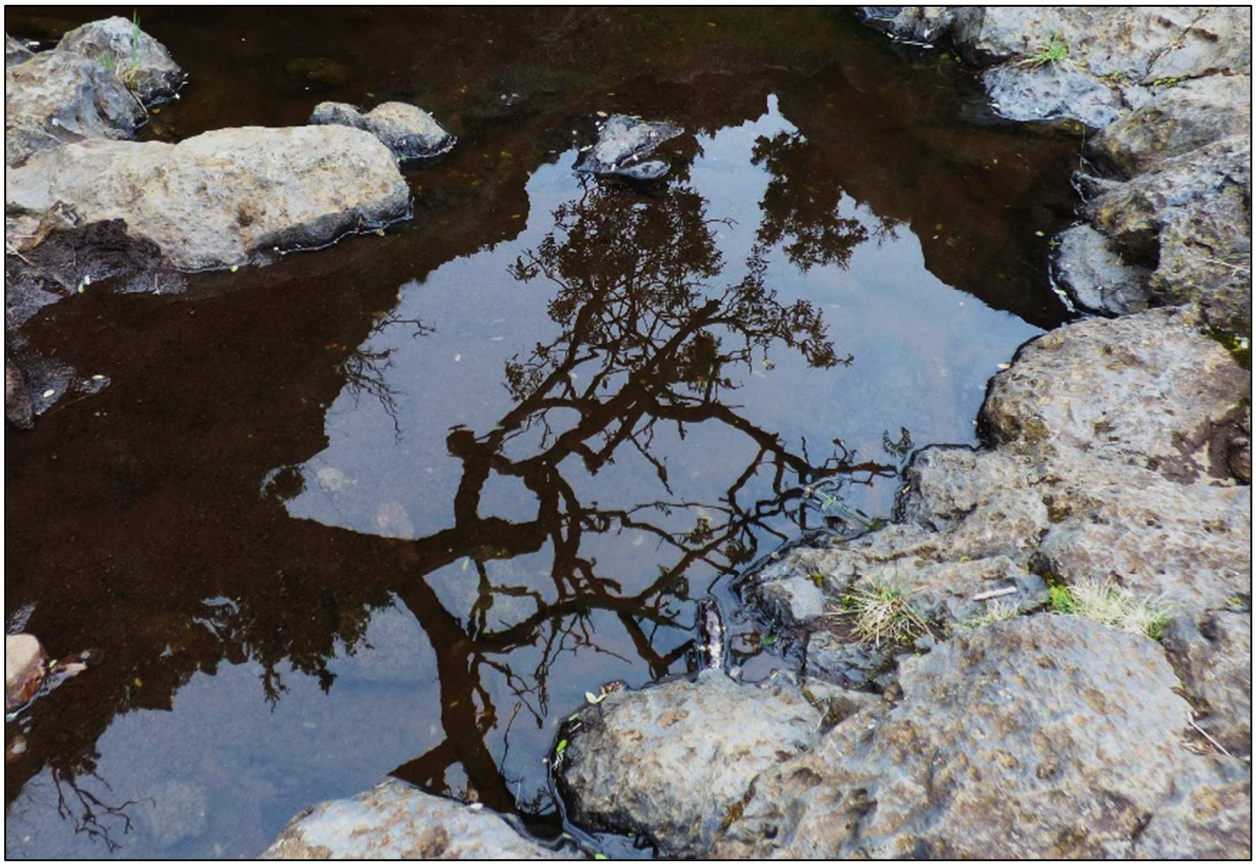
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Ephemeral pool of water under a māmane tree in Kamehamenui Forest Reserve.
***"Hahai nō ka ua i ka ululā‘au"* - The rain follows the forest.**

APPENDIX E. NATIVE BIRDS AND MAMMAL PROFILE



Photo: Chris Eckart

Forest Birds

Hawai‘i ‘amakihi

Hemignathus virens

SPECIES STATUS:
State Listed Endangered on Lāna‘i
State Recognized as Endemic
NatureServe Heritage Rank G3—Vulnerable

SPECIES INFORMATION: The Hawai‘i ‘amakihi is a small, generalist Hawaiian honeycreeper (Family: Fringillidae). Until 1995, the Hawai‘i ‘amakihi, and the O‘ahu (*H. flavus*) and Kaua‘i ‘amakihi (*H. kauaiensis*) were considered a single species: the common ‘amakihi (*H. virens*). Plumage of all species is similar; males are yellow-green to olive with black lores. Females are generally similar, but duller. All have decurved bills. Plumage of males is bright yellow-green above, and there is some inter-island variation, especially among females. The Hawai‘i ‘amakihi is brighter and smaller than the Kaua‘i ‘amakihi. Hawai‘i ‘amakihi are generalized foragers that glean arthropods from the leaves, blossoms, twigs, branches, and less frequently from tree trunks, ferns, and shrubs. Feeds on nectar predominately from the flowers of ‘ōhi‘a (*Metrosideros polymorpha*), māmane (*Sophora chrysophylla*), and native lobelias (Campanulaceae), but also forages on flowers of a number of other native and non-native plants. They also eat fruit from native and non-native plants, but predominately from pilo (*Coprosma* spp.). Forages alone, in pairs, in family groups, or in mixed flocks. Courtship behavior is somewhat complex and includes courtship chases, advertising displays, and courtship feeding. Pairs remain together for successive breeding seasons. Pair selects nest site; female builds an open-cup nest and lays two or three eggs. Only females incubate eggs and brood nestlings. Males deliver food to females who then feed nestlings. Fledglings are dependent on parents for up to three months. The Hawai‘i ‘amakihi usually raise two broods in a season.

DISTRIBUTION: Occurs between 300 and 2,900 meters (1,000 – 9,500 feet) on Hawai‘i, Maui and Moloka‘i; not common below 500 meters (1,625 feet). Widely distributed on Hawai‘i and Maui. Original range likely included all forested regions of the above islands as well as those on Lāna‘i, where it was last seen in 1976.

ABUNDANCE: The Hawaiian Forest Bird Survey (1976-1983) estimated the population at 870,000 ± 5,612 (95% confidence interval) birds on the island of Hawai‘i, 44,000 ± 1,786 birds on east Maui, 3,000 ± 408 on west Maui, and 1,800 ± 357 birds on Moloka‘i. Populations on Hawai‘i and Maui are probably stable; the Moloka‘i population is probably declining.

LOCATION AND CONDITION OF KEY HABITAT: A range of habitats including native shrubland and dry, mesic, and wet forests in montane and subalpine communities. Densities are highest on the island of Hawai‘i in subalpine ‘ōhi‘a scrub in Ka‘ū, and in māmane/naio (*Sophora chrysophylla* and *Myoporum sandiwicense*) forests on Mauna Kea. ‘Amakihi also are common in koa (*Acacia koa*) reforestation areas at higher elevations. On Maui, they are common in subalpine dry communities dominated by ‘ōhi‘a, māmane, pūkiawe (*Styphelia tamieameiae*)

and ʻaʻaliʻi (*Dodonea viscosa*). They also occupy some non-native tree plantations on Maui, near areas where native vegetation persists. Habitat on Molokaʻi is restricted to the ʻōhiʻa forests of the eastern half of the island. The condition of this habitat varies considerably. Much of the species' current range is under State or federal jurisdiction.

THREATS: Although populations appear stable they are likely susceptible to the same factors that threaten other native Hawaiian forest birds, including loss and degradation of habitat, predation by introduced mammals, and disease.

CONSERVATION ACTIONS: Hawaiʻi ʻamakihi likely have benefited from management actions to conserve other endangered forest birds in the Hakalau Forest National Wildlife Refuge, Hawaiʻi Volcanoes National Park, and the ʻŌlaʻa/Kīlauea Watershed Partnership. These efforts include fencing, ungulate and small mammal control, forest restoration, habitat monitoring, and studies of disease and disease vectors. Future management specific to the Hawaiʻi ʻamakihi may include the following:

- Translocate captive-bred individuals to Lānaʻi and Kahoʻolawe.
- Conduct public education and outreach.
- Continue protection and management of wildlife sanctuaries and refuges.

MONITORING: Continue forest bird surveys and habitat monitoring.

RESEARCH PRIORITIES: Research priorities for most Hawaiian forest birds include improving methods for controlling rats (*Rattus* spp.) and feral cats (*Felis silvestris*) in native forests, determining the ecological requirements of *Culex* mosquitoes at mid- and high-elevation forests, and developing methods to control mosquito populations. Currently, the U.S. Geological Survey's Biological Resources Division is conducting genetic analyses to determine the species' phylogenetic status and examining the relationship between genetic diversity and disease resistance. Additional research priorities include the following:

- Quantify population structure, dispersal patterns, survivorship, nesting phenology and success, especially for Maui and Molokaʻi populations.
- Determine if competition with Japanese white-eyes (*Zosterops japonicus*) occurs, and if so, its effect on Hawaiʻi ʻamakihi populations.
- Conduct translocation experiments using Hawaiʻi ʻamakihi to help reestablish this and other Hawaiian honeycreeper populations.

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Photo: Eric Nishibayashi

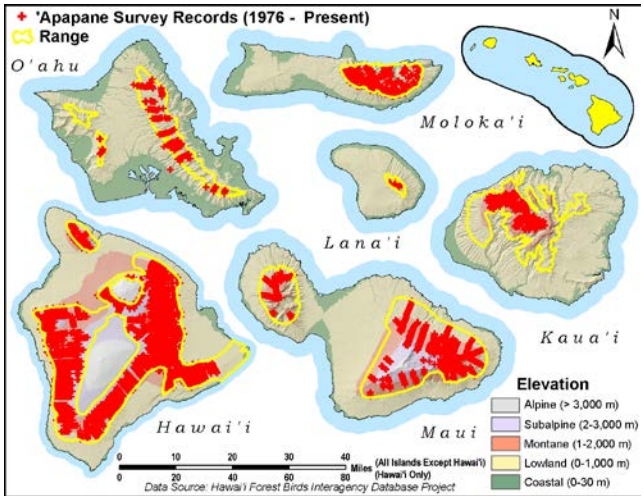
Forest Birds

ʻApapane

Himatione sanguinea

SPECIES STATUS:
State Recognized as Endemic
NatureServe Heritage Rank G3—Vulnerable
IUCN Red List Ranking— Least Concern

SPECIES INFORMATION: The ʻapapane is a small, crimson, primarily nectarivorous Hawaiian honeycreeper (Family: Fringillidae) and is an important ʻōhiʻa (*Metrosideros polymorpha*) pollinator. It is the most abundant and widely distributed Hawaiian honeycreeper, and is often seen flying above the canopy in search of patches of flowering ʻōhiʻa. Wide-ranging movements may facilitate disease transmission among native forest birds. ʻApapane often forage in conspecific flocks, likely to overwhelm ʻiʻiwi (*Vestiaria coccinea*) and ʻākohekohe (*Palmeria dolei*), which often defend flower-rich trees. Outside the breeding season, ʻapapane also join mixed-species flocks. They feed on insects, which they glean from outer foliage and twigs in the upper- and mid-canopy. Sexual chasing and courtship feeding often precede nest building, a task shared by both male and female. Pairs defend small territories around nests. Females incubate three eggs and brood young; males feed females away from the nest. Both parents feed nestlings, and fledglings may remain with their parents for up to four months.



DISTRIBUTION: Occurs in native forests above 1,250 meters (4,100 feet) on the islands of Hawaiʻi, Maui, and Kauaʻi. On Oʻahu, occurs in the Koʻolau Range from 300 meters (975 feet) to summit at 946 meters (3,075 feet), and are less common in the Waiʻanae Range above 600 meters (1,950 feet). Rare on Molokaʻi and Lānaʻi. Historically were common at low elevations on all islands with appropriate habitat.

ABUNDANCE: Based on Hawaiian Forest Bird Surveys (1976-1981): 1,080,000 ± 25,000 (95% confidence interval) birds on island of Hawaiʻi, 110,000 ± 9,000 on Maui (86% on Haleakalā), 39,000 ± 5,000 on Molokaʻi, 540 ± 213 on Lānaʻi, and 30,000 ± 1,500 on Kauaʻi (Oʻahu was not included in surveys). On Kauaʻi, populations declined after the 1992 hurricane but have significantly increased since, estimated at 64,972 ± 2,014 (SE) birds in 2000. Rare on Molokaʻi and Lānaʻi.

LOCATION AND CONDITION OF KEY HABITAT: Mesic and wet forests dominated by ʻōhiʻa and koa (*Acacia koa*), primarily at elevations greater than 1,250 meters (4,100 feet). The

primary reason for this limitation is the high density of cold-intolerant *Culex* mosquitoes, an important disease vector, below this elevation. Occupied habitats also contain kōlea (*Myrsine lessertiana*), naio (*Myoporum sandwicense*), and hapu'u tree ferns (*Cibotium* spp.). Māmane (*Sophora chrysophylla*) is common in high-elevation foraging habitat. Although much of the species' current range is under State or Federal jurisdiction, habitat protection and restoration efforts vary considerably.

THREATS: Although populations appear stable on the islands of Hawai'i, Maui, and Kaua'i, they are likely susceptible to the same factors that threaten other native Hawaiian forest birds including habitat loss and degradation, predation by introduced mammals, and disease. For 'apapane the following is of particular concern:

- Disease. Of Hawaii's native forest birds, 'apapane have the highest prevalence of avian malaria. Individuals infected with avian pox also are more likely to be infected with malaria. Foraging movements may increase their exposure to disease. 'Apapane breed in mid-elevation forests, which suggests some disease resistance.

CONSERVATION ACTIONS: 'Apapane likely benefited from actions to conserve other endangered forest birds on northeastern Haleakalā, Hakalau Forest National Wildlife Refuge, Hawai'i Volcanoes National Park, the 'Ōla'a/Kīlauea Watershed Partnership, and Alaka'i Wilderness Preserve and surrounding areas. These efforts include fencing, ungulate and small mammal control, forest restoration, habitat monitoring, and studies of disease and disease vectors. Future actions specific to the protection of 'apapane may include the following:

- Control mosquitos in degraded habitats.
- Conduct public education and outreach.
- Continue protection and management of wildlife sanctuaries and refuges.

MONITORING: Continue forest bird surveys and habitat monitoring on all islands.

RESEARCH PRIORITIES: Research priorities for most Hawaiian forest birds include improving methods for controlling rats and feral cats in native forests, determining ecological requirements of *Culex* mosquitoes at mid- and high-elevation forests, and developing methods to control mosquito populations. Research priorities specific to 'apapane include the following:

- Determine if disease-resistant individuals exist and if so, if resistance is passed to offspring. Disease-resistant birds could be used to found of new populations.
- Determine the role of 'apapane in disease transmission between high- and low-elevation habitats.
- Conduct life history studies to quantify the population structure, dispersal patterns, survivorship, nesting phenology, and success of this poorly known species.

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Photo: Jack Jeffery

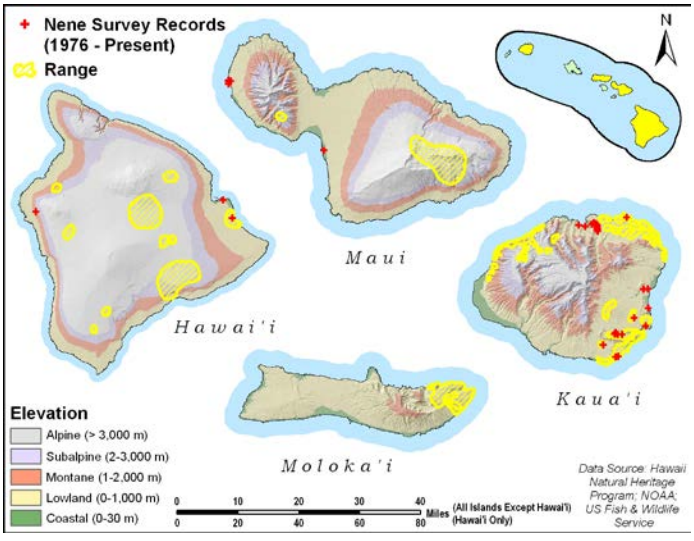
Waterbirds

Nēnē
or Hawaiian goose

Branta sandvicensis

SPECIES STATUS:
Federally Listed as Endangered
State Listed as Endangered
State Recognized as Endemic
NatureServe Heritage Rank G1 - Critically Imperiled
IUCN Red List Ranking - Vulnerable
Revised Recovery Plan for the Nēnē or Hawaiian Goose (*Branta sandvicensis*) – USFWS 2004

SPECIES INFORMATION: Historically, at least five species of geese (family: Anatidae) occurred in Hawai'i; today, only the nēnē, or Hawaiian goose, survives. Adults are mostly dark brown or sepia with a black face and crown, cream-colored cheeks, and a buff neck with black streaks. Females are smaller than males. Compared to other geese, nēnē are more terrestrial and have longer legs and less webbing between their toes, which likely facilitates walking on lava flows. Nēnē graze and browse on the leaves, seeds, flowers, and fruits of at least 50 native and nonnative grasses, sedges, composites, and shrubs. Diet varies by location and habitat, and they may require a diverse suite of food plants. Currently, several species of nonnative grass are important in mid- and high-elevation habitats. Nēnē facilitate seed dispersal and play an important role in influencing the species composition of early successional plant communities. Historically, flocks moved between high-elevation feeding habitats and lowland nesting areas. Pairs mate for life and engage in relatively simple courtship displays in which the male attacks or threatens potential competitors, runs back to his mate, and calls loudly. Nēnē have an extended breeding season, and nesting may occur in all months except May, June, and July, although the majority of birds nest between October and March, and most clutches are laid between October and December. Nests consist of a shallow scrape lined with plant material and down. Breeding pairs usually return to the previous year's nest site, typically in dense vegetation; when available, kīpuka may be preferred. Females lay two to five eggs, which hatch after 30 days. Young are precocial and not fed by their parents; however, they remain with their parents for up to a year.



DISTRIBUTION: Between sea level and 2,400 meters (7,800 feet) elevation on the island of Hawai'i, Maui, Kaua'i, and Moloka'i, and a single pair was reported on O'ahu in 2014. Historically, the

species was found on all Main Hawaiian Islands and was likely widespread.

ABUNDANCE: In 1951, the wild nēnē population was estimated at 30 individuals and information on historical abundance is limited. The current population is estimated at 2,450–2,550 birds, with 550 on the island of Hawai'i, 400 on Maui, 1,500 on Kaua'i, 80 on Moloka'i, and a single nesting pair reported on O'ahu in 2014. During 2005-2010, about 224 nēnē were removed from near the Kaua'i Airport and released at remote relocation sites on that island to reduce the risk of bird-aircraft strikes. Since 2011, the continued growth of the Kaua'i nēnē population prompted the removal of an additional 600 nēnē from the vicinity of the Kaua'i Airport and which were released into the wild on Hawai'i and Maui.

LOCATION AND CONDITION OF KEY HABITAT: Nēnē historically occurred in lowland dry forest, shrubland, grassland, and montane dry forest, and shrubland. Current habitat preferences are likely biased by the location of release sites of captive-bred birds. They currently use a wide variety of habitats including coastal dune vegetation and nonnative grasslands (e.g., golf courses, pastures, rural areas), sparsely vegetated low- and high-elevation lava flows, mid-elevation native and nonnative shrubland, early successional cinderfall, cinder deserts, native alpine grasslands and shrublands, and open native and nonnative alpine shrubland-woodland community interfaces. Nesting occurs in a variety of habitats, including beach strand, shrubland, grassland, and lava rock, and at a range of elevations. On the islands of Hawai'i and Maui, most nests are built under native vegetation, such as pūkiawe (*Styphelia tameiameiae*), 'a'ali'i (*Dondonaea viscose*), and 'ōhi'a (*Metrosideros polymorpha*). On Kaua'i, however, most nesting areas are dominated by nonnative species, and nēnē often nest under Christmas berry (*Schinus terebinthifolius*), shrub verbena (*Lantana camara*), and ironwood (*Casuarina* spp.). The condition of habitats occupied by nēnē varies considerably. Many of the areas used by the species are managed for conservation by the State of Hawai'i and the U.S. Fish and Wildlife Service (USFWS).

THREATS: Historical threats included habitat loss and degradation, hunting, and predation by rats (*Rattus* spp.), cats (*Felis silvestris*), dogs (*Canis familiaris*), and the small Indian mongoose (*Herpestes auropunctatus*). Current threats include predation by nonnative mammals; exposure to diseases that can be transmitted by introduced nonnative animals such as feral and domestic cats (e.g. toxoplasmosis); nutritional deficiencies due to paucity of quality habitat, exposure stress at high-elevation habitats; a lack of contiguous lowland habitat; human-caused disturbance and mortality (e.g., road mortality, disturbance by hikers, aircraft strikes, collisions with wind turbines); behavioral problems related to captive propagation; and inbreeding depression.

CONSERVATION ACTIONS: Past and current actions include captive propagation and release of captive-bred individuals into the wild, predator control, habitat enhancement, research and monitoring, private conservation efforts, formation of the Nēnē Recovery Action Group, and public education. Other actions specific to conservation of nēnē should include the following:

- Enhance and protect habitats used by nēnē, including foraging habitat, breeding grounds, and summer flocking areas.
- Increase predator control effort and effectiveness, including use of predator-proof fences. Increase efforts to detect and remove mongooses from Kaua'i.

- Significantly increase efforts to minimize negative human-nēnē interactions through public education and outreach focused on communities or areas where the number of nēnē are known to be increasing; continue to promote avoidance and minimization measures that will reduce the risk of collisions with vehicles , aircraft, and wind turbines.
- Develop a statewide long-range management plan for nēnē that includes all of the distinct populations and anticipates changes resulting from management actions and human interaction.
- Continue the nēnē population reintroduction efforts and establish additional populations only where risks can be minimized and habitat quality can support recovery.

MONITORING: Continue surveys to monitor abundance and distribution and annual productivity.

RESEARCH PRIORITIES:

- Standardize survey and monitoring protocols and develop a platform for data sharing.
- Conduct studies on diet and nutrition, particularly as it relates to forage quality of nonnative versus native vegetation, focusing on the needs of goslings and breeding females.
- Refine predator control and exclusion methods.
- Evaluate movement patterns and habitat use by nēnē.
- Evaluate and refine translocation and release methods that incorporates monitoring subsequent dispersal and movement patterns, survival, and reproduction.
- Investigate population genetics as a management tool to monitor the potential for inbreeding.

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Photo: USFWS

Terrestrial Mammal

ʻŌpeʻapeʻa or Hawaiian hoary bat

Lasiurus cinereus semotus

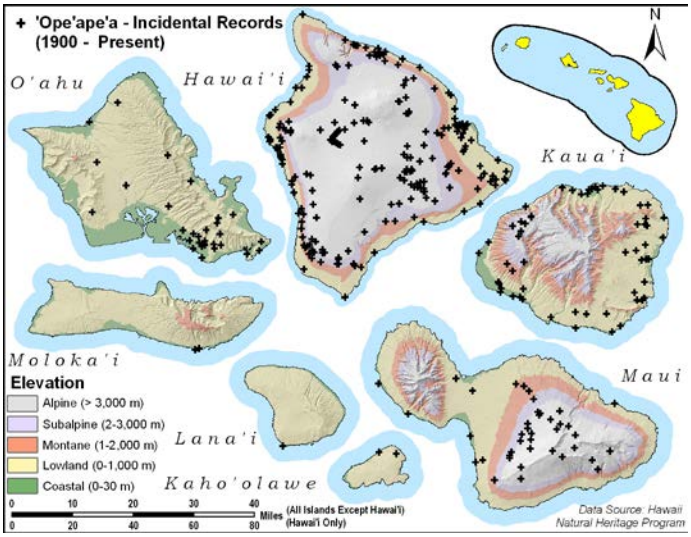
SPECIES STATUS:
Federally Listed as Endangered
State Listed as Endangered
State Recognized as Indigenous (at the Species Level and Endemic at the Subspecies Level)
NatureServe Heritage Rank G5/T2 – Species Secure/Subspecies Imperiled
Recovery Plan for the Hawaiian Hoary Bat – USFWS 1998

SPECIES INFORMATION: The ʻōpeʻapeʻa, or Hawaiian hoary bat (Family: Vespertilionidae), is Hawaiʻi's only native terrestrial mammal, although sub-fossil evidence indicates that at least one other bat species was native to the islands. Additionally, the hoary bat has dispersed to the Hawaiian Islands from the mainland at least twice, forming two different populations of Hawaiian hoary bats (Russell et al. 2015). The first emigrant arrived approximately ten thousand years ago, and the more recent emigrant arrived an estimated 600 years ago (Russell et al. 2015). Both sexes have a coat of brown and gray fur. Individual hairs of the coat are tipped or frosted with white; hence the name "hoary" which means frosted. The older population of hoary bats on the Hawaiian Islands is typically chestnut brown in color with less white "frosting" of the fur tips—it has largely lost the "frosted" appearance. The more recent population comprises individuals that are more hoary ("frosted"), similar to mainland hoary bats. Males and females have a wingspan of approximately one-third of a meter (1 foot), and females are typically larger than males. The Hawaiian name refers to a half taro leaf or canoe sail shape; these being somewhat similar to the shape of the bat.

Little research has been done on the ʻōpeʻapeʻa, and little is known about its habitat requirements or population status. Fewer than 30 accounts of roosting are known statewide, but these indicate that ʻōpeʻapeʻa roost in native and non-native vegetation from 1 to 9 meters (3 – 29 feet) above ground level; the species is rarely observed using lava tubes, cracks in rocks, or human-made structures for roosting. While roosting during the day, ʻōpeʻapeʻa are solitary, although mothers and pups roost together. They begin foraging either just before or after sunset depending on the time of year; altitude also may affect activity patterns. ʻŌpeʻapeʻa feed on a variety of native and non-native night-flying insects, including moths, beetles, crickets, mosquitoes, and termites; and similar to other insectivorous bats, prey is located using echolocation. Water courses and edges (e.g., coastlines and forest/pasture boundaries) appear to be important foraging areas; the species also is attracted to insects that congregate near lights. Breeding bats (e.g., lactating females) have been documented only on the islands of Hawaiʻi, Kauaʻi, and Oʻahu (Dave Johnston pers. obs.). Mating most likely occurs between September and December, and females usually give birth to twins during June. Mother bats likely stay

with their pups until they are six to seven weeks old. Little is known regarding dispersal or movements, but inter-island dispersal is possible.

DISTRIBUTION: The hoary bat is the most widely distributed bat in North America. In Hawai'i, 'ōpe'ape'a have been reported from all the Main Hawaiian Islands except for Ni'ihau, although specimen records exist only for Kaua'i, O'ahu, Maui, Moloka'i, and the island of Hawai'i. 'Ōpe'ape'a occur in a wide range of habitats across a wide elevation gradient. On the island of Hawai'i, bats are found primarily from sea level to 2,288 meters (7,500 feet) elevation, although they have been observed near the island's summits (above 3,963 meters or 13,000 feet). See "Location and Condition of Key Habitat," below, for distribution by seasons.



ABUNDANCE: Mostly unknown, although Pinzari et al. 2014 suggested that the population on the island of Hawai'i has been stable or is slightly increasing based on occupancy models from acoustic monitoring. Survey methods to count or estimate populations of solitary roosting bats have not been established. Although based on incomplete data, Kaua'i and the island of Hawai'i may support the largest populations.

LOCATION AND CONDITION OF KEY HABITAT: 'Ōpe'ape'a have been found roosting in 'ōhi'a (*Metrosideros polymorpha*), pu hala (*Pandanus tectorius*), coconut palms (*Cocos nucifera*), kukui (*Aleurites moluccana*), kiawe (*Proscopis pallida*), avocado (*Persea americana*), shower trees (*Cassie javanica*), pūkiawe (*Styphelia tameiameiae*), fern clumps, eucalyptus (*Eucalyptus* spp.), cook pine (*Araucaria columnaris*), and Norfolk Island pine (*Araucaria heterophylla*) stands. Recent work on the island of Hawai'i found that bat activity varied with season and altitude, and the greatest level of activity occurred at low elevations (below 1,280 meters or 4,200 feet) from April to December (Bonaccorso et al. 2015). Because warm temperatures are strongly associated with reproductive success in this and other bat species, it has been suggested that key breeding habitat is likely to occur at sites where the average July minimum temperature is above 11°C (52°F). If true, key breeding habitat on the island of Hawai'i would occur below 1,280 meters (4,200 feet) elevation (Bonaccorso et al. 2015). Because bats use both native and non-native habitat for foraging and roosting, the importance of non-native timber stands, particularly those at low elevations, should be determined. Breeding sites are known for Mānuka Natural Area Reserve and scattered areas along the Hāmākua Coast.

THREATS: Bats are affected by habitat loss, pesticides, collisions with structures, and roost disturbance. A reduction in tree cover (e.g., roost sites) might be the primary reason for the species' decline in Hawai'i. Pesticides also may have reduced populations. Bats are known to interact and sometimes collide with wind turbines. Lastly, bats of many species are affected by predation, so this may also be a problem for 'ōpe'ape'a.

CONSERVATION ACTIONS: The goals of conservation actions are to not only protect current populations and key breeding habitats, but also to establish additional populations thereby reducing the risk of extinction (U.S. Fish and Wildlife Service 1998). In addition to common statewide and island conservation actions, specific management directed toward ʻōpeʻapeʻa should include the following:

- Conserve known occupied habitat.
- Develop and implement conservation plans and strategies that guide the management and use of forests to reduce negative effects on known bat populations.
- Support Hawaiian hoary bat research.

MONITORING: Continue surveys of population and distribution in known and likely habitats and identify key limiting factors affecting the recovery of the species.

RESEARCH PRIORITIES: Given that little is known about ʻōpeʻapeʻa any research would contribute to the understanding of and ability to conserve this species. Research priorities for the ʻōpeʻapeʻa include the following:

- Develop standard survey and monitoring methods and procedures that will allow the accurate estimation of populations and changes in activity and/or occupancy.
- Conduct occupancy surveys of all the Main Hawaiian Islands to examine distribution and population trends.
- Identify key breeding and wintering sites.
- Better describe roost site characteristics and preferences.
- Increase efforts to track and monitor movements and behaviors.
- Determine the extent to which Hawaiian hoary bats use torpor.
- Better describe threats and important factors limiting recovery such as whether depredation by introduced animals or availability of prey represent constraints for populations.
- Continue to support the development of avoidance and minimization measures that can be effectively implemented to reduce collisions with wind turbines.
- Direct research findings toward the development of conservation and management actions that address the needs and deficiencies of the species and refine these approaches using an adaptive management approach.

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Photo: NRCS

Pueo or Hawaiian Short-eared Owl

Asio flammeus sandwichensis

SPECIES STATUS:
State listed as Endangered on O'ahu
State recognized as Endemic at the subspecies level
NatureServe Heritage Rank G5/T2 –
Species secure/Subspecies imperiled

SPECIES INFORMATION: The pueo, or Hawaiian short-eared owl, is an endemic subspecies of the nearly pandemic short-eared owl (*Asio flammeus*; Family: Strigidae). The species is thought to have colonized the Hawaiian Islands sometime after the arrival of Polynesians. Unlike most owls, pueo are active during the day (i.e., diurnal), and are commonly seen hovering or soaring over open areas. Like short-eared owls in continental environments, those in Hawai'i primarily consume small mammals. Their relatively recent establishment on Hawai'i may have been tied to the rats (*Rattus exulans*) that Polynesians brought to the islands. Little is known about the breeding biology of pueo, but nests have been found throughout the year. Males perform aerial displays known as a sky dancing display to prospective females. Nests are constructed by females and are comprised of simple scrapes in the ground lined with grasses and feather down. Females also perform all incubating and brooding. Males feed females and defend nests. Chicks hatch asynchronously and are fed by female with food delivered by male. Young may fledge from nest on foot before they are able to fly and depend on their parents for approximately two months.

DISTRIBUTION: Found on all the Main Hawaiian Islands from sea level to 2,450 meters (8,000 feet).

ABUNDANCE: Unknown. Because of relatively few detections, the Hawaiian Forest Bird Survey did not estimate the population size of the pueo. Pueo were widespread at the end of the 19th century, but are thought to be declining.

LOCATION AND CONDITION OF KEY HABITAT: Pueo occupy a variety of habitats, including wet and dry forests, but are most common in open habitats such as grasslands, shrublands, and montane parklands, including urban areas and those actively managed for conservation. Because of a lack of historical population data and the species' current, broad habitat use, key habitat variables are difficult to determine. Pueo occur in many areas that are managed by the Sate of Hawai'i or Federal agencies.

THREATS: Pueo are likely susceptible to the same factors that threaten other native Hawaiian birds, including: loss and degradation of habitat, predation by introduced mammals, and disease. However, their persistence in lowland, non-native and rangeland habitats suggests

that they may be less vulnerable to extinction than other native birds, especially because they may be resistant to avian malaria (*Plasmodium relictum*) and avian pox (*Poxvirus avium*). Despite this, for pueo populations, the following are of particular concern:

- "Sick owl syndrome". Mortality on Kaua'i has been attributed to this syndrome, which may be related to pesticide poisoning or food shortages.
- Predation. Because pueo nest on the ground, their eggs and young are vulnerable to predation by rats (*Rattus* spp.), cats (*Felis silvestris*), and the small Indian mongoose (*Herpestes auropunctatus*).
- Habitat loss. May be particularly important to O'ahu pueo populations.
- Contaminants or toxins. Because pueo are top predators, fat-soluble contaminants may accumulate in prey species; may be related to "sick owl syndrome" (see above).
- Human interaction. Hunting behavior and habitat use predispose pueo to vehicular collisions, which have been documented on Lāna'i and the island of Hawai'i.

CONSERVATION ACTIONS: Pueo likely have benefited from management activities designed to conserve other endangered birds. They also may benefit from game bird management; high densities of pueo occur on lands where game birds also are common. In addition to these efforts, future management specific to the pueo may include the following:

- Determine population trends, especially on islands where "sick owl syndrome" has been documented.
- Public outreach and education.
- Continue protection and management of wildlife sanctuaries and refuges.

MONITORING: Regular island-wide population surveys are necessary to determine population trends for this species. This information is needed to assess the efficacy of habitat management efforts.

RESEARCH PRIORITIES: Research priorities specific to pueo include the following:

- Analysis of population trends and changes in habitat occupancy, especially on O'ahu.
- Determine the cause of "sick owl syndrome" and its potential effect on populations.
- Quantify the number of vehicular collisions and determine the level of threat to populations.

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Photo: C. S. N. Bailey, NPS

Seabirds

ʻUaʻu or Hawaiian petrel

Pterodroma sandwichensis

SPECIES STATUS:
Federally Listed as Endangered
State Listed as Endangered
State Recognized as Indigenous
NatureServe Heritage Rank G2/T2 –
Species Globally Imperiled/Subspecies Locally Imperiled
IUCN Red List Ranking – Vulnerable
Regional Seabird Conservation Plan – USFWS 2005

SPECIES INFORMATION: The ʻuaʻu or Hawaiian petrel is a medium-sized, nocturnal gadfly petrel (Family: Procellariidae) endemic to Hawaiʻi. The name is derived from a commonly uttered call, heard at colonies. Adults are uniformly dark grayish black above forming a partial collar which contrasts with white throat, forehead, and cheeks; entirely white below except for black tail and leading and trailing edges of underwings. Owing to darkness of back color, the ʻW-patternʻ across back and upper surface of wings is not visible except in worm plumage. Bill black, and legs and feet mostly pink. Even during the breeding season, ʻuaʻu often feed thousands of kilometers from their breeding colonies, usually foraging within mixed-species feeding flocks over schools of predatory fishes. They feed by seizing prey while sitting on the water or by dipping prey while flapping just above the ocean surface. In Hawaiʻi, they feed primarily on squid, but also on fish, especially goatfish and lantern fish, and crustaceans. ʻUaʻu nest in colonies, form long-term pair bonds, and return to the same nest site year after year. Colonies are now typically in high-elevation, xeric habitats or wet, dense forests, although before the arrival of the Polynesians and their associated animals these birds nested in the lowlands, too. They nest in burrows, crevices, or cracks in lava tubes; nest chambers can be from 1 to 9 meters (3-30 feet) deep. Most eggs are laid in May and June and most birds fledge by December, although there are significant inter-island differences in breeding phenology; for example, the nesters that are earliest by more than a month reside at the summit of Haleakala Volcano. Both parents incubate the single egg, and brood and feed the chick. Birds first breed at five to six years of age.

DISTRIBUTION: Nests among the Main Hawaiian Islands (MHI) including Maui, Hawaiʻi, Kauaʻi, Lānaʻi, and possibly on Molokaʻi. Subfossil evidence indicates that prior to the arrival of Polynesians, ʻuaʻu was common throughout the MHI. At sea, they occur throughout the central tropical and subtropical Pacific Ocean.

ABUNDANCE: In the early 1990s the population was estimated at 19,000 individuals with a breeding population of 4,500 to 5,000 pairs, although inaccessible nesting locations make accurate counts difficult. Analysis of at-sea counts indicate broad consistency with the island-based estimates. More recently (1998-2011) the global population was estimated at 52,000 birds,

although due to differences in sampling methods it is unknown whether these higher numbers reflect a population increase or a difference in the proportion of the total population sampled. More than 1,800 individuals occur at Haleakalā National Park on Maui (a few hundred more nest in West Maui), around 150 pairs occur on Mauna Kea, Hawai'i; around 1,600 pairs occur on Kaua'i; several thousand birds occur on Lāna'i; and potentially around 50 pairs nest on Moloka'i.

LOCATION AND CONDITION OF KEY HABITAT: Nests in a variety of remote, inland habitats. On the islands of Hawai'i and Maui, colonies are located above 2,500 meters (8,200 feet) in xeric habitats with very sparse vegetation, with most nests in existing crevices in the lava. On Kaua'i and Lāna'i, and West Maui colonies occur in lower-elevation forests dominated by 'ōhi'a (*Metrosideros polymorpha*) often with a dense understory of uluhe fern (*Dicranopteris linearis*). At sea, they are pelagic and occur over the open ocean.

THREATS:

- Historical hunting. Nestlings were considered a delicacy by Polynesians, and were harvested from nest burrows, including artificial ones constructed by the Polynesians. Adults were netted as they returned to colonies, and smoky fires were sometimes lit along flight corridors to disorient and ground birds.
- Introduced predators. Adults and chicks are susceptible to depredation by dogs, pigs, rats, barn owls, feral cats, and the small Indian mongoose. The presence of these destructive introduced animals, the main force behind population decline, has relegated the species now to nest only in remote interior areas, at very high altitude, or on islands that are predator-free.
- Feral ungulates. Feral goats (*Capra hircus*), mouflon sheep (*Ovis musimon*), and potentially axis deer (*Axis axis*) trample burrows and degrade nesting habitat.
- Artificial lighting. Street and resort lights, especially in coastal areas, disorient fledglings, causing them to eventually fall to the ground exhausted or increasing their chance of colliding with artificial structures (i.e., fallout) such as powerlines. Once on the ground, fledglings are killed by cars, cats, and dogs, or die of starvation or dehydration.
- Collisions. Adults and fledglings are susceptible to mortality from collisions with obstacles such as communication towers, utility lines, fences, and wind farm structures while commuting between inland nest sites and the ocean at night.
- Colony locations. The remoteness of colonies, as well as the habitat in which they occur (e.g., steep terrain or dense forest), complicates predator and ungulate eradication or control.

CONSERVATION ACTIONS: Past actions directed at 'a'o (Newell's shearwater [*Puffinus auricularis*]) have often benefited 'ua'u populations. These actions include the rescue and rehabilitation of downed fledglings by the Save Our Shearwaters (SOS) program and efforts to shade and curtail resort and event lighting and streetlights. Current and future conservation efforts on Kaua'i to benefit should include efforts to reduce and shield lighting, control predators and invasive species at breeding colonies, conduct surveys to locate and characterize additional colonies, evaluate updated population estimates, and implement management actions appropriately. Actions being carried out in association with several Habitat Conservation Plans, along with State and federal recovery efforts are resulting in conservation benefits to 'ua'u on Maui, Lāna'i and Kaua'i; these include efforts to protect existing breeding populations and establish new colonies using predator-proof fencing, predator control,

ungulate control, social attraction, and translocation work plans. In addition to these efforts, future management actions specific to ʻuaʻu populations should include the following:

- Continue predator and ungulate control at colonies on Hawaiʻi, Maui, Lānaʻi, and Kauaʻi, and potentially at offshore islets that contain suitable nesting habitat.
- Locate additional breeding colonies on Lānaʻi, Hawaiʻi, Maui, and Kauaʻi and perform surveys on Molokaʻi, Lānaʻi, and Kahoʻolawe to assess ʻuaʻu presence on these islands.
- Continue to identify fallout areas and minimize effects of powerlines and artificial lights.
- Continue to support the SOS program, particularly public outreach about light attraction and fallout, the rescue and rehabilitation program, and the establishment of similar programs on other islands where appropriate.
- Re-establish/expand breeding colonies by identifying suitable candidate locations for social attraction and/or translocation, and continue to refine translocation protocols.

MONITORING: Continue at-sea and terrestrial surveys in known and likely habitats to evaluate the population size and status, and to locate unidentified breeding colonies. Monitor breeding incidence, breeding density, reproductive success, causes of mortality, population trends, return rates and effectiveness of management at breeding colonies. Assess the efficacy of predator control efforts.

RESEARCH PRIORITIES:

- Develop and implement standardized survey and monitoring protocols that can be used throughout Hawaiʻi to better estimate population parameters and changes.
- Expand and refine radar studies to monitor population trends, locate colonies, investigate behavior, determine geographic variability in threats, and evaluate the effectiveness of conservation measures.
- Conduct long-term demographic studies to evaluate reproductive success, breeding incidence, breeding density, colony boundaries, population trends, and survival rates.
- Develop, refine, and monitor the outcome of conservation actions and measures that are employed to avoid and minimize impacts from flight collision and other causes, and broaden adaptive management approaches.

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APPENDIX F. ARCHAEOLOGICAL INVENTORY SURVEY

An Archaeological Inventory Survey in Support of the Kamehamenui Forest Reserve Management Plan

TMK: (2) 2-3-005:002

Kamehamenui and Kealahou 3 & 4 Ahupua‘a
Kula District
Island of Maui

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Island of Maui

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EXECUTIVE SUMMARY

At the request of H.T. Harvey and Associates, on behalf of the Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW), ASM Affiliates conducted an Archaeological Inventory Survey of approximately 320 acres and a Reconnaissance Survey of 25 miles of linear trail routes (referred to hereafter as the 'project area') within the 3,3433.72-acre Kamehamenui Forest Reserve identified as Tax Map Key (2) 2-3-005:002 (referred to hereafter as the 'subject parcel') located in Kamehamenui and Kealahou 3rd and 4th *ahupua'a*, Kula District, Island of Maui. DOFAW is preparing a management plan for the entirety of the subject parcel. The management plan includes the future construction of an archery range, three parking areas, and 25 miles of new trail routes within KFR to provide recreational and conservation opportunities. The proposed archery range and parking lots would be constructed within the 320-acre portion of the project area located in the makai (western) half of KFR and henceforth called Survey Area 1. The 25 miles of proposed new trails would be constructed in the mauka (eastern) half of KFR, referred to as Survey Area 2. These new trails would connect with existing trails in the Kula Forest Reserve, which borders the subject parcel along its southeast boundary.

T ASM prepared this study to identify, determine the significance of, and provide treatment recommendations for any historic properties that may exist within the project area, and to assist DOFAW with their planning for the future public use of the KFR. The current study will accompany a Management Plan being prepared the DOFAW Maui Branch to fulfill recommendations made by the Hawai'i Tropical Forest Recovery Action Plan, which resulted from the 1992 Federal Hawai'i Tropical Forest Recovery Act. This report prepared in accordance with Hawai'i Administrative Rules (HAR) §13-275 (Rules Governing Procedures for Historic Preservation Review to Comment on Section 6E-8, HRS, Projects) as well as HAR §13-276 (Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports).Compliance with the above standards is sufficient for meeting the historic preservation review process requirements of both the Department of Land and Natural Resources–State Historic Preservation Division (DLNR-SHPD) and the County of Maui with regards to the proposed project.

As a result of the AIS fieldwork, one newly identified site was documented in Survey Area 1. This site, Site 50-50-11-T-1, consists of 82 features associated with Erewhon Cattle Ranch that are spread throughout the 320-acre Survey Area 1. Archival research indicates that the Erehwon Ranch utilized the area for cattle ranching and agriculture from the mid-19th century through 1990. These activities likely disturbed any evidence of Precontact and early Historic agriculture or habitation; however, Historic Period ranching infrastructure, including features related to water management, livestock control, and potato cultivation remains present. The reconnaissance survey resulted in the identification and documentation of three newly identified features and three previously identified features in Survey Area 2. These include a modified outcrop (Temp. Site T-2), a cairn/rock mound (Temp. Site T-3), and a cairn (Temp. Site T-4). The previously identified features consist of two rock walls (Temp No. SM-03 and SM-04) and a rock pile (Temp No. SM-05).

Site T-1, retains sufficient integrity to be considered significant under Criterion b and d for the association of the site with the von Tempsky family and for information yielded relative to Historic agriculture and ranching in Kula respectively. It is recommended that a preservation plan be prepared for Site T-1. The sites identified in Survey Area 2 (T-2, T-3, T-4, SM-03, SM-04, SM-05) were not evaluated for significance due to the limited scope of the reconnaissance survey portion of the study. However, it is recommended that DOFAW avoid these sites while finalizing the trail routes and camping sites in Survey Area 2. As such, the recommended determination of effect for the portion of the proposed project that is to occur within makai portion of the KFR (within Survey Area 1), pursuant to HAR §13-275, is "Effect, with proposed mitigation commitments." An archaeological preservation plan meeting the standards of HAR §13-277 should be prepared for Site T-1and submitted to DLNR-SHPD for review and acceptance as part of the future implementation of the development activities specified in the management plan.

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1. INTRODUCTION

At the request of H. T. Harvey, and on behalf of the Department of Land and Natural Resources (DLNR), Division of Forestry and Wildlife (DOFAW), ASM Affiliates (ASM) conducted an Archaeological Inventory Survey (AIS) of approximately 320-acres (referred to hereafter as the 'project area') within the 3,433.72-acre Kamehamenui Forest Reserve (KFR). As part of the AIS, ASM also conducted an archaeological reconnaissance survey of 25 miles of linear trail routes within the KFR. The KFR encompasses the entirety of Tax Map Key (TMK): (2) 2-3-005:002 (referred to hereafter as the 'subject parcel') and spans portions of three *ahupua'a*—Kamehamenui and Kealahou 3rd and 4th—in the Kula District on the Island of Maui (Figures 1, 2, and 3). DOFAW is preparing a management plan for the entirety of the subject parcel. The management plan includes the future construction of an archery range, three parking areas, and 25 miles of new trail routes within KFR to provide recreational and conservation opportunities (Figure 4). The proposed archery range and parking lots would be constructed within the 320-acre portion of the project area located in the makai (western) half of KFR and henceforth called Survey Area 1. The 25 miles of proposed new trails would be constructed in the mauka (eastern) half of KFR, referred to as Survey Area 2. These new trails would connect with existing trails in the Kula Forest Reserve, which borders the subject parcel along its southeast boundary.

ASM prepared this study to identify, determine the significance of, and provide treatment recommendations for any historic properties that may exist within the project area, and to assist DOFAW with their planning for the future public use of the KFR. The current study will accompany a management plan being prepared DOFAW to fulfill recommendations made by the Hawai'i Tropical Forest Recovery Action Plan, which resulted from the 1992 Federal Hawai'i Tropical Forest Recovery Act. This report prepared in accordance with Hawai'i Administrative Rules (HAR) §13-275 (Rules Governing Procedures for Historic Preservation Review to Comment on Section 6E-8, HRS, Projects) as well as HAR §13-276 (Rules Governing Minimal Standards for Archaeological Inventory Surveys and Reports). Compliance with the above standards is sufficient for meeting the historic preservation review process requirements of both the Department of Land and Natural Resources–State Historic Preservation Division (DLNR-SHPD) and the County of Maui with regards to the proposed project.

This report presents background information describing the proposed project, the scope of work, the project area's physical and cultural contexts, previous archaeological work conducted in the vicinity of the project area, and the current survey expectations based on that background research. The survey expectations are followed by an explanation of ASM's field methods, a description of the field findings, a presentation of significant assessments and treatment recommendations for the documented historic properties, and a recommended determination of effect for the proposed project.

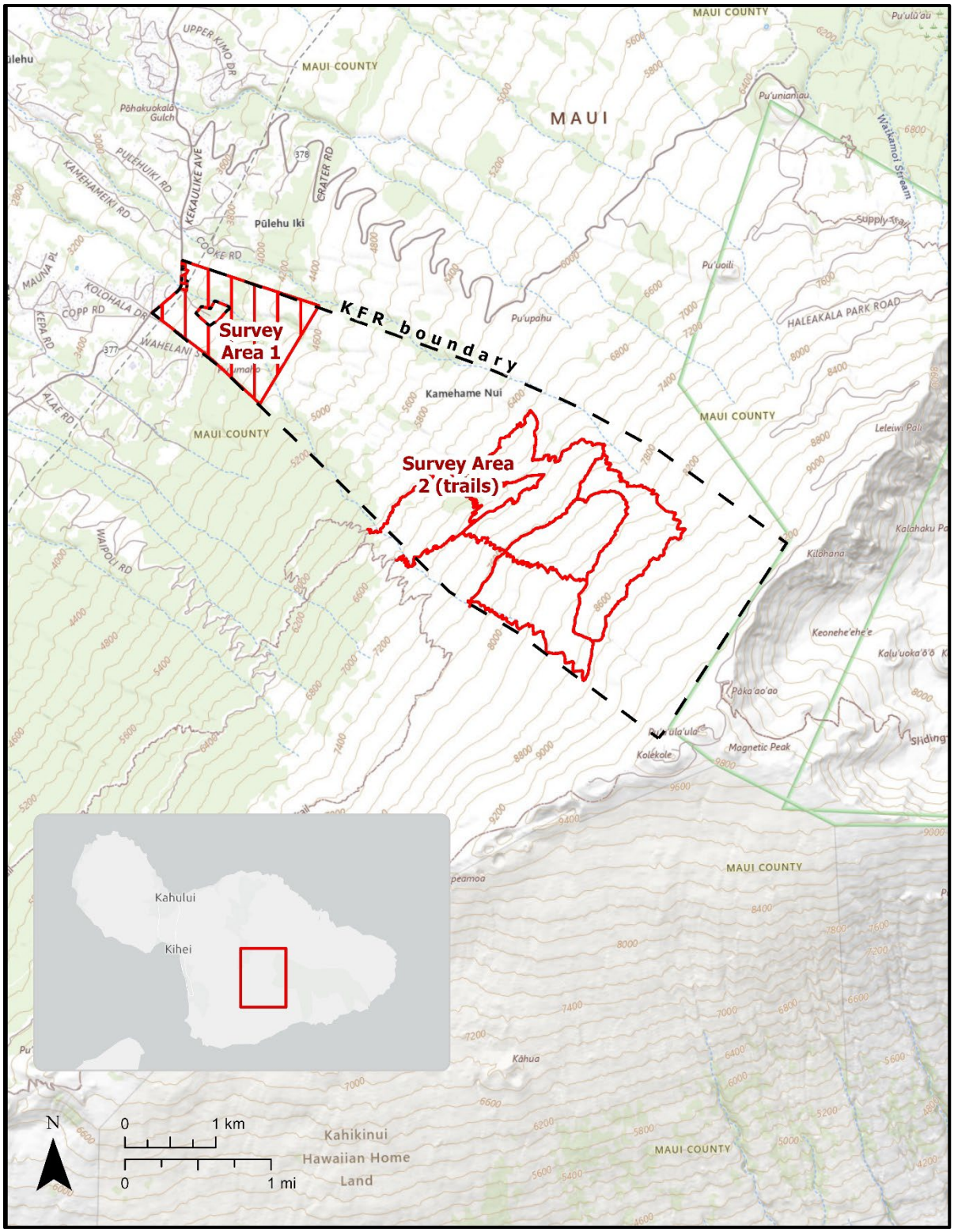


Figure 1. Project area location.

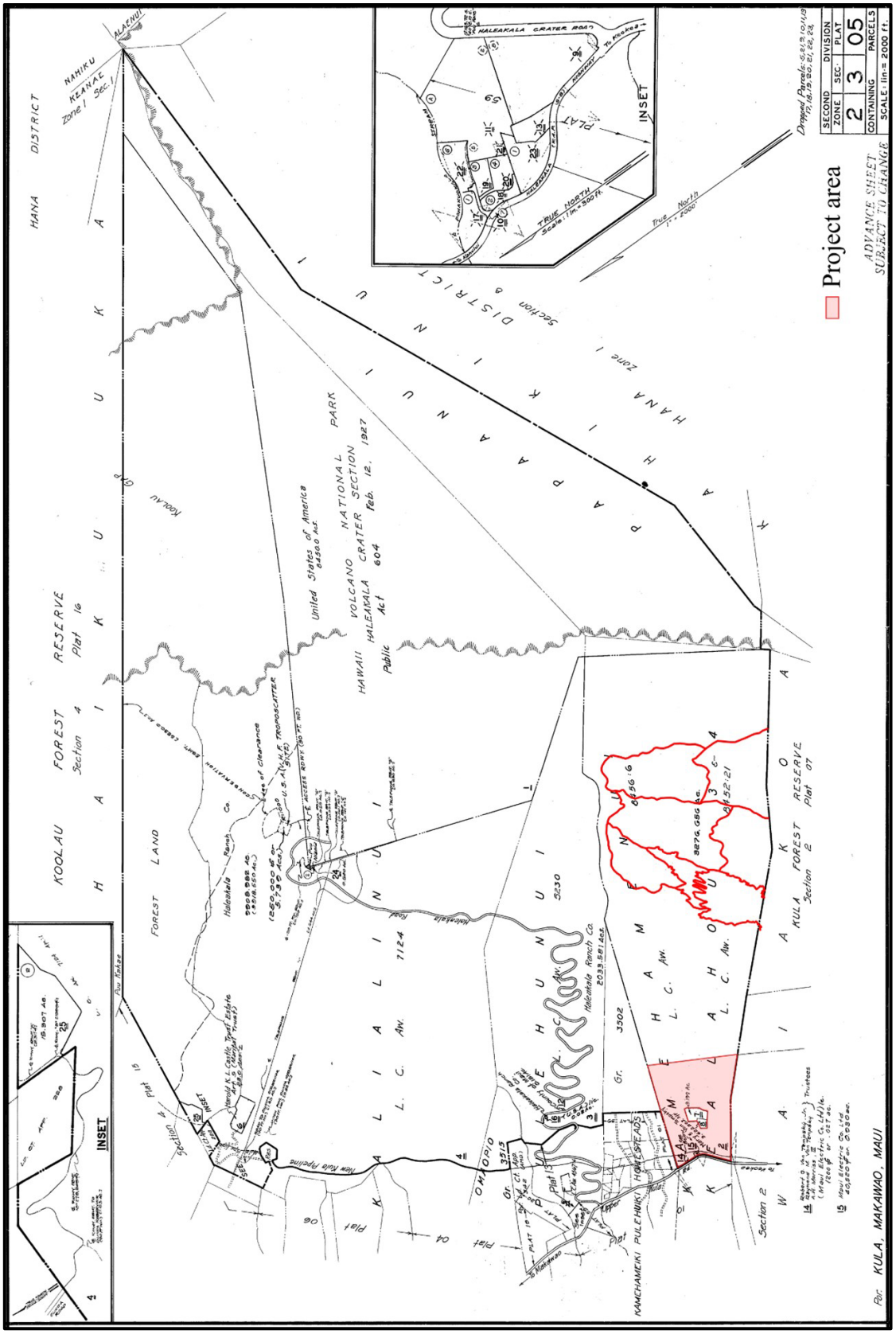


Figure 2. Tax Map (2) 2-3-05 showing project area located within portion of parcel 002.

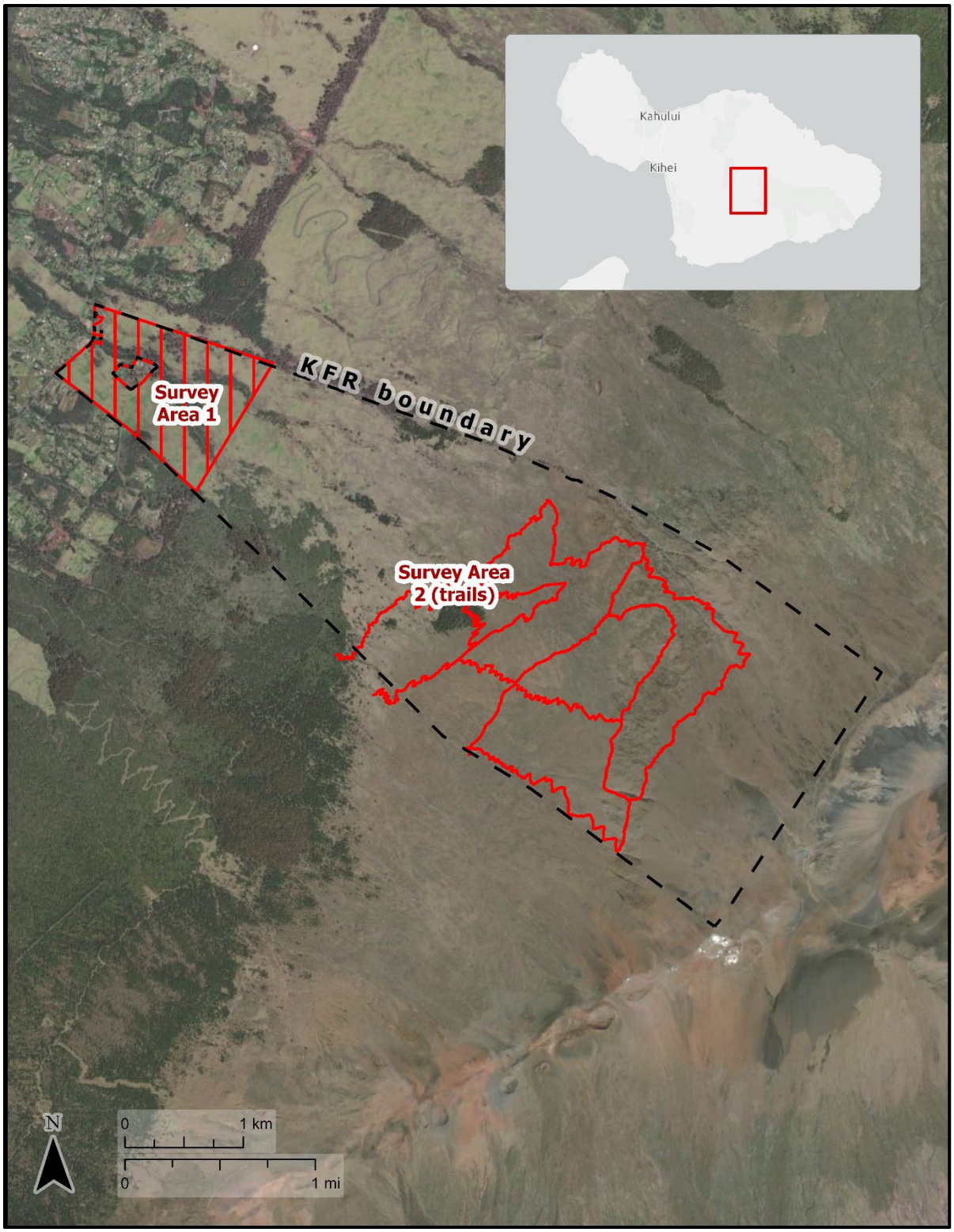


Figure 3. Google Earth™ satellite image showing project area location.

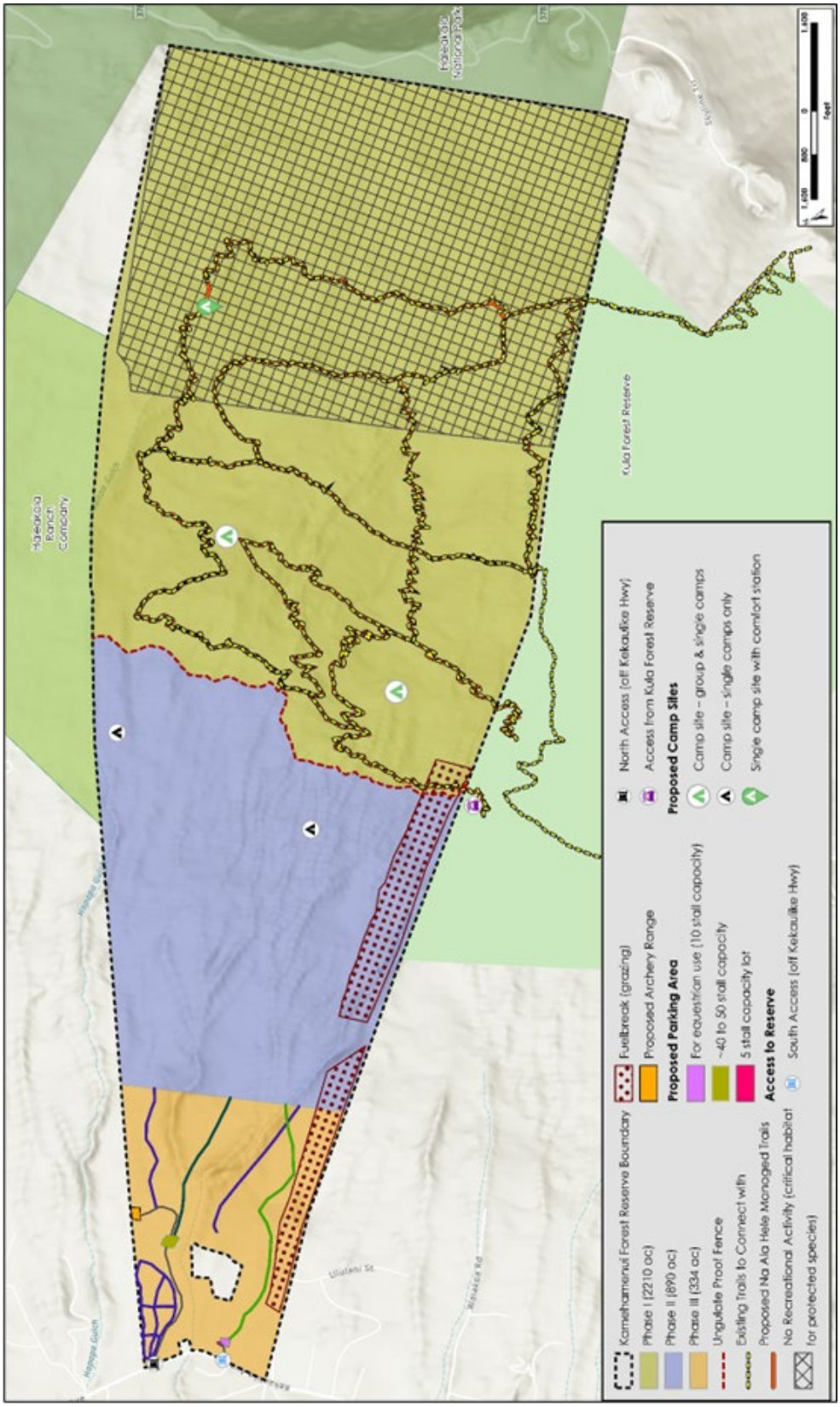


Figure 4. Planned improvements in Kamehamenui Forest Reserve.

PROJECT AREA DESCRIPTION

The project area is located within the boundaries of the Kamehamenui Forest Reserve (KFR), which encompasses the entirety of the subject parcel (TMK parcel (2) 2-3-005:002). The KFR is situated on the western slope of Haleakalā Mountain between 1,097 meters (3,600 feet) and 2,957 m (9,700 ft) elevation, with its eastern boundary running just below the summit. The KFR is mostly surrounded by undeveloped land with the exception of some residential properties along it's west and southwest boundaries: To the north, it is bound by two contiguous privately-owned agricultural parcels, as well as by a conservation/agriculturally-zoned parcel owned by the Haleakalā Ranch Company. To the east, it is bordered by the Haleakalā National Park. To the south, it abuts a portion of the Kula Forest Reserve and a conglomeration of variously zoned agricultural and residential parcels and, to the west, it is bound by Kekaulike Avenue, which provides the main access route into the project area. Adjacent to Kekaulike Avenue, the KFR boundary surrounds TMK (2) 2-3-005:015 (0.93 acres) on three sides; this parcel is occupied by a substation owned by Maui Electric Company, Ltd. Lastly, two privately-owned residential parcels exist within the boundaries of the KFR: TMK: (2) 2-3-005:007 (9.2 acres) and 008 (3.6 acres). The former parcel (:007) includes the historic Tudor-style von Tempsky family home, which was constructed in 1927. These two parcels are excluded from the reserve, as well as the conservation and recreational development proposed with this project.

The KFR is currently accessible via an unpaved ranch road located on the eastern side of Kekaulike Avenue or by foot through existing trails in the adjacent Kula Forest Reserve. The unpaved road enters the project area from Kekaulike Avenue, proceeding upslope before terminating near the center of the reserve. For the most part, the road is visible by deep tire tracks. It crosses over eroding red dirt hills covered in foraging grass, as well as level pastureland. Near the von Tempsky residence, however, it crosses over exposed bedrock in a low-lying area. From this access road, several other roads branch off to give access to opposite ends of the property. Numerous ranch gates are present along these access roads. Since the late 1800s, much of the subject parcel has been used for cattle grazing and various ranching activities associated with Erehwon Ranch, which has effectively transformed this landscape into rolling pastures with a mix of introduced plant species. Through state-issued leases, ranching persisted until recently as the primary land use activity.

The proposed project area includes two discontinuous areas within KFR: Survey Area 1 is in the northwestern part of the KFR, and Survey Area 2 is in the central-eastern part of the KFR (see Figure 1). Survey Area 1 covers approximately 320 acres and is situated between 1,097 and 1,372 meters (3,600 and 4,500 feet) above mean sea level (amsl). It is located approximately 15.7 kilometers (9.75 miles) inland from the coast at Ma‘alaea Bay. The two residential parcels within KFR, TMKs (2) 2-3-005:007 and 008, lay within the boundaries of Survey Area 1; however, they are excluded from the project area. Modern and historic land disturbance is evident throughout this area. The ground surface exhibits signs of having been previously chain-dragged and mechanically altered for grazing purposes. Additionally, networks of paddocks—fenced with wooden posts, t-posts, and barbed wire—delineate modern grazing areas. Fencing also runs along the western, southern, and much of the eastern project area boundaries (eucalyptus trees line the non-fenced sections). There are several cattle troughs throughout, with a few accompanying water catchment systems consisting of galvanized and PVC waterlines that transport water across the pastures to select cattle troughs. Modern rubbish consisting of torn pieces of shade cloth, metal debris, fencing materials, and glass water jugs, are found throughout Survey Area 1.

Survey Area 2 consists of the route of the 25 miles of proposed new trails in the central- east portion of the study parcel. Some of these new trails would connect with existing trails in the Kula Forest Reserve, which borders the subject parcel along its southeast boundary (see Figures 4 and 5). This area is situated between 1,890 to 2,658 meters (6,200 to 8,720 feet) amsl. It lies within the transition zone of the native mesic and dry shrubland, terminating at the lower edge of the sparsely vegetated subalpine shrubland.

Topography

The terrain throughout the KFR varies from gentle, undulating pastureland to deep-cut gulches and steep, rocky slopes.

Survey Area 1 Topography

Survey Area 1 is characterized by an undulating landscape that slopes downward from southeast to northwest (Figure 5). Meandering cattle trails and dugouts are scattered throughout the rolling pastures, which are intermittently dissected by numerous drainage channels of varying depths, predominately Keāhuaiwi Gulch and its associated branches (Figure 6). Despite the presence of not only Keāhuaiwi Gulch—as well as other minor drainages—none were flowing at the time this survey took place. This is unsurprising as perennial freshwater sources are rare in the higher altitude regions of Haleakalā.

Survey Area 2 Topography

Survey Area 2 is characterized by steeper slopes and deep, wide drainages of exposed, heavily-weathered pāhoehoe bedrock (Figure 7 and 8). These drainages gradually transition as they extend downslope (toward Survey Area 1) to be less steep and grass covered. As in Survey Area 1, these drainages do not offer perennial water flow.



Figure 5. Undulating landscape containing pasture lands in Survey Area 1, view to the east.



Figure 6. Keāhuaiwi Gulch in Survey Area 1, view to the northwest.



Figure 7. Steep sloping landscaping in Survey Area 2, view to the southwest.



Figure 8. Exposed pahoehoe within drainage in Survey Area 2, view to the north.

Vegetation

Being that the KFR is actively grazed and utilized as a cattle ranch, vegetation consists primarily of low-lying kikuyu (*Pennisetum clandestinum*) forage grass, interspersed with apple of Sodom (*Solanum linnaeanum*), fireweed (*Senecio madagasceriensis*), and scattered pine (*Pinus* sp.) trees. These grazing lands are interrupted occasionally by moderately sloped, southeast-northwest oriented outcroppings of exposed pāhoehoe bedrock vegetated by occasional pūkiawe (*Styphelia tameiameiae*).

Survey Area 1 Vegetation

Survey Area 1 is dominated by grassland/pastureland consisting primarily of non-native species. Peppered throughout this grassland/pastureland are groves of mesic forest consisting primarily of non-native species (Starr and Starr 2021:4). These mesic forest groves exist primarily along the edges of Keāhuaiwi Gulch and throughout its interior slopes, as well as along and within a pronounced branch gulch that adjoins Keāhuaiwi in the eastern third of Survey Area 1. The tree canopy in the vicinity of Keāhuaiwi Gulch, and its primary branch gulch, consists of relatively dense overstories of mature and juvenile non-native Australian black and silver wattle trees (*Acacia mearnsii* and *Acacia dealbata*, respectively), which have largely shaded out the underbrush except for dense thickets of wild sawtooth blackberry (*Rubus argutus*) and bigpod ceanothus (*Ceanothus megacarpus*) shrubs. This has created a ground surface generally devoid of vegetation in these areas. Finally, the southern and northern boundaries of Survey Area 1 are marked by systematically planted linear configurations of mature eucalyptus (*Eucalyptus* sp.) trees that were likely planted to demarcate the boundaries of the Erehwon Ranch.

Survey Area 2 Vegetation

Various native shrubs are present in Survey Area 2, including shrub kupaoa (*Dubautia Menziesii*), pūkiawe (*Styphelia tameiameiae*), ʻōhelo (*Vaccinium reticulatum*), and kukaenēnē (*Coprosma ernodeoides*), all of which are common in the alpine and subalpine zones of Haleakalā (Starr and Starr 2021:4). Several native tree species are also present, including most commonly ʻaʻaliʻi (*Dodonaea viscosa*), which is usually found in small groves. Additional trees in this zone include māmane (*Sophora chrysophylla*), Haleakalā sandalwood (*Santalum haleakalae*), and hōʻawa (*Pittosporum confertiflorum*). Unfortunately, these native tree species appear to be in poor condition because of the

stress of intense axis deer pressure (Starr and Starr 2021:5). Finally, Survey Area 2 contains several isolated plantings of non-native peach, apple, and fig trees, which appear to be in a state of considerable neglect.

Geology and Soils

The underlying geology within the project area includes Hana Volcanics (Qhn0, Qhn2, Qhn2v, and Qhnt in Figure 9) and Kula Volcanics (Qkul and Qkuls in Figure 9). The Qhn0 type of Hana Volcanics originated from the Haleakalā volcano between 50,000 and 140,000 years ago. They are composed of picrobsalt and come in ʻaʻā and ankaramitic forms. The Qhn2 type of Hana Volcanics (the Basanite of Red Hill) originated from the Halekalā volcano between 13,000 and 30,000 years ago. They are composed of basanite and come in ʻaʻā form. The Qhn2v type of Hana Volcanics (the Basanite of Red Hill) likewise originated from the Haleakalā volcano between 13,000 and 30,000 years ago. They are composed of basanite; however, unlike their Qhn2 counterpart, they come in coarse, near-vent fallout cinder and splatter forms. The Qhnt type of Hana Volcanics (a tephra) originated from the Haleakalā volcano between 0 and 13,000 years ago. They are composed of basanite and come in a well-sorted, distal fallout, poorly to nonindurated ash form. The Qkul type of Kula Volcanics originated from the Haleakalā volcano between 140,000 and 780,000 years ago. They are composed of basanite and minor picrobasalt and come in both pāhoehoe and ʻaʻā forms. The Qkuls type of Kula Volcanics (a summit ankaramite) likewise originated from the Haleakalā volcano but between 194,000 and 230,000 years ago. They are composed of picrobasalt and come in ʻaʻā form (Sherrod et al. 2021; Stearns and MacDonald 1942).

Various soil and rock types are present within the project area (Figure 10, Table 1). The majority of the KFR contains loam soils (KDIE, KxC, KxD, LME, LMF, and LNE); however, there are significant areas of rock (rRO and rRK) and cinder land (rCl and 8) (Soil Survey Staff 2019). Significantly, axis deer (*Axis axis*) present within KFR have greatly contributed to soil erosion, particularly directly flanking Keāhuaiwi Gulch and its interior slopes due to their intensive trampling.

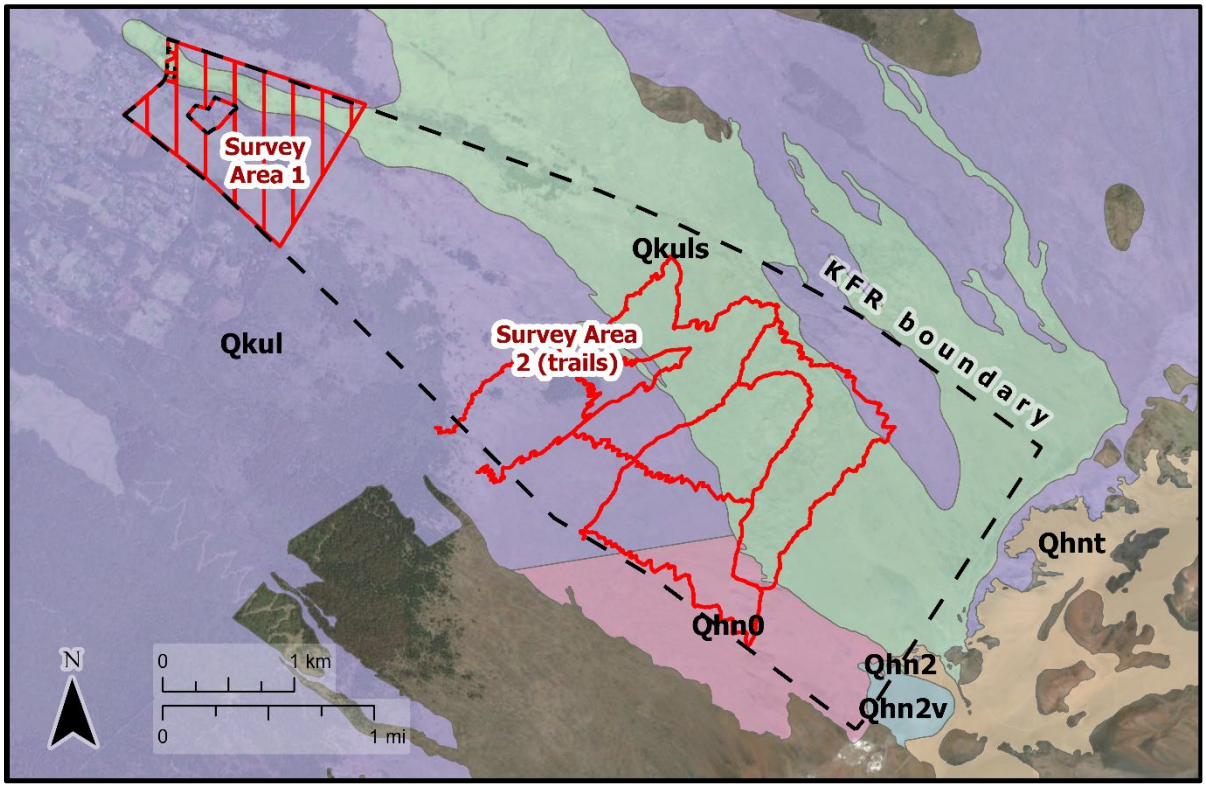


Figure 9. Geological units present in the project area.

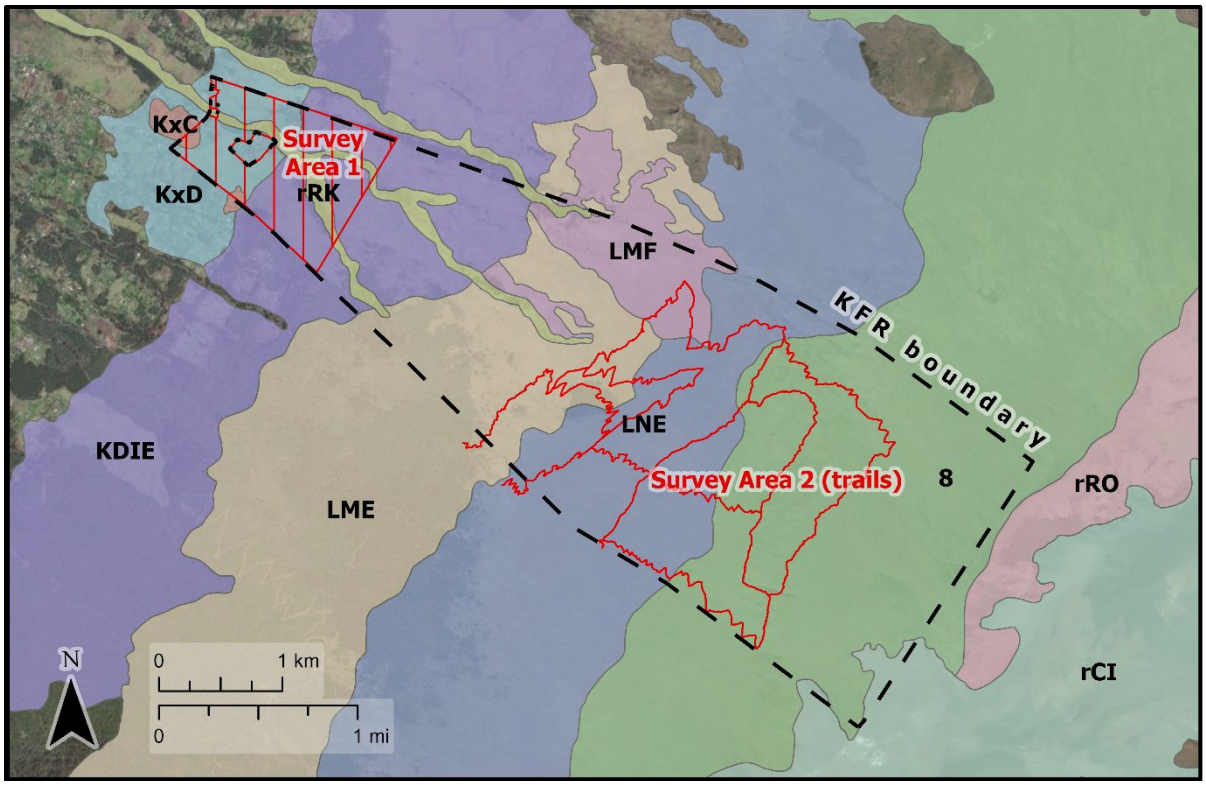


Figure 10. Soils present in the project area.

Table 1. Summary of soils present within KFR.

Location	*Soil Symbol*	*Soil Name*	*Soil Description*
In KFR	rCl	Cinder land	n/a
In KFR	rRO	Rock outcrop	n/a
Area 1	KDIE	Kapoipoi loam	7 to 40 percent slopes
Area 1	KxC	Kula loam	4 to 12 percent slopes
Area 1	KxD	Kula loam	12 to 20 percent slopes
Area 1	rRK	Rock land	n/a
Area 2	8	Lava flows-Cinder land complex	2 to 40 percent slopes, MLRA 161A
Area 2	LME	Laumaia loam	7 to 40 percent slopes
Area 2	LMF	Laumaia loam	40 to 70 percent slopes
Area 2	LNE	Laumaia extremely stony loam	40 to 70 percent slopes

Climate and Hydrology

The climate at this elevation in Kula District is moderately cool, with a mean annual temperature between 52° to 61° Fahrenheit throughout the year (Soil Survey Staff 2022). Average annual rainfall within Survey Area 1 is between 27 and 30 inches (69 and 76 millimeters). Average annual rainfall within Survey Area 2 between 37 and 40 inches (94 and 104 millimeters). The highest rainfall occurs during the autumn month of September, and the least amount of rainfall occurs during the winter month of February (Giambelluca et al. 2013). Trade winds often blow from east to west across this region, except when kona winds are blowing (typically during the summer months), and the wind pattern is reversed. One prominent climatic variable is the presence of an inversion layer, which is the altitudinal zone where warmer air from the coast meets and mixes with cooler air from higher elevations. It is observed as a sort of "ring of clouds" around the mountain. At Haleakalā Mountain, this layer typically exists around 2,134 meters (7,000 feet) amsl. This inversion layer frequently produces warmer temperatures and less rainfall above this altitude, and cooler temperatures and significantly more rainfall below (Carson and Mintmier 2007:8-9; Ziegler 2002:76-79). This inversion layer lies between Survey Area 1 and Survey Area 2. When this cloudy layer is present, cloud cover can be dense, even foggy, and rainfall can be heavy throughout the entire proposed project area.

2. BACKGROUND

To generate a set of expectations regarding the nature of archaeological resources that might be encountered within the current study area, and to establish an environment within which to assess the significance of any such resources, a general culture-historical context for the Kula region that includes specific information regarding the known history of Kamehamenui and Kealahou 3 & 4 *ahupua'a* and the project area is presented. This is followed by a discussion of relevant prior archaeological studies conducted in the vicinity of the study area.

The culture-historical context and summary of previously conducted archaeological and cultural research presented below are based on research conducted by ASM Affiliates at various physical and digital repositories. Primary English language and Hawaiian language resources were found at multiple state agencies, including the State Historic Preservation Division, Hawai'i State Archives, and the Department of Accounting and General Services Land Survey Division. Digital collections provided through the Office of Hawaiian Affairs Papakilo and Kīpuka databases, Waihona 'Āina, the Ulukau Hawaiian Electronic Library, the Hawai'i Genealogical Indexes, and Newspapers.com provided further historical context and information. Lastly, secondary resources stored at ASM Affiliates' Hilo and Kahului offices offer general information regarding the history of land use, politics, and culture change in Hawai'i, enhancing the broad sampling of primary source materials cited throughout this archaeological inventory survey.

CULTURE-HISTORICAL CONTEXT

While the question of when Hawai'i was first settled by Polynesians remains contested, scholars working in the fields of archaeology, folklore, Hawaiian studies, and linguistics have offered several theories. With advances in palynology and radiocarbon dating techniques, Kirch (2011), Athens et al. (2014), and Wilmshurst et al. (2011) have argued that Polynesians arrived in the Hawaiian Islands sometime between A.D. 1000 and A.D. 1200. This initial migration on intricately crafted wa'a kaulua (double-hulled canoes) to Hawai'i from Kahiki, the ancestral homelands of Hawaiian deities and peoples from southern Pacific islands, occurred at least from initial settlement to the 13th century. According to Fornander (1969), Hawaiians brought from their homeland certain Polynesian customs and beliefs: the major gods Kāne, Kū, Lono, and Kanaloa (who have cognates in other Pacific cultures); the kapu system of political and religious governance; and the concepts of pu'uhonua (places of refuge), 'aumakua (ancestral deity), and mana (divine power). Archaeologist Kenneth Emory who worked in the early to mid-20th century reported that the sources of early Hawaiian populations originated from the southern Marquesas Islands (Emory in Tatar 1982). However, Emory's theory is not universally accepted, as Hawaiian scholars in the past and present have argued for a pluralistic outlook on ancestral Hawaiian origins from Kahiki (Case 2015; Fornander 1916-1917; Kamakau 1866; Kikiloi 2010; Nakaa 1893; Poepoe 1906).

Although stories of episodic migrations were widely published in the Hawaiian language by knowledgeable and skilled kū'auhau (individuals trained in the discipline of remembering genealogies and associated ancestral stories), the cultural belief that living organisms were hānau 'ia (born) out of a time of eternal darkness (pō) and chaos (kahuli) were brought and adapted by ancestral Hawaiian populations to reflect their deep connection to their environment. As an example, the Kumulipo, Hawai'i's most famed ko'ihonua (a cosmogonic genealogical chant), establishes a birth-rank genealogical order for all living beings (Beckwith 1951; Liliuokalani 1978). One such genealogical relationship that remains widely accepted in Hawai'i is the belief that kalo (taro) plants (in addition to all other plants, land animals, and sea creatures), are elder siblings to humans (Beckwith 1951). This concept of hierarchical creation enforces the belief that all life forms are intimately connected, evidencing the cultural transformations that occurred in the islands through intensive interaction with their local environment to form a uniquely Hawaiian culture.

In Hawai'i's ancient past, inhabitants were primarily engaged in subsistence-level agriculture and fishing (Handy et al. 1991). Following the initial settlement period, communities clustered in the ko'olau (windward) shores of the Hawaiian Islands where freshwater was abundant. Sheltered bays allowed for nearshore fisheries (enriched by numerous estuaries) and deep-sea fisheries to be easily accessed (McEldowney 1979). Widespread environmental modification of the land also occurred as early Hawaiian mahi'ai (farmers) developed new subsistence strategies, adapting their familiar patterns and traditional tools to work efficiently in their new home (Kirch 1985; Pogue 1978). Areas with the richest natural resources became heavily populated over time, resulting in the population's expansion to the kona (leeward) side of the islands and to more remote areas (Cordy 2000).

Overview of Traditional Hawaiian Land Management Strategies

Adding to an already complex society was the development of traditional land stewardship systems, including the ahupua'a. The ahupua'a was the principal land division that functioned for both taxation purposes and furnished its residents with nearly all subsistence and household necessities. Ahupua'a are land divisions that typically include

multiple ecozones from mauka (upland mountainous regions) to makai (shore and near-shore regions), assuring a diverse subsistence resource base (Hommon 1986). Although the ahupuaʻa land division typically incorporated all of the eco-zones, their size and shape varied greatly (Cannelora 1974). Noted Hawaiian historian and scholar Samuel Kamakau summarized the ecozones that could be found in a given ahupuaʻa:

> Here are some names for [the zones of] the mountains—the *mauna* or *kuahiwi*. A mountain is called a *kuahiwi*, but *mauna* is the overall term for the whole mountain, and there are many names applied to one, according to its delineations (*ʻano*). The part directly in back and in front of the summit proper is called the *kuamauna*, mountaintop; below the *kuamauna* is the *kuahea*, and makai of the *kuahea* is the *kuahiwi* proper. This is where small trees begin to grow; it is the *wao nahele*. Makai of this region the trees are tall, and this is the *wao lipo*. Makai of the *wao lipo* is the *wao ʻeiwa*, and makai of that the *wao maʻukele*. Makai of the *wao maʻukele* is the *wao akua*, and makai of there is the *wao kanaka*, the area that people cultivate. Makai of the *wao kanaka* is the *ʻamaʻu*, fern belt, and makai of the *ʻamaʻu* the *ʻapaʻa*, grasslands.
>
> A solitary group of trees is a *moku laʻau* (a "stand" of trees) or an *ulu laʻau*, grove. Thickets that extend to the *kuahiwi* are *ulunahele*, wild growth. An area where *koa* trees suitable for canoes (*koa waʻa*) grow is a *wao koa* and mauk a of there is a *wao laʻau*, timber land. These are dry forest growths from the *ʻapaʻa* up to the *kuahiwi*. The places that are "spongy" (*naele*) are found in the *wao maʻukele*, the wet forest.
>
> Makai of the *ʻapaʻa* are the *paheʻe* [*pili* grass] and *ʻilima* growths and makai of them the *kula*, open country, and the *ʻapoho* hollows near to the habitations of men. Then comes the *kahakai*, coast, the *kahaone*, sandy beach, and the *kalawa*, the curve of the seashore—right down to the *ʻae kai*, the water's edge.
>
> That is the way *ka poʻe kahiko* [the ancient people] named the land from mountain peak to sea. (Kamakau 1976:8-9)

The makaʻāinana (commoners, literally the "people that attend the land") who lived on the land had rights to gather resources for subsistence and tribute within their ahupuaʻa (Jokiel et al. 2011). As part of these rights, residents were required to supply resources and labor to aliʻi (chiefs) of local, regional, and island chiefdoms. The ahupuaʻa became the equivalent of a local community with its own social, economic, and political significance and served as the taxable land division during the annual Makahiki procession (Kelly 1956). During the time of Makahiki, the paramount aliʻi sent select members of his/her retinue to collect hoʻokupu (tribute and offerings) in the form of goods from each ahupuaʻa. The makaʻāinana brought their share of hoʻokupu to an ahu (altar) that was marked with the image of a puaʻa (pig), serving as a physical visual marker of ahupuaʻa boundaries. In most instances, these boundaries followed mountain ridges, hills, rivers, or ravines (Alexander 1890). However, Chinen (1958:1) reports that "oftentimes only a line of growth of a certain type of tree or grass marked a boundary; and sometimes only a stone determined the corner of a division." These ephemeral markers, as well as their more permanent counterparts, were oftentimes named as evidenced in the thousands of boundary markers names that are listed in Soehren (2005).

Ahupuaʻa were ruled by aliʻi ʻai ahupuaʻa or chiefs who controlled the ahupuaʻa resources. Generally speaking, aliʻi ʻai ahupuaʻa had complete autonomy over the ahupuaʻa they oversaw (Malo 1951). Ahupuaʻa residents were not bound to the land nor were they considered property of the aliʻi. If the living conditions under a particular ahupuaʻa chief were deemed unsuitable, the residents could move freely in pursuit of more favorable conditions (Lam 1985). This structure safeguarded the well-being of the people and the overall productivity of the land, lest the chief loses the principal support and loyalty of his or her supporters. In turn, ahupuaʻa lands were managed by an appointed konohiki, oftentimes a chief of lower rank, who oversaw and coordinated stewardship of an area's natural resources (Lam 1985). In some places, the poʻo lawaiʻa (head fisherman) held the same responsibilities as the konohiki (Jokiel et al. 2011). When necessary, the konohiki took the liberty of implementing kapu (restrictions and prohibitions) to protect the mana of an area's resources from environmental and spiritual depletion.

Many ahupuaʻa were divided into smaller land units termed ʻili andʻili kūpono (often shortened to ʻili kū). ʻIli were created for the convenience of the ahupuaʻa chief and served as the basic land unit which hoaʻāina (caretakers of particular lands) often retained for multiple generations (Jokiel et al. 2011; MacKenzie 2015). As ʻili were typically passed down in families, so too were the kuleana (responsibilities, privileges) that were associated with it. The right to use and cultivate ʻili was maintained within the ʻohana, regardless of the succession of aliʻi ʻai ahupuaʻa (Handy et al. 1991). Malo (1951) recorded several types of ʻili, including the ʻili paʻa (a single intact parcel) and ʻili lele (a discontinuous parcel dispersed across an area). Whether dispersed or wholly intact, ʻili required a cross-section of available resources, and for the hoaʻāina, this generally included access to agriculturally fertile lands and coastal

fisheries. ʻIli kūpono differed from other ʻili lands because they did not fall under the jurisdiction of the ahupuaʻa chief. Rather, they were specific areas containing resources that were highly valued by the ruling paramount chiefs, such as fishponds (Handy et al. 1991).

Aliʻi ʻai ahupuaʻa, in turn, answered to an aliʻi ʻai moku (chief who claimed the abundance of the entire moku or district) (Malo 1951). The island of Maui is comprised of twelve moku (districts) that include Kāʻanapali, Lāhainā, Wailuku, Kula, Honuaʻula, Kahikinui, Kaupō, Kīpahulu, Hāna, Koʻolau, Hāmākua Loa, and Hāmākua Poko. Although a moku comprises multiple ahupuaʻa, moku were considered geographical subdivisions with no explicit reference to rights in the land (Cannelora 1974). While the ahupuaʻa was the most common and fundamental land division unit within the traditional Hawaiian land management structure, variances occurred, such as the existence of the kalana. By definition, a kalana is a division of land that is smaller than a moku. Kalana was sometimes used interchangeably with the term ʻokana (Lucas 1995; Pukui and Elbert 1986), but Kamakau (Kamakau 1976) equates a kalana to a moku and states that ʻokana is merely a subdistrict. Despite these contending and sometimes conflicting definitions, what is clear is that kalana consisted of several ahupuaʻa and ʻili ʻāina.

This form of district subdividing was integral to Hawaiian life and the product of advanced natural resource management systems. As populations resided in an area over the centuries, direct teaching and extensive observations of an area's natural cycles and resources were retained, well-understood, and passed down orally over the generations. This knowledge informed management decisions that aimed to sustainably adapt subsistence practices to meet the needs of growing populations. The ahupuaʻa system and the highly complex land management system that developed in the islands are but one example of the unique Hawaiian culture that developed in these islands.

Intensification and Development of Hawaiian Land Stewardship Practices

Hawaiian philosophies of life in relation to the environment helped to maintain both natural, spiritual, and social order. In describing the intimate relationship that exists between Hawaiians and ʻāina (land), Kepā Maly writes:

> In the Hawaiian context, these values—the "sense of place"—have developed over hundreds of generations of evolving "cultural attachment" to the natural, physical, and spiritual environments. In any culturally sensitive discussion on land use in Hawaiʻi, one must understand that Hawaiian culture evolved in close partnership with its' natural environment. Thus, Hawaiian culture does not have a clear dividing line of where culture and nature begins.
>
> In a traditional Hawaiian context, nature and culture are one in the same, there is no division between the two. The wealth and limitations of the land and ocean resources gave birth to, and shaped the Hawaiian world view. The *ʻāina* (land), *wai* (water), *kai* (ocean), and *lewa* (sky) were the foundation of life and the source of the spiritual relationship between people and their environs. (Maly 2001)

The ʻōlelo noʻeau (proverbial saying) "hānau ka ʻāina, hānau ke aliʻi, hānau ke kanaka" (born was the land, born were the chiefs, born were the commoners), conveys the belief that all things of the land, including kanaka (humans), are connected through kinship links that extend beyond the immediate family (Pukui 1983:57). ʻĀina or land, was perhaps most revered, as noted in the ʻōlelo noʻeau "he aliʻi ka ʻāina; he kauwā ke kanaka," which Pukui (Pukui 1983:62) translated as "[t]he land is a chief; man is its servant." The lifeways of early Hawaiians, which were dependent entirely from the finite natural resources of these islands, necessitated the development of sustainable resource management practices. Over time, what developed was an ecologically responsive management system that integrated the care of watersheds, natural freshwater systems, and nearshore fisheries (Jokiel et al. 2011).

Disciplined and astute observation of the natural world became one of the most fundamental stewardship tools used by the ancient Hawaiians. The vast knowledge acquired through direct observation enabled them to detect and record the subtlest of changes, distinctions, and correlations in the natural world. Examples of their keen observations are evident in the development of Hawaiian nomenclature to describe various rains, clouds, winds, stones, environments, flora, and fauna. Many of these names are geographically unique or island-specific, and have been recorded in oli (chants), mele (songs), pule (prayers), inoa ʻāina (place names), and ʻōlelo noʻeau (proverbial sayings). Other Hawaiian arts and practices such as hula (traditional dance), lapaʻau (traditional healing), lawaiʻa (fishing), mahiʻai (farming) further aided in the practice of knowing the rhythms and cycles of a particular place.

Comprehensive systems of observing and stewarding the land were coupled by the strict adherence to practices that maintained and enhanced the kapu and mana of all things in the Hawaiian world. In Hawaiian belief, all things natural, places, and even people, especially those of high rank, possessed mana or "divine power" (Pukui and Elbert 1986:235; Pukui et al. 1972). Mana was believed to be derived from the plethora of Hawaiian gods (kini akua) who were embodied in elemental forces, land, natural resources, and certain material objects and persons (Crabbe et al. 2017). Buck (1993) expanded on this concept noting that mana was associated with "the well-being of a community,

in human knowledge and skills (canoe building, harvesting) and in nature (crop fertility, weather etc.)" (c.f. Else 2004:244).

To ensure the mana of certain resources, places, and people, kapu of various kinds were implemented and strictly enforced to limit over-exploitation and defilement. Elbert and Pukui (1986:132) defined kapu as "taboo, prohibitions; special privilege or exemption." Kepelino noted that kapu associated with akua (deities) applied to all social classes, while kapu associated with aliʻi were applied to the people (in Beckwith 1971). As kapu dictated social relationships, they also provided "environmental rules and controls that were essential for a subsistence economy" (Else 2004:246). The companion to kapu was noa, translated as "freed of taboo, released from restrictions, profane, freedom" (Pukui and Elbert 1986:268). Some kapu, particularly those associated with maintaining social hierarchy and gender differentiation were unremitting, while those kapu placed on natural resources were applied and enforced according to seasonal changes. The application of kapu to natural resources ensured that such resources remained available for future use. When the aliʻi or the lesser chiefs (including konohiki and poʻo lawaiʻa) determined that a particular resource was to be made available to the people, a decree was proclaimed indicating that kapu had been lifted, thereby making it noa. Although transitioning a resource from a state of kapu to noa allowed for its use, people were expected to practice sustainable harvesting methods and pay tribute to the paramount chief and the akua associated with that resource. Kapu were strictly enforced and violators faced serious consequences including death (Jokiel et al. 2011). Violators who escaped execution sought refuge at a puʻuhonua, a designated place of refuge or an individual who could pardon the accused (Kamakau 1992). After completing the proper rituals, the violator was absolved of his or her crime and allowed to reintegrate back into society.

In summary, the layering and interweaving of beliefs, land stewardship practices, and the socio-political system forms the basis of the relationship shared between the Hawaiian people and the land. It is through the analysis of these dynamic elements that we develop an understanding of the complexity of place.

CULTURE HISTORICAL CONTEXT OF KAMEHAMENUI AND KEALAHOU

The project area extends across the ahupuaʻa of Kamehamenui and Kealahou 3 and 4, three of the seventeen ahupuaʻa that make up the expansive Kula District (Figure 11). The name Kamehamenui is sometimes referred to in the historical record as Kamehame 1st and is sometimes spelled Kamehame Nui (lit. large Ka-mehame). This ahupuaʻa name is derived from the endemic Antidesma sp. of tree known in Hawaiian by several names including hame, hamehame, mehamehame, haʻa, and haʻāmaile (Bishop Museum 2021). There are two known Antidesma species in the Hawaiian Islands, A. platyphyllum, which is commonly found in mesic to wet forests between the 150-1,525 meter elevation, and A. pulvinatum, which is found in dry to mesic forests between the 30-1,220 meter elevation (Wagner et al. 1999). According to Malcolm N. Chun, different parts of the hame plant were utilized medicinally and sometimes mixed with other plant parts to treat ailments such as nausea, vomiting, ulcers, and scrofulous sores (Chun in Bishop Museum 2021). In addition to its medicinal value, the fruit and bark of the hame tree were traditionally used to dye kapa in shades of reds and purples, and the hardwood was used as house framing and for making kua (anvil) used in kapa making (Abbott 1992; Krauss 1993; Rock 1913).

Whereas Kamehamehanui comprises the north half of the project area, the southern half encompasses a portion of Kealahou Ahupuaʻa whose name has been translated by (Pukui et al. 1974:101) as "the new pathway." The ahupuaʻa of Kealahou, which lies between Kamehamenui and Waiakoa, was divided into four relatively narrow strips of land, and the project area encompasses that portion identified as Kealahou 3rd and 4th (see Figure 11).

Kamehamenui and Kealahou are situated in the traditional moku of Kula (see Figure 11), whose name has been translated as "plain" and is one of twelve traditional moku that make up the island of Maui (King 1935; Pukui et al. 1974:123). In expanding on the historical use of the term kula, Lucas (1995:60) adds that it is "...the open country back from the sea; the name of the region of a mountain near its base," and that it also refers to "any open uncultivated land; a field for cultivation; a pasture..." that was distinct from wet or meadowland. According to Robert D. King (1935:216), the Principal Cadastral Engineer of the Territory of Hawaiʻi, in 1859 "...for taxation, educational, and judicial purposes...", the moku boundaries were adjusted and the Kula District was renamed the Makawao District. In providing a general description of Kula, Handy et al. (1991:510-511) explained:

> Kula is the *ʻokana* [sub-district] directly north of Honuaʻula, and occupies most of the central plain of Maui, created by the joining of the two volcanic domes of West and East Maui. *Kula* means open country, or plain as distinct from valley or stream bottom, and has long been used as a term to distinguish between dry, or "*kula* land." and "wet-taro land." This is an essential characteristic of Kula, the central plain of Maui which is practically devoid of streams.

> Kula was always an arid region, through its long, low seashore, vast stony *kula* lands, and broad uplands. Both on the coast, where fishing was good, and on the lower westward slopes of Haleakalā a considerable population existed. So far as we could learn Kula supported no Hawaiian taro, and the fisherman in this section must have depended for vegetable food mainly on *poi* brought from the wet lands of Waikapu and Wailuku to westward across the plain to supplement their usual sweet-potato diet. In recent times, however, Chinese taro has been raised at a considerable elevation. Kula was widely famous for its sweet potato plantations. *'Uala* was the staple of life here.

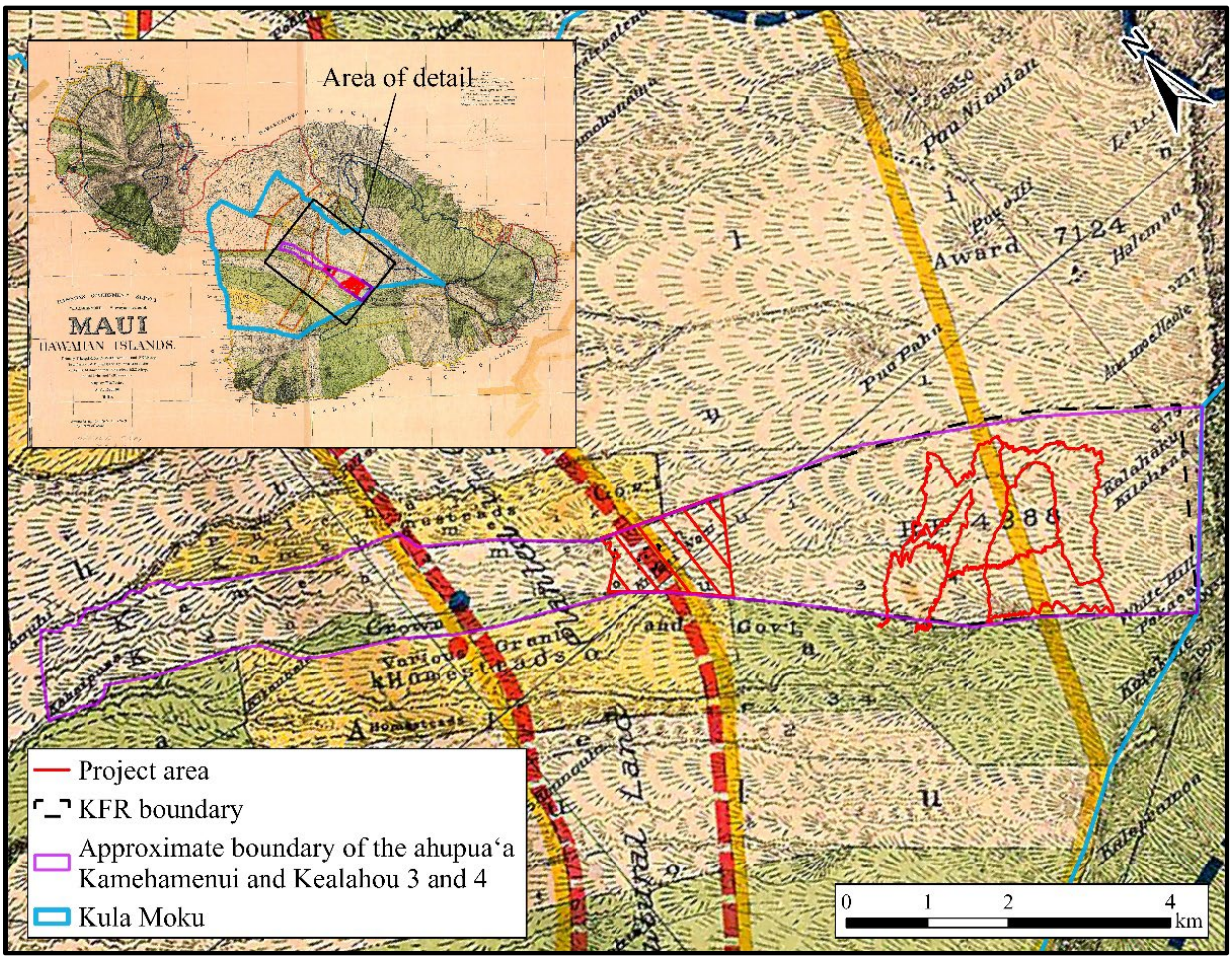


Figure 11. Location of the project area within traditional Hawaiian land divisions.

Furthermore, Handy et al. (1991:276) added that:

> All the country below the west and south slopes of Haleakala, specifically Kula, Honua'ula, Kahikinui, and Kaupo, in old Hawaiian times depended on the sweet potato. The leeward flanks of Haleakala were not as favorable for dry or upland taro culture...However, some upland taro was grown, up to an altitude of 3,000 feet. A few such small patches belonging to cowboys were visited in 1931. But there never were extensive upland plantations here...The prevalence of prayers invoking rain and the existence at 'Ulupalakua of a rain cult evidence a scarcity of enough rain even for the sweet-potato crops. There was excellent deep-water fishing available to the folk of Kula and Honua'ula...

Precontact populations in the vicinity of the project area were believed to be significant. Handy and Handy (1972:272) state that "[O]n the south coast of Maui, from Kula to 'Ulupalakua, a consistently dry and lava-strewn country...was a notable area for sweet potato, which, combined with the fishing, must have supported a sizable population..."

Traditional Agricultural Practices

As evidenced in Handy et al.'s (1991) description, ʻuala (sweet potatoes) were an important staple crop to the native inhabitants of this region. In the Kula District, where perennial streams are absent, dryland horticultural techniques were employed and the native farmers often constructed stone and earth embankments, practiced crop rotation, and relied upon rainfall to irrigate their dryland fields (Kolb 1997). Malo (1951) points out that farming kula land was fraught with many challenges and goes on to note some of the methods the planters employed for successful yields. Malo (1951:204-205) writes:

> 3. On the *kula* lands, farming was a laborious occupation and called for great patience, being attended with many drawbacks. On some of these were grubs, or caterpillars, or blight, *hauoki* (frost), of *kahe* (freshets), or the sun was too scorching; besides which there were many other hindrances.
>
> 8. The cultivation of *kula* lands was quite different from that of irrigable lands. The farmer merely cleared of weeds as much land as he thought would suffice. If he was to plant *taro* (upland *taro*), he dug holes and enriched them with a mulch of *kukui* leaves, ashes, or dirt, after which he planted the *taro*. In some places they simply planted without mulch or fertilizer.
>
> 10. If a field of potatoes was desired, the soil was raised into hills, in which the stems were planted; or the stems might merely be thrust into the ground any how, and the hilling done after the plants were grown; the vines were also thrown back upon the hill. In six months the potatoes were ripe. Such was the cultivation of the *kula* land.

According to Malo (1951), ʻuala (sweet-potato) was the primary crop grown in the kula regions and because of the prolonged dryness, the people of these lands frequently suffered from famine. Despite the difficult environmental conditions, the Kula natives labored diligently all while transforming once forested areas into arable fields. Kolb and O'Claray (in Kolb et al. 1997:45) provide some idea of the cultivation practices observed by the native farmers:

> In ancient times, cultivating sweet potato was a critical component of the upcountry field system, and a laborious and demanding task. The first step of cultivation was to clear a planting area. A sweet potato patch required arable soil free from other plants, and since Kula was an open forested area, this required that planting occurred either in a forest clearing or that a section of forest had to be cleared of existing vegetation. Vegetation and trees were cut and then burned in order to help fertilize the soil. We assume that after a number of plantings when soil nutrients became depleted, gardens were abandoned and left to become fallow for ten to twenty years before being cleared again...Thus cleared garden areas (*mala*) were probably rotated routinely through an areas of forest of secondary growth in a shifting fashion.

Once an area was cleared, sweet potatoes were planted using specific methods suitable to the local environmental conditions. One such method recorded by (Kamakau 1976) was known as maloʻeka (lit. dirty loin cloth), in which the farmer built large bonfires so that the smoke cloud would shelter the patch from the heat of the sun. This method made the planters exceptionally dirty, covering them with dirt and smoke. In the wetter areas, native planters utilized a method known as haʻaheo (proud), likely a reference to the ease of cultivation in areas with ample rainfall (Kolb and O'Claray in Kolb 1997). In addition to the methods described above, the native planters also constructed features such as terraces to help with soil retention, channel and absorb water run-off, or to delineate individual plots (Handy et al. 1991; Kamakau 1992; Kuykendall 1938).

The people of Kula spent so much of their time in the uplands that they became known for their ignorance in marine subsistence activities. Such ideas are evident in several ʻōlelo noʻeau including "O Kula i ka hoe hewa," translated as "Kula of the ignorant canoe paddler" which was said as a pun about how those of Kula "did not know how to paddle canoes because they were uplanders" (Pukui 1983:270). Another saying, "Kula unahi pikapika heʻe" translates as "Kula people, scalers of the suckers on the tentacles of the octopus" which according to Pukui (1983:205) was:

> said in fun of the people of Kula, Maui. A Kula chiefess who lived inland did not know what the suckers on an octopus were and tried to scale them as one scales a fish."

Lastly, Pukui (1983:255) recorded yet another saying, "No Kula ia poʻe ke hoe hewa nei" which translates as "To Kula belong the people who are such poor paddlers." Aside for the perceived ignorance in coastal subsistence activities, the native farmers of Kula took great length to develop place-based agricultural practices—practices that would carry them well into the 19th century and afford opportunities for native farmers to participate in the market economy.

Traditional Moʻolelo of Kamehamenui and Kealahou Ahupuaʻa and the Greater Kula District

Moʻolelo offers rich resources for understanding the cultural landscape, land use, and practices of an area. They are another source of history that informs our understanding of how peoples of the past expressed their relationships to their lands and environment. An exhaustive search through published resources and historical Hawaiian language newspapers resulted in no moʻolelo that explicitly named the ahupuaʻa of Kamehamenui or Kealahou. However, there are moʻolelo that speak of events that take place in the broader moku of Kula, which area summarized below.

The Legend Concerning the Battle of the Owls and the Massacre of the People and Chiefs of Maui

A traditional account published by W. H. Uaua in the June 29th, 1871 edition of the Hawaiian language newspaper, Ke Au ʻOkoʻa relates the story of ʻAʻapueo, a mother owl who hailed from Kula, who along with her husband, Pueokaia and how they exacted revenge on the men and chiefs of Wailuku after they had committed cruel acts against their owl children (Uaua 1871). Presented below is a translated summary of Uaua's published account.

This tale concerns two pueo (owls), ʻAʻapueo and her mate Pueokaia, who planned a raid on the men and chiefs of Wailuku to exact their revenge on the cruel acts against their children. The story begins with the wife of a man named Kapoʻi. The woman, who is unnamed in this story traveled to the plains of Papalekailiu and upon reaching Pohaku O Makaku discovered a large rock called Alaha, which was situated near the boundary of Hamakuapoko. There at Alaha, the woman discovered an owl nest with seven eggs nestled within. She removed all the eggs and returned home to her husband in Kaimuheʻe above the famous waters of Kanuha and Mauai in Wailuku and told her husband of her findings. Meanwhile, back at Alaha, ʻAʻapueo, the mother owl from Kula, discovered that her eggs were missing and frantically searched for them. ʻAʻapueo eventually found her eggs in the hands of Kapoʻi and begged him to return them.

"Kapoi, those eggs are mine, return them," to which he replied, "How many eggs did you have?" ʻAʻapueo, responded "seven" and with heartless intent, Kapoʻi smashed her eggs on a rock wall, leaving nothing but shattered shells and yolks for ʻAʻapueo. ʻAʻapueo flew to the wall where her eggs had been destroyed and wept. She picked up the broken shells and yolks and hurried back to her husband, Pueokaia, who lived on a hill in the uplands of Awau near the Wailuku River. Upon arriving home, she told her husband of the callous deeds of Kapoʻi and revealed to him the remnants of what was left of her eggs.

Furious, Pueokaia traveled to each island from Hawaiʻi to Kauaʻi to enlist the help of his fellow owls to exact their revenge on Kapoʻi. The owls from Hawaiʻi heeded Pueokaia's cry for help and those owls from Hilo, Puna and Kaʻū gathered in Hana at a place called Kapueokahi, and the owls from Kona, Kohala, and Hāmākua gathered at Puʻupueo in Kīpahulu. Meanwhile, ʻAʻapueo gathered the owls of Oʻahu where they met at Kaulanaakapueo in Makapuʻu and showed them the broken shells. Agreeing to help, the owls waited there at Makapuʻu as she traveled to Kauaʻi to summon all the owls of that island, upon which the news of this gathering reached the island of Niʻihau and swiftly those owls flew to Kauaʻi. Once the owls of Kauaʻi and Niʻihau heard the pleas of ʻAʻapueo they quickly traveled to Oʻahu to meet with the others that waited at Kaulanaakapueo in Makapuʻu and together the flock traveled to Molokaʻi, Lānaʻi, and Kahoʻolawe. With every owl from Molokaʻi to Kauaʻi, ʻAʻapueo led them to Manawaipueo to meet with the owls of East and West Maui. It was said that their numbers filled the sky and shut out the sun's light. The owls led their attack and slaughtered many men, including chiefs, from Nā Wai ʻEhā. Amongst those that were killed were the perpetrators responsible for the attack, Kapoʻi, and his wife. This great battle between men and owls was commemorated in the naming of Wailuku (Uaua 1871).

The Legend of Kawaunuiaola

Fornander (1916-1917) recorded the following account which tells the story of a cunning woman named Kawaunuiaola from Kula and her crafty efforts to lure her husband, Hoeu, back into her life. Having lived together for some time, Hoeu left Kawaunuiaola and took unto himself another wife. Overcome with sadness after her husband had left her, Kawaunuiaola placed a kapu around her home and isolated herself. Living in total isolation, the cunning woman devised a plan. At mealtime, she would petition her husband, as her god, where she offered the following words:

Eia ka ai e Hoeu,	Here is the food Hoeu,
Eia ka ia	Here is the fish,
Eia ka wai,	Here is the water,
Amama ua noa,	Accept them all, they are free from restrictions.

After she uttered these words, she would have the following conversation but would reply in a different voice:

E ai paha wau?	May I eat?
O ai paha.	You may.
O kuu wahi ai hea la auanei?	Which food shall it be?
E Laalaawale.	Say, Laalaawale,
O ko waho ai hea auanei?	Which food shall it be?
O ko wahi poi paha.	Shall it be your poi?
O ai hoi ha	Proceed and partake of the food

In addition to her conversations, the woman also prayed each night for her husband's return. Passerbys would hear Kawaunuiaola having this conversation and soon people began to suspect that she had taken a new husband. Rumors of Kawaunuiaola having another husband quickly spread and soon reached Hoeu in the following manner:

> Say, Hoeu, your wife, Kawaunuiaola acts in a strange very strange way; she must have obtained a new husband, for we have heard two voices talking; one in the voice of a female and the other in the voice of a man. It must be a new husband. (Fornander 1916-1917:554)

When Hoeu heard these words, he deserted the woman he was living with and returned to Kula and inquired with Kawaunuiaola about the rumors, which she denied. Soon the couple made up and Hoeu and Kawaunuiaola lived on as husband and wife (Fornander 1916-1917).

Traditional Accounts of Haleakalā

Of particular importance to the current study is the project area's location on the western slopes of Haleakalā, a 3,000 m (10,000 ft) tall dormant volcano with an impressive erosion crater at its peak, which—with its high-altitude lunaresque landscape—has long drawn visitors and helped create a sense of sacredness of place. Numerous legends featuring a variety of Polynesian deities are associated Haleakalā Mountain. The demi-god Maui is associated with the Maui Island as a whole, but he also plays a role in the significance of Haleakalā Mountain. Being a volcano, and one that was active during the time of human occupation, Haleakalā Mountain is also closely associated with the Hawaiian volcano goddess, Pele. Other deities also have connections to Haleakalā Mountain, and their legends provide insight into the meaning and significance of this mountain. Below are some traditional accounts that speak to the cultural importance of the mountain.

The island of Maui is named after the Polynesian demi-god of the same name who is included in legends from all over Polynesia (Pukui et al. 1974:148; Tomonari-Tuggle and Tuggle 2007:37). Maui is often portrayed as "the trickster hero," with his antics taking varying forms in different places (Beckwith 1970:227). In Hawai'i, Haleakalā Mountain is associated with one of Maui's most famous exploits. Maui is said to have "lassoed the sun here in order to lengthen the day," so that his mother, Hina, would be able to dry her kapa (traditional bark cloth) (Pukui et al. 1974:36). Beckwith (1970:230) retells one version of this story from East Maui:

> Maui's next feat is stopping the sun from moving so fast. Hina [his mother] sends him to a big wiliwili tree where he finds his old blind grandmother cooking bananas and steals them one by one until she recognizes him and agrees to help him. He sits by the trunk of the tree and lassoes the sun's rays as the sun comes up. The sun pleads for life and agrees that the days shall be longer in summer and short during the six winter months.

Tomonari-Tuggle and Tuggle (2007:38–39) note that Maui legends and stories associated with Haleakalā Mountain include notions of sun-snaring and sun-related observations, which may imply that solar observation activities were conducted in the high-altitude regions of this mountain. This also suggests that temples or archaeological sites related to this activity may be found in or near the summit or other high peaks.

In addition to Maui, several other deities and legendary figures are associated with Haleakuā. Pele, the goddess of volcanoes, is associated with the formation of all Hawaiian volcanoes, including Haleakalā Mountain. Early Polynesian settlers to Maui would have witnessed volcanic activity in the crater (Tomonari-Tuggle and Tuggle 2007:39), and lava flows would have likely continued until after AD1100-1200. Haleakalā Mountain's most recent eruption occurred between AD1480 and 1600 (Hawaiian Volcano Observatory 1999; 2003). As a place of recent volcanic activity, Pele is naturally associated with this entire region. Kamohoali'i, the elder brother of Pele, is also associated with the volcano as he is often depicted as living in sacred cliffs including those at Haleakalā Mountain. Emerson (1892) notes that Kamohoali'i lived in a sacred cliff on Hawai'i Island, and he was also said "…to make his home in the highest cone in the crater of Haleakalā." Lastly, Lilinoe is recorded by Westervelt (1963:56) as being the goddess of Haleakalā Mountain (see also Emory 1921:257). She is said to be the goddess of "dead fires and desolation,

and a snow goddess" (Westervelt 1963:56). Her relationship as the younger sister to Poliʻahu, the snow goddess of Mauna Kea on Hawaiʻi Island, is potentially suggestive of how Hawaiians may have seen these two mountains in relation to each other (indeed, they are intervisible).

Although only a handful were presented here, Haleakalā Mountain's association with various legends and deities implies the presence of shrines or other physical features of ritual. Furthermore, some other Maui legends deriving from East Maui include elements of solar observation, and might possibly indicate the presence of temples or other places associated with astronomical observations and rituals (Tomonari-Tuggle and Tuggle 2007:38–39). Along with featuring in legends, certain places have special meanings, which are often intimated by the names given to them.

Winds, Rains Associated with Kamehamenui and the Greater Kula District

In addition to the moʻolelo summarized above, the following narratives and subsequent ʻōlelo noʻeau (proverbial sayings; listed in Table 4) relate information about the makani (winds) and ua (rains) of Kamehamenui and the broader Kula region. Such knowledge evidences the long-term relationship of the district communities to their immediate environment. Native Geographer Katrina-Ann R. Kapāʻanaokalāokeola Nākoa Oliveira (Oliveira 2014:64) offers a concise description regarding the natural environment as it was understood by Native Hawaiians of the past:

> Ancestral Kānaka recognized the connection between the heavens, lands, and oceans and how all three were interconnected and interdependent upon one another. In spite of the interwoven nature of the sky, land, and sea, however, Kānaka of ancestral times did not have a term that directly translates to what we have come to know today as "environment." Rather, the *Hawaiian Dictionary* offers two phrases that approximate the notion of environment: (1) "ʻano o ka nohona" and (2) "nā mea e hoʻopuni ana." ʻAno o ka nohona refers to the nature of one's relationship to one's surroundings or places. Nā mea e hoʻopuni ana relates to everything that surrounds or encircles a person.

Reacquainting ourselves with such information allows us to appreciate and understand the local environment as it was once observed by ancestral Hawaiian populations.

Winds of Kula Described in He Kaʻao no Pakaʻa

Natural features such as winds and rains are well documented in historical literature and compositions one of which includes the story title *He Kaʻao no Pakaʻa* penned by Fornander (1918-1919). This legendary account concerns a man named Pakaʻa, who was a respected servant of Keawenuiaʻumi, a chief of Hawaiʻi Island. As a valued advisor to the king, he had the duty of caring for the king's possessions including his double hauled canoe, and whatever Pakaʻa advised, the king obeyed. Pakaʻa's brother, Lapakahoe also served as an advisor in the chief's royal court. Pakaʻa kept a special gourd calabash called Laʻamaomao, which he named after his mother, who during her lifetime had developed a special relationship with the winds. Within this special container were her bones and Pakaʻa would call upon her to summon the power of the winds. While Pakaʻa was serving under Keawenuiaʻumi, two men Hoʻokeleihilo and Hoʻokeleipuna joined the court and Pakaʻa soon found himself being mistreated by the king. His responsibilities with the exception of caring for the king's personal items were stripped from him and given to the two men. After some time, Pakaʻa left Keawenuiaʻumi's court and took some of the king's possessions including his *kapa* (bark cloth), *malo* (loin cloth), and placed them in his sacred calabash.

Pakaʻa settled on the leeward side of Molokaʻi and took up a wife, who was a chiefess. She later gave birth to their son, who they named Kuaapakaʻa. Pakaʻa taught his son all the chants and everything he knew about Keawenuiaʻumi for he wanted to be prepared should the king desire to have him back in his court. His son mastered all that he had taught him and eventually, Pakaʻa's prediction had come true and a canoe arrived from Hilo carrying the message that Keawenuiaʻumi was looking for his long lost servant. Pakaʻa, however, did not tell the messengers that he was indeed Pakaʻa. In a dream, Pakaʻa and Keawenuiaʻumi came to each other and Pakaʻa told the chief of his whereabouts. Without hesitation, Keawenuiaʻumi summoned his six district chiefs to seek out Pakaʻa.

Pakaʻa and his son set out in their canoe pretending to be fishing for ʻuhu (parrot fish), a fishing style that required one to continuously gaze down at the ocean to avoid being seen by Keawenuiaʻumi's chiefs. The canoes of the district chiefs led the way with Keawenuiaʻumi's canoe following behind. As each of the canoes belonging to the district chiefs passed, Kuaapakaʻa at the advice of his father chanted insultingly out to each of the district chiefs, pointing out discrepancies in their lineage and the shortcomings of the lands they ruled. This greatly angered the district chiefs causing them to sail past the father and son.

The king's double hauled canoe finally made its way toward the small fishing canoe and onboard was Lapakahoe, brother of Pakaʻa. Lapakahoe inquired with the young boy about his knowledge of these chiefs, pointing out that such

knowledge was only held by a few people, one of which was Pakaʻa and asked if he knew where the chief's former servant was. The boy however, continued with his taunts, this time calling forth all the winds of the various lands, including those of Maui and Molokaʻi—an Incantation that brought about a violent storm. The line describing the winds of Kula reads, "He kehau ko Kula," translated as "The kehau is of Kula" (Fornander 1918-1919:100-101).

After calling forth all the winds of the islands, Kuaapakaʻa proceeded to call forth all the men aboard the king's canoe by name. Angered by the boy's remarks, the chief's canoe drew away until nothing, but a mere speck of the canoe was in sight. At which time, at the orders of his father, Kuaapakaʻa uncovered the sacred wind gourd Laʻamaomao, sending a fury of wind over the ocean that caused the ocean to churn and overwhelmed the chief's canoe. After watching the chief's canoe nearly swamped with water, the boy placed the cover back on the sacred gourd, causing the ocean to become calm once again. Although devoid of all their possessions, the chief and his men landed on Molokaʻi.

Although Pakaʻa remained out of sight of the chief, he gave specific orders to his son on how to best care for the chief for he knew of all the chief's favorite things. He gave his son the chief's malo and told the son to offer it to Keawenuiaʻumi. Pakaʻa then gave his son the chief's kapa which was scented with fragrant plants of Laʻa (ʻŌlaʻa), Puna. As Kuaapakaʻa handed the kapa to the chief, he recognized the scent. Pakaʻa intended to grow the chief's desires by giving him all of his favorite things that reminded him of how he once cared for the chief. This went on for some time as Kuaapakaʻa again uncovered Laʻamaomao causing a storm that kept the chief on the island which lasted for four months. After closing the gourd, the weather had calmed and Keawenuiaʻumi strongly desired to have the young Kuaapakaʻa join his court. After negotiating with the king, the boy consented. The chief's canoe was made prepared and they set sail for Kauaʻi, where they encountered a storm incited by the wind gourd Laʻamaomao. Nonetheless, Kuaapakaʻa had come prepared with food and other necessities. The young boy offered protection and food to everyone on the canoe except for the sailing masters, Hoʻokeleihilo and Hoʻokeleipuna, the very men that had replaced his father. Weak and battered from the storm, the two men eventually fell overboard at which time Kuaapakaʻa covered the sacred gourd sending calmness over the waters. Kuaapakaʻa ordered the canoe back to Hawaiʻi Island and after several more cunning acts, Kuaapakaʻa revealed his true identity to Keawenuiaʻumi and ordered the boy to bring his father Pakaʻa to him. Pakaʻa refused the king's orders until full restoration was made to which the king agreed and upon Pakaʻa's return to Hawaiʻi, the whole of Hawaiʻi Island was given to him.

Nāulu and ʻŪkiukiu, the Cloud Warriors

This is a story told to Armine von Tempsky by Makalii and retold in *Sites of Maui* by Elspeth Sterling (1998); these two were trade wind-driven clouds, with Nāulu traveling along the southern flank of Haleakalā and ʻŪkiukiu along the northern flank. These two clouds were in an eternal battle for the summit of Haleakalā. While ʻŪkiukiu usually won, occasionally Nāulu succeeded in pushing ʻŪkiukiu back and then on other occasions a truce would be called and the two cloud warriors would rest, leaving clear blue skies between "heaped white masses of vapor" along the summit. According to Makalii, this space of blue skies "was called Alanui o Lani—The Highway to Heaven" (Sterling 1998:243).

In Akana and Gonzalez (2015) book, *Hānau Ka Ua*, a compilation of Hawaiian rain names, they provide additional insight into the Nāulu and ʻŪkiukiu rain clouds and offered the following synopsis on the cultural significance of rain:

> Our kūpuna [ancestors] had an intimate relationship with the elements. They were keen observers of their environment, with all of its life-giving and life-taking forces. They had a nuanced understanding of the rains of their home. They knew that one place could have several different rains, and that each rain was distinguishable from another. They knew when a particular rain would fall, its color, duration, intensity, the path it would take, the sound it made on the trees, the scent it carried, and the effect it had on people. (Akana and Gonzalez 2015:xv)

Although Akana and Gonzalez (2015) did not document any specific rain names for Kamehamenui or Kealahou, they did document two rain names that were associated with the Kula District including the Nāulu, which was known throughout all of East Maui and the ʻŪkiu, which was also known as ʻŪkiukiu. Concerning the Nāulu rain, Akana and Gonzalez (2015:187) describe it as a "sudden shower" and that this name is applied to both the cloud and a wind that accompanies this rain. When observed in the Kula Distrct, the Nāulu shower is described as a cold, misty rain. Akana and Gonzales (2015) does not offer any concise description of the ʻŪkiu rain, however, Sterling (1998:99) described it as "a soft drizzel" and associated it with Makawao.

Whereas *Hānau Ka Ua* provides us with a comprehensive listing of rain names across the Hawaiian Islands, there is no comparable publication f*or wind names* to date. Listed in Table 4 are wind names that can be found referenced in Hawaiian and English language primary sources:

Table 2. Wind names associated with Kula District

Wind Name	*Notes*
Hau	Translates as "cool, iced; ice, frost, dew,snow" (Pukui and Elbert 1986:60). A cool breeze that descends from the uplands of Kula (Stodden n.d:7)
Nau	Translates as "to chew, munch, masticate" (Pukui and Elbert 1986:262). A wind of Kula, Maui (Stodden n.d:7)
ʻŪkiu	Refers to a chilly north wind; same as ʻŪkiʻukiu; also a rain name (Pukui and Elbert 1986).
ʻŪkiʻukiu	Translates as "to blow gently." Same as ʻŪkiu. Refers to a chilly north wind; also a rain name (Pukui and Elbert 1986:366).
Kēhau	Translates as "dew, mist, dewdrop" (Pukui and Elbert 1986:142). A gentle land breeze associated with Kula, Maui.
Kiu	Translates as "spy, scout, observe secretly"(Pukui and Elbert 1986:155). A strong, moderately cold northwesterly wind that blows directly from Kahaleakala; a wind which prostrates houses (Green 1871)

In Pukui's (1983) book titled *ʻŌlelo Noʻeau Hawaiian Proverbs and Poetical Sayings*, she recorded the following sayings along with their literal and figurative translation that speaks of the *Hau* and the *Kēhau* breeze of Kula, Maui:

> *Kokolo ka uahi o Kula, he Kēhau.*
>
> The smoke of Kula Creeps along when the Kēhau breeze blow.
>
> Where there is smoke there is fire (Pukui 1983:197).
>
> *Moe kokolo ka uahi o Kula, he Hau.*
>
> The smoke of Kula traveled low and swift, borne by the Hau wind.
>
> Said of one who is swift in movement. Also, in love and war much depends on the swiftness and subtlety. (Pukui 1983:236)

Traditional Place Names in Kamehamenui and Kealahou

Place names are often suggestive of a location's meaning, value, and significance. The Native Hawaiian names of places can inform the cultural context of traditional Hawaiian land use and provide elements of this context that may not be available from archaeological investigations. And, Kikiloi (2010:75) asserts that the recovery of traditional place names "help[s] to transform once-empty geographic spaces into cultural places enriched with meaning and significance." As such, researching place names helps provide a deeper, richer cultural context to any project area.

The following list (Table 3; Figure 12) provides a summary of the key place names in the project area vicinity. They were compiled from several map collections—including Government Registered Maps on file with the Department of Accounting and General Services and the U.S. Geological Survey—and various oral and written sources—including oli (chants), mele (songs), moʻolelo (stories), nane (riddles), ʻōlelo noʻeau (proverb and poetical expressions), Māhele ʻĀina records and Boundary Commission testimonies, and researched compilations of Hawaiian place names (see Pukui et al. 1974).

Note that, as Monahan (2017:6) points out, translation, interpretation, and nuanced meaning paint a sometimes nebulous or intricate picture of the Hawaiian place names:

> Because Hawaiians did not have a written system of communication prior to the arrival of Captain James Cook in 1778, our understanding of the meaning of Hawaiian place names in based on translations and interpretations from the nineteenth and twentieth century. As such, some places have more than one possible interpretation, which is particularly so since Hawaiians also highly valued both kaona ("hidden meaning") and huna ("secret meaning"), or "double meanings," in their poetic description of the natural world.

Table 3. List of significant place names.

Place Name	*Place Type*	*Meaning*	*Sources/References*
Haleakalā	Volcano, mountain	lit. "house [used] by the sun"	Pukui et al. (1974:36)
Hāpapa	Gulch	lit. "rock stratum"	Monsarrat (1924); Pukui et al. (1974:42); USGS (1924)
Helani*	ʻIli (a traditional land division)	lit. "a sky, or a royal chief"	Pukui et al. (1974:44)10/9/2024 10:04:00 AM
Kamehamenui**	Ahupuaʻa (a traditional land division)	lit. "the large hame [Antidesma pulvinatum] tree"	Pukui et al. (1974:81)
Keāhuaiwi	Gulch	lit. "the bone pile"	Pukui et al. (1974:101); USGS (1957)
Kealahou**	Ahupuaʻa (a traditional land division)	lit. "the new pathway"	Pukui et al. (1974:101)
Kilohana	Peak	lit. "lookout point," or "outer tapa," or "best, superior"	Dodge (1885); Monsarrat (1878; 1884); Pukui et al. (1974:111–112); Wall (1929)
Kula**	Moku (a traditional land division)	lit. "plain" (as in, a description of the landscape)	Pukui et al. (1974:123)
Kulaai Noni/Nani	Unknown	"Kula" translated as "field, pasture, open country" and "ai" (possibly "ʻai") translated as "food or food plant." Interpreted as "field of noni" (Kulaʻai Noni) or "beautiful food field" (Kulaʻai Nani)	Dodge (1885); Pukui and Elbert (1986:178)
Pākaoao	Hill	"Pā" translated as "enclosure" and Kaoao being the name of Kekaulike's younger brother, so it's interpreted as the "the enclosure of Kaoao", and it is also known as White Hill	Dodge (1885); Monsarrat (1884); Soehren (2002)
Peeluakolo*	ʻIli (a traditional land division)	lit. "creeping caterpiller"	Pukui and Elbert (1986:163, 322)
Puʻu Moho	Hill	lit. "moho hill" (a moho is an extinct flightless Hawaiian rail); this hill marks the boundary point along Kealahou Ahupuaʻa and is sometimes misspelled as "Puʻu Maho"	Pukui and Elbert (1986:251); USGS (1957)

* Location unmapped as these were identified via written sources and their exact location is unknown.
** Location mapped on Figure 12.

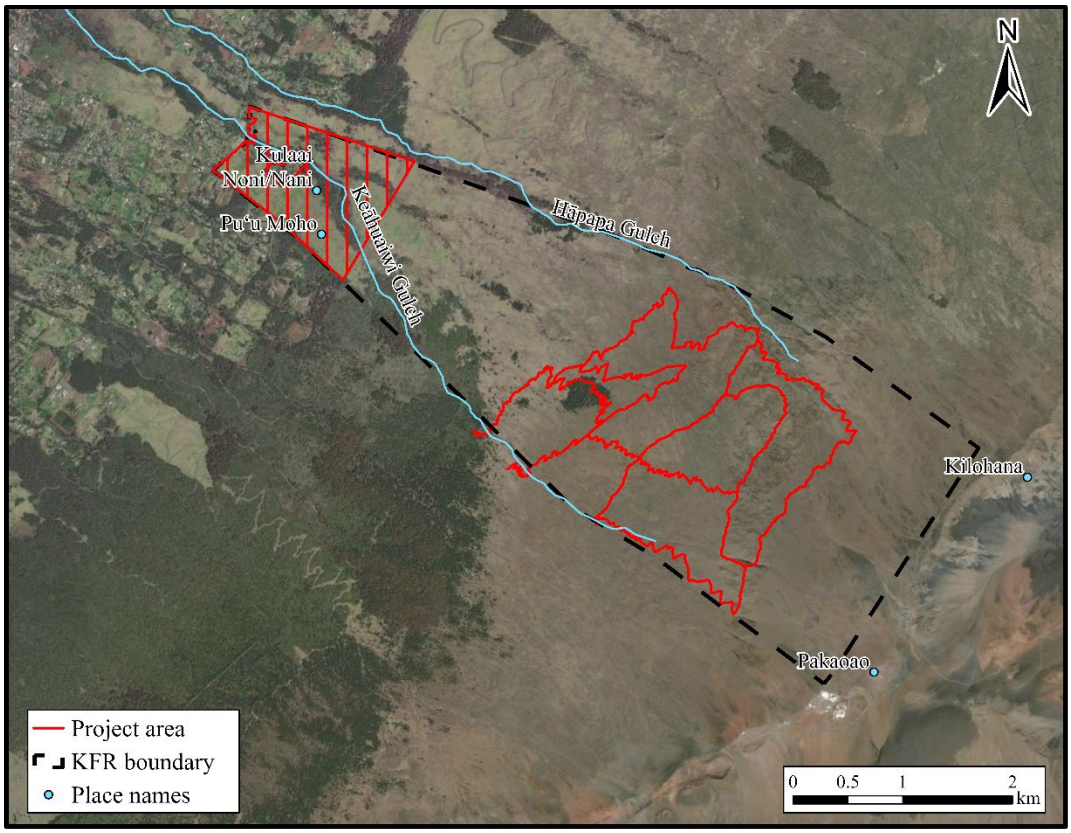


Figure 12. Traditional place names within the project area.

Chiefly Accounts Associated with the Moku of Kula

Throughout much of the pre-Contact and Early Historic periods, the island of Maui was divided into two independent chiefdoms, West Maui and East Maui (also sometimes called the Hāna chiefdom) (Cachola-Abad 2000; Fornander 1880; Kamakau 1992). West Maui included the districts of Kaʻanapali and Lahaina, and East Maui included the remaining districts of Hāmākua Poko, Hāmākua Loa, Koʻolau, Hāna, Kīpahulu, Kaupō, Kahikinui, Honuaʻula, Kula, and Nāpoko or Wailuku (King 1935). The formalization of Maui's districts has been credited to two brothers, Kākaʻe and Kakaʻalaneo, who reigned sometime about the 1500s (Maly and Maly 2005). It was during this time that ties with the neighboring islands of Lānaʻi and Molokaʻi were strengthened (Beckwith 1970). Fornander (1880) traces the Maui chiefly lineage to Paumakua, who was descended from the Hema branch of the Ulu line, and whose genealogy spread over Maui and Hawaiʻi Island. Fornander (1880:26–27) writes:

> …there is little to tell of the Maui Paumakua of the Hema line, the son of Huanuikalalailai... Through his son Haho and grandson Palena he became the great-grandfather and progenitor of the noted Hanalaa, whom both the Maui and Hawaii chiefs contended for as their ancestor under the varying names of Hanalaa-nui and Hanalaa-iki, asserting that Palena was the father of twins who bore those names.

Cachola-Abad (2000:175) writes that "each of these aliʻi nui seemed to have served as the nominal sovereign over the entirety of Maui." However, the political distinction between the East and West Maui chiefs appears to have occurred during the time of Palena or Hanalaʻa's reign (Cachola-Abad 2000). This political division persisted until the time of the 16th-century high chief Kiha-a-Piʻilani, who managed to consolidate East and West Maui under his rule (Kirch 2010). Prior to Kiha-a-Piʻilani, the chiefs ruling the greater part of Maui also ruled over the island of Lānaʻi and at times Molokaʻi (Fornander 1880). Kiha-a-Piʻilani was also instrumental in completing the construction of the ala loa, a trail encircling the entire island that was initiated by his father, Piʻilani.

The few recorded accounts of Hawaiian royalty visiting Kula are limited, and those that have been recorded begin around the first half of the 18th century (Fornander 1880; Kamakau 1992). This period of Maui's history has been "...characterized by a resurgence of political instability and social upheaval..." with on-going inter-island and intra-island conflict (Kolb 1997:18). Kamakau (1992) describes the Kula District during the reign of the aliʻi (chief) Kiha-

a-Piʻilani and the efforts undertaken by the aliʻi to restore food production during a famine. As a preamble to the telling of this story, both Kamakau (1992) and Fornander (1916) detail the feud and subsequent power struggle between Kiha-a-Piʻilani and his brother, Lono-a-Piʻilani, after the death of their father, high chief Piʻilani.

After inheriting his father's kingdom, Lono-a-Piʻilani began to display great displeasure towards his younger brother. After one particularly cruel incident, Kiha-a-Piʻilani escaped from the royal court and retreated to the countryside of Makawao, where he lived covertly as a farmer and took Koleamoku, a chiefess who descended from the ruling line of East Maui, as his wife. In detailing the account of Kiha-a-Piʻilani's time in Kula, Kamakau (1992:23–24) writes:

> There was a famine in Kula and Makawao, and the people subsisted on laulele, pualele, popolo, and other weeds. One night, Kiha-a-Piʻilani went to clear a patch of ferns to plant sweet potatoes, and on that same night he made a large one that would naturally require the labor of eighty men to clear. When morning came, the huge patch was noticed, an immense one indeed. The people said skeptically of this great undertaking, "Where will he find enough sweet-potato slips to cover the patch." Next day Kiha-a-Piʻilani went to Hamakuapoko and Haliʻimaile to ask for potato slips...then he made a carrier (ʻaweʻawe) of morning-flory vines, placed the bundles of slips in it, and lifted it with great strength onto his back. The sunshine beat down on his back, the ʻUkiʻukiu breeze blew in front of him, the ʻUlalena rain added its share, and intense heat reflected from the ʻulei vines.
>
> One old man remarked to another, "There must be a chief near by for this is the first time that a rainbow is spread before the trees." As they were speaking a man came from below with a huge load on his back, and they called to him to come into the house. He shifted his load, saw the old men, Kau-lani and his companion, let down his burden, and entered. Each of them gave him a bundle of popolo greens and sweet potato which he ate until he was satisfied. They asked, "Where are you going?" He answered, "I am returning to the boundary of Kula and Makawao." "Are you a native of the place?" they inquired. "Yes," he replied. They said, "There is not a native from Kula to Hamakua with whom we are not acquainted. You are a stranger." "Yes, I am a stranger." They said, "The god has revealed your identity. You are chief, Kiha-a-Piʻi-lani." He answered, "I am he. Conceal your knowledge of me and tell no one..."

Kiha-a-Piʻilani stayed in Kula for some time, until he was able to garner the support needed to dethrone his elder brother and his father-in-law, as well as the ruling chief of East Maui, Hoʻolaemakua (Fornander 1916). Kiha-a-Piʻilani developed political alliances with ʻUmi, a powerful Hawaiʻi Island chief who was the husband of his sister, Piʻikeaapiʻilani (R. Cordy 2000; Fornander 1916; Kirch 2010). ʻUmi summoned his war counselors to prepare for an invasion of Maui, ordering his district chiefs to make ready the war canoes and gather the warriors. Kiha-a-Piʻilani's forces first attacked Hoʻolaemakua and gained control over East Maui. Then he turned his attention to slaying his brother. Differences arise regarding who was ruling West Maui at the time of this invasion. Fornander (1916) writes that Lonoapiʻilani had already died and that his son Kalaninuikupuapāikalaninui was ruling West Maui. Kamakau (1992), on the other hand, contends that Lonoapiʻilani was still ruling at the time of the invasion and that, upon hearing of Hoʻolaemākua's death, he "trembled with fear of death, and died." With his successful military overthrow of his brother and the ruling chief of East Maui, Kiha-a-Piʻilani gained control over the entire island of Maui, just as his father, Piʻilani, had.

Kamakau (1992:70) documented the following account of Alapaʻinui's (a Hawaiʻi Island chief), visit to Kīhei in coastal Pūlehunui (the ahupuaʻa laying to the north of Kamehamenui), in Kula, sometime around the mid-1730s:

> Alapaʻi sailed from Kohala on Hawaii with a great company of the chiefs of Hawaii, his war leaders, warriors, and the district chiefs of the island, to the great consternation of the chiefs of Maui. But when he landed at Mokulau in Kaupo [Maui] and heard that Ke-kau-like was dying, he gave up all thought of war and wished only to meet Ke-kau-like and his [half] sister Ke-kuʻi-apo-iwa-nui. He had heard that Kamehameha-nui had been chosen ruler over Maui and he had no desire to make war upon his sister's child. He landed at Kiheipukoa with all his chiefs and fighting men, commanded by the two leaders, Ka-lani-ʻopuʻu and Keoua, who acted as spies over the district for Alapaʻi. There the great chief, Alapaʻi, son of Ka-uaua son of Mahi, had a friendly meeting with Ke-kuʻi-apo-iwa-nui and her son Kamehemeha-nui, to whom the land had descended, and with Ka-lola, Ka-hekili, and Ku-hoʻoheihei-pahu, the other children of Ke-kau-like by Ke-kuʻi-apo-iwa-nui.

Fornander (1880) related the following story of a petty chief named Kukeawe, who circa 1785, was given charge of Kahekili's hogs, which were allowed to roam freely on the Kula slopes. Kukeawe, however, abused his authority, leading to a civil unrest and ultimately his death. According to Fornander (1880:227–228):

> While Kahekili was carrying on the war on Oahu and suppressing the revolt of the Oahu chiefs, a serious disturbance on Maui had occurred which gave him much uneasiness. It appears that he had given the charge of his heard of hogs that were running in the Kula district and on the slopes of Haleakala to a petty chief named Kukeawe. This gentleman, not satisfied with whatever he could embezzle from his master's herds, made raids upon the farmers and country people of Kula, Honuaula, Kahikinui, and even as far as Kaupo, robbing them of their hogs, under the pretext that they belonged to Kahekili. Indignant at this tyranny and oppression, the country people rose in arms and a civil war commenced. Kukeawe called the military forces left by Kahekili at Wailuku to his assistance; a series of battles were fought, and finally Kukeawe was killed at Kamaole-i-kai, near Palauea, and the revolted farmers remained masters of the situation.

Because of the oppression caused by Kukeawe, the following ʻōlelo noʻeau (poetical expression) has been recorded by Pukui (1983:12): "'Ai puaʻa a Kukeawe" which is "[s]aid of a person who is not satisfied with the number of his own pigs and so robs his neighbors of theirs." Pukui (1983:12) recounted the following version of the rebellion:

> Kukeawe was a friend of Kahekili who was allowed to help himself to any of Kahekiliʻs pigs in Kula, Maui. But Kukeawe also took the pigs belonging to the people of Kula, Honuaʻula, and Kahikinui and plundered their possessions. These people rose in rebellion, led by ʻOpū, and surprised the followers of Kukeawe while they were ascending Haleakalā on the way to Kula. Kukeawe's party retreated but found their way blocked by other parties led by Kawehena, Kahoʻoluhina, and Kuheana. Kukeawe was killed and his body set up at Palauea for all to see.

Kamakau (1992) recorded that, while the battles between the forces of Kalaniʻōpuʻu and Kahekili were taking place, sightings of the first European explorers were made off the windward coast of East Maui in November of 1778.

The Arrival of Europeans and Agricultural Transformations (1778-1847)

Captain James Cook first arrived in the Hawaiian Islands in 1778. As noted above, his ships were sighted off the windward coast of Maui during the battle between Kalaniʻōpuʻu of Hawaiʻi Island and Kahekili of Maui. Although Cook did not travel to the leeward side of East Maui, where the proposed project area is located, he penned a few observations about his encounters with canoes carrying goods that belonged to Kalaniʻōpuʻu (Beaglehole 1967:476):

> Monday 30th. In the afternoon of the 30th being off the NE end of the island, several canoes came off to the Ships, most of them belonged to a Chief named Terryaboo [Kalaniopuu] who came in one; he made me a present of two or three small pigs and we got by barter from the other people a little fruit. After a stay of about two hours they all left us except six of eight who chused [sic] to remain, a double sailing canoe came soon after to attend upon them which we towed astern all night. In the evening, we discovered another island of the windward [Hawaii]...our Indian friends not chusing [sic] to accompany us, imbarked [sic] in their canoe and left us.

The arrival of foreigners to Hawaiʻi brought significant economic and cultural changes to the islands. By 1810, Kamehameha I conquered the Hawaiian Islands through military force (with the exception of Kauaʻi, which he brought under his control through peaceful negotiations) (Kamakau 1992). From 1811 until his death in 1819, Kamehameha I was economically vested in the sandalwood industry and controlled all aspects of its trade. This industry brought numerous vessels to Maui, and foreign goods would become an important aspect of the economy (Cottrell 2002). By 1820, Lāhainā was the seat of the Hawaiian government and the center of the sandalwood trade—an industry that greatly benefitted the king, but was terribly destructive to the ʻāina (land) and the makaʻāinana (commoners). It shifted the focus of the makaʻāinana from cultivating the land to working exclusively on filling the coffers of the aliʻi with the prized ʻiliahi (Hawaiian sandalwood) (Kuykendall and Day 1976; Oliver 1961). The devastation caused by the sandalwood trade left entire forests badly depleted, including in Kula District, and many chiefs, including Kamehameha I's son, Liholiho (Kamehameha II), in significant debt with foreign sandalwood traders. By 1830, however, the sandalwood trade was no longer profitable, and the entire industry collapsed (Lahaina Restoration Foundation 1972). As the sandalwood trade declined, Maui continued to experience an influx of foreigners, notably Christian missionaries and an increasing number of whalers, who viewed the islands merely as a place to stop for rest and provisioning.

This increase in whalers added more pressure to the island's forest resources, as the demand for fuelwood spiked. According to Korte (1961), the demand for fuelwood between 1824 and 1861 destroyed at least 10,000 acres of native forest. Korte (1961) also reported that a number of sawmills were harvesting koa (Acacia koa) wood before 1854 in East Makawao and Kula on Maui. Forest resources in Kula were hard hit throughout the mid-1800s, and intensified agriculture, which required expansion into the forest areas, furthered the degradation.

By the 1840s, the increase in whaling ships also created a demand for foreign produce, including wheat and potatoes. Kula's agricultural products, including wheat, "were among the early commodities to be offered for sale by Hawaiians to the foreigners" (Donham 1992:5). Concerning wheat production, Green (1844:1) commented that, although the "natives of the island [did] not wish it for their own consumption," nor do they desire the change from their favorite "fish and poi," some of them nonetheless took up wheat cultivation in Kula. J.S. Green speculated that wheat was introduced to the islands by a visitor to the Lāhainā area. He mentions that his first purchase of wheat from a Kula man was in 1835 (Green 1871). Green (1844) described wheat being grown in the valleys to allow for shelter from the occasional strong winds. He describes this wheat to be of large growth and of excellent quality, and recognized the challenge of the peʻelua (caterpillar) in the Kula region, which would often ravage the vegetation of the area resulting in famine. Regardless, from 1843 and for several years thereafter, Kula continued to produce an abundance of wheat, which was typically sold to Lāhainā or Wailuku for one dollar per bushel (Green 1844). In addition to the environmental challenges, wheat production was extremely laborious, including high cleaning costs (Green 1852). By 1852, wheat cultivation was in decline. Green (1852) reports that only a single gentleman by the name of Kupanihi continued to cultivate wheat in Kula. As wheat gradually declined, the market for foreign varieties of potatoes was on an uptick.

Prior to the 1830s, the only available potatoes were those of the native variety (ʻuala maoli). But with new varieties being transported by ship and exchanged with native farmers, demand for foreign varieties (ʻuala haole or ʻuala kahiki), specifically Irish potatoes, led to a production boom that spread both locally and eventually to the continental U.S. (Kuykendall 1938). Gilman (1854) reported that three varieties of Irish potatoes were being grown in Hawaiian soil, including the red, white, and the long pink-eye variety. According to Thrum, "a large red variety was said to have been introduced by Captain Joseph Maughan, who gave some to Boki, who in turn gave some to Hoapili of Maui, where they flourished…" (Thrum in Barrere 1975:45). However, the red potato was favored because it could withstand the harsh conditions associated with the long voyage between Hawaiʻi and North America. In a report submitted to the Royal Hawaiian Agricultural Society in 1854, G. Gilman (1854:138) related information about the beginnings of this industry:

> …sometime previous to 1830 a few Irish potatoes had been left here, it is presumed, by some whaleship, and an "old resident" informs me that from '30 to '35 they used to consider themselves fortunate in getting an occasional calabash full, from some of the valleys back of Lahaina. A few found their way to Wailuku, on this island, and for years there was but one patch cultivated at that place. From that patch the seed is supposed to have been taken to Kula, or as it is sometimes called, the "Potato District," which is that belt of land lying on the side of the mountain Hale a ka la on east Maui, about 2000 feet above the sea and extending from Makawao to and inclusive of Honuaula, or Mr. Torbert's plantation.

Green (1844:1) described the potato growing region in Kula District in the following account, which was published in The Polynesian in 1844:

> 1st There is a strip or belt of land of from two to four miles in width, I should judge, for no measurement has been made—gradually ascending and terminating at the base of Haleakala, the high mountain of East Maui. The upper part of this belt is, I presume, in the region of frost, it being 4,000 feet or more above the level of the sea. This land is higher up in the mountain than the land occupied by the people, only now and then a house being seen, and these occupied temporarily by canoe makers. This belt of land extends from Makawao, say from Mr. McLane's sugar plantation to Honuaulu [Honuaʻula], some fifteen miles I should judge. 2d. The land below the belt above described, among the habitations of natives, and where they cultivate the sweet potatoe, banana and sometimes dry kalo, is capable, much of it, being cultivated with wheat. Nearly all the wheat that has been raised was produced here. 3d . The best land which I have seen in Kula, for wheat or any thing else, is the land which produces the Irish potatoe—This is a strip of land commencing near the middle of Kula, and extending to Honuaula. It commences about mid-way from the habitations of the natives and the mountain, and may be three-fourths of a mile in width.

Although small-scale potato growing was undertaken throughout Maui to supply visiting ships, farmers in Kula District were some of the first to pioneer the large-scale cultivation of Irish potatoes (Kuykendall 1938). In describing its extent in 1846, James Jackson Jarves (in Kuykendall 1938:313) wrote:

> It ranges along the mountain [Haleakala] between 2000 and 5000 feet elevation, for the distance of 12 miles. The forest is but partially cleared, and the seeds put into the rich virgin soil. The crop now

> in the ground is immense. The fields being all in blossom have a fine appearance, spreading as they do, over the broad surface of the mountain.

The colored version of Hawai‘i Registered Map No. 1268 prepared by surveyor F.S. Dodge in 1885 depicts this belt of agricultural land along the western slopes of Hale‘akula, labeling the area as “Good Agricultural Land: Planted Corn, Irish Potatoes, etc.” (Figure 13). The western portion of Survey Area 1 of the current project area is within this agricultural belt, suggesting that potatoes and other crops were likely cultivated within the project area during the middle of the 20th century.

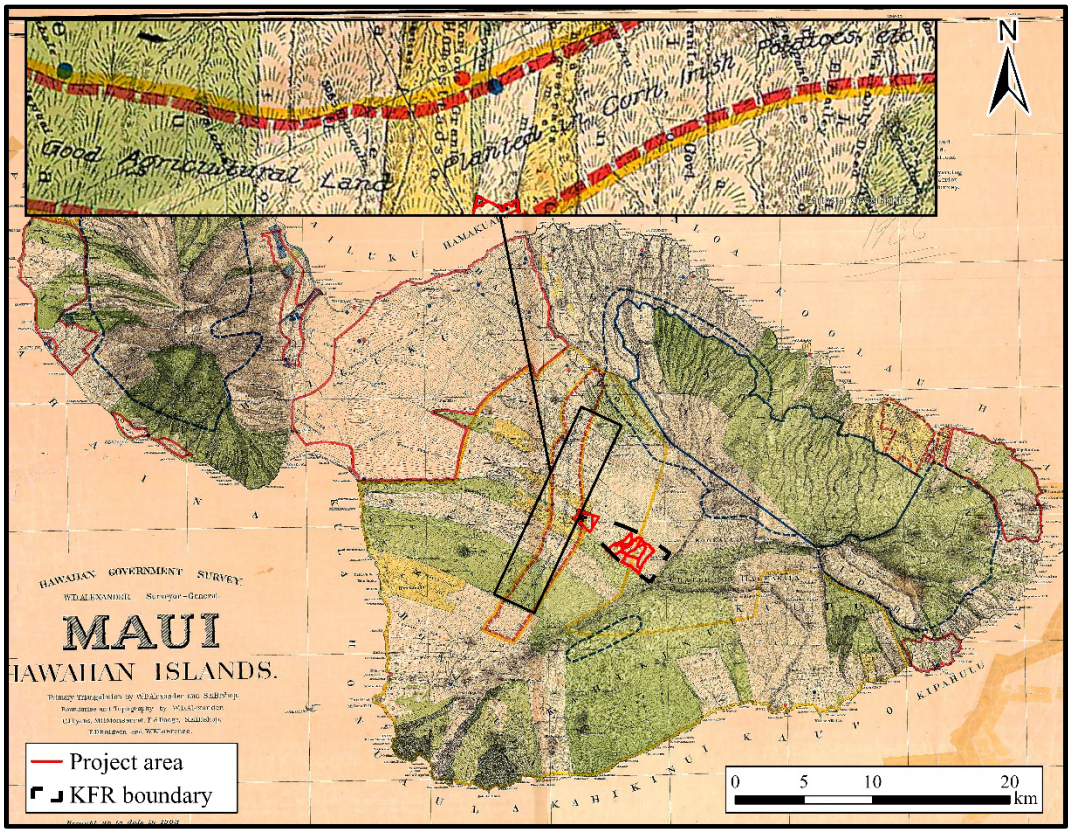


Figure 13. Hawai‘i Registered Map No. 1268 by Dodge (1885) depicting the western portion of the project area within “Good Agricultural Land.”

By the fall of 1849, the stimulating effects of the California Gold Rush—and its associated neglect of agriculture in California—had created an agriculture boom in the Hawaiian Islands. This led to intensified efforts to grow vegetables that could be exported, particularly Irish potatoes. The demand led to more native residents either taking up farming Irish potatoes or relocating to places like Kula or Honua‘ula, which were the major potato production centers on Maui (Kuykendall 1938). This resulted in a population influx into Kula. During this time, native farmers cultivated, harvested, barreled, then hauled each barrel to the coast, which was between ten to twelve miles from the fields (Gilman 1854). Kuykendall (1938:313) reported that “...the potatoes were carried down to the shore and taken to Lahaina or were sold directly to ships which called at Kalepolepo” in coastal Kīhei. The native farmers either bartered or sold each barrel for 50 cents, which was, in turn, sold to visiting ships for between $1.50 upwards of $3.00 per barrel. By 1847, carts and pack bullocks helped to haul the potatoes to the coast; however, the use of these tools was not widespread amongst the native farmers. In quoting an article printed in the November 24th, 1849, edition of the newspaper The Polynesian, Kuykendall (1938:321) conveys:

> The call for [potatoes] is loud and pressing, as some vessels bound for California have taken as many as a thousand barrels each. The price is high, and the probability is that the market can not be supplied this autumn. Kula, however, is full of people. Strangers from Wailuku, Hamakua and Lahaina are there preparing the ground and planting, so that if the demand from California shall be as urgent next spring as it is now the people will reap a rich harvest... They often repeat the saying of a foreigner, who, after having visited the mines of California, came back to Maui quite satisfied,

> and said to his neighbors at Waikapu, "California is yonder in Kula. There is the fold without the fatigue and sickness of the mining country."

Because of the agricultural stir caused by the California Gold Rush, Kula became known by the epithet "Kalifonia" and "Nu Kalifonia" (Kuykendall 1938:321). Between 1848-1849, the first Hawaiian-grown Irish potatoes were carried on the American schooner Boston by an old whaleman, Captain Cole to the shores of San Francisco. Exporting potatoes proved to be lucrative. Gilman (1854) reported that a single barrel of Hawaiian-grown potatoes could be sold in California between $40 or $50 per barrel. The exporting of Irish potatoes to California, which peaked between 1849 to 1851, was considered by Gilman (1854:139) to be "the most important and largest branch of our exporting trade." The local and international demand for Irish potatoes significantly outpaced production (Gilman 1854). In an attempt to keep up production, Chinese farmers were brought in. They added vegetables such as corn, beans, cabbage, onions, (more) wheat, and cotton to the crops grown at larger scale in the islands (Kolb et al. 1997). Meager crops, depleted fields, poor planting practices, and untimely drought conditions eventually devastated this export-focused agricultural industry. Despite efforts to market Hawaiian potatoes under different guises, the once sought-after Hawaiian-grown Irish potatoes soon developed a less than favorable reputation on the continental U.S. Unable to recover, by 1854 the international boom for Irish potatoes was a bust and production shifted to domestic markets (Gilman 1854).

The Mahele and Land Commission Awards (1848-1851)

As the potato boom swept through Kula during the mid-1800s, the Hawaiian Kingdom had become an established center of commerce and trade in the Pacific, recognized internationally by the United States and other nations in the Pacific and Europe (Sai 2011). As Hawaiian political elites sought ways to modernize the burgeoning Kingdom, and as more Westerners settled in the Hawaiian Islands, major socioeconomic and political changes took place, including the formal adoption of a Hawaiian constitution by 1840, the change in governance from an absolute monarchy to a constitutional monarchy, and the shift towards a Euro-American model of private land ownership. This change in land governance was partially informed by ex-missionaries and Euro-American businessmen, who were hesitant to enter business deals on leasehold lands that could be revoked from them at any time. Kauikeaouli (Kamehameha III), through intense deliberations with his high-ranking chiefs and political advisors, separated and defined the ownership of all lands in the Kingdom (King n.d.). They decided that three classes of people each had one-third vested rights to the lands of Hawai‘i: The Mō‘ī (king, high chief), the ali‘i and konohiki (chiefs, lesser chiefs), and the hoa‘āina (commoners, tenants).

In 1846, King Kauikeaouli formed the Board of Commissioners to Quiet Land Titles (more commonly known as the Land Commission, or Māhele ‘Āina) to adopt guiding principles and procedures for dividing the lands, grant land titles, and act as a court of record to investigate and ultimately award or reject all claims brought before them (Bailey in Commissioner of Public Lands 1929). All land claims, whether by chiefs for an entire ahupua‘a or ‘ili kūpono (nearly independent ‘ili land division within an ahupua‘a, that paid tribute to the ruling chief and not to the chief of the ahupua‘a), or by hoa‘āina for their house lots and gardens, had to be filed with the Land Commission within two years of the effective date of the Act—February 14, 1846—to be considered. This deadline was extended several times for chiefs and konohiki, but not for hoa‘āina (Soehren 2002).

King Kauikeaouli and some 245 chiefs spent nearly two years trying, unsuccessfully, to divide all the lands of ai‘i amongst themselves before the whole matter was referred to the Privy Council on December 18, 1847 (King n.d. Kuykendall 1938). Once Kauikeaouli and his chiefs accepted the principles of the Privy Council, the Māhele ‘Āina was completed on March 7, 1848, in just forty days. The names of nearly all of the ahupua‘a and ‘ili kūpono of the Hawaiian Islands, as well as the names of the chiefs who claimed them, were recorded in the Buke Māhele (Māhele Book) (Buke Māhele 1848; Soehren 2002). As this process unfolded, King Kauikeaouli, who received roughly one-third of the lands of Hawai‘i, realized the importance of setting aside public lands, which could later be sold to raise money for the government, as well as be purchased by his subjects in fee simple in the future. Accordingly, the day after the division, when the name of the last chief was recorded in the Buke Māhele, the King commuted about two-thirds of the lands awarded to him to the government (King n.d.). Unlike Kauikeaouli, the chiefs and konohiki were required to present their claims to the Land Commission to receive their Land Commission Awards (LCAs). The chiefs who participated in the Māhele were also required to provide commutations to the government of a portion of their lands, in order to receive a Royal Patent giving them title to their remaining lands. The lands surrendered to the government by the King and chiefs became known as "Government Land." The lands personally retained by King Kauikeaouli became known as "Crown Land." Lastly, the lands received by the chiefs became known as "Konohiki Land" (Chinen 1958:vii; 1961:13). To expedite the work of the Land Commission, all lands awarded during the

Māhele were identified by name only, with the understanding that the ancient boundaries would prevail until the lands could be formally surveyed.

In 1848, the chiefess, Ane Keohokālole (mother of Queen Liliʻuokalani and King David Kalākaua), was awarded roughly 5,067 acres in Kamehamenui (also identified as Kamehame 1), Kealahou 3rd, and Kealahou 4th (Commissioner of Public Lands 1929). Kamehamenui was awarded as parcel 6 of LCA 8456, whereas Kealahou 3rd and 4th were awarded to her as parcel 21 of LCA 8452. A decade later, in 1858, Kamehamenui was conveyed to Keohokālole via Royal Patent Grant 4388 and Kealahou 3rd and 4th were conveyed via Royal Patent Grant 7453. The location of Keohokālole's awards in shown in Figure 14. A year later, through an act of the legislature, adjustments of district boundaries "...for taxation, educational, and judicial purposes..." would begin consolidating the traditional districts of Hāmākua Loa, Hāmākua Poko, Hāliʻimaile, Makawao and Kula, to be renamed the Makawao District (King 1935).

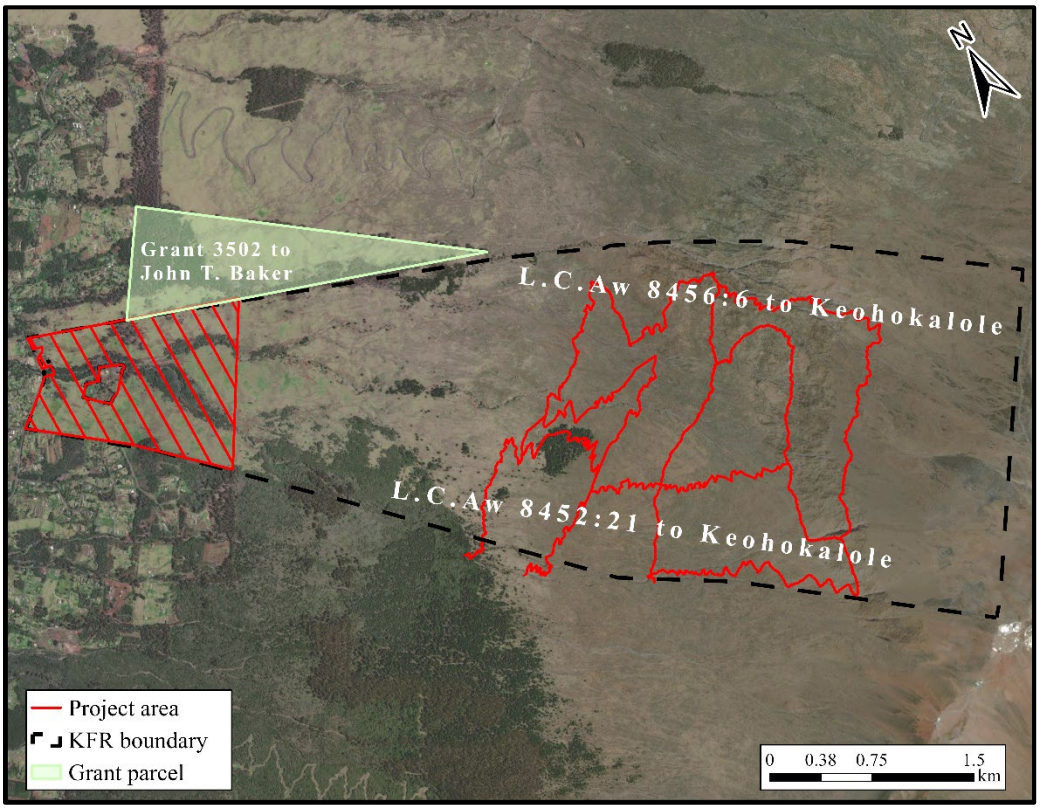


Figure 14. Google Earth™ map showing location of LCAw and Grants in and adjacent to the project area.

Kuleana Awards

As the King and his aliʻi and konohiki claimed large tracts of land via the Māhele, questions arose regarding the protection of rights for the native tenants. To resolve this matter, on August 6, 1850, the Kuleana Act (also known as the Enabling Act) was passed, clarifying the process by which hoaʻāina (native tenants) could claim fee simple title to any portion of lands that they physically occupied, actively cultivated, or had improved (Garavoy 2005). The Kuleana Act also clarified access to kuleana parcels, which were typically landlocked, and addressed gathering rights within an ahupuaʻa. Lands awarded through the Kuleana Act were and still are referred to as kuleana awards or kuleana lands. The Land Commission oversaw the program and administered the kuleana as Land Commission Awards (Chinen 1958).Native tenants were required to register in writing with the Land Commission if they wished to claim their lands. Upon registration, they were assigned a number for each claim, and that number (the Native Register) was used to track the claimant through the land claims process. The native tenants registering their kuleana were then required to have at least two individuals (typically neighbors) provide testimony to confirm their claim to the land. Those testimonies given in Hawaiian became known as the Native Testimony, and those given in English became known as the Foreign Testimony. Upon provision of the required information, the Land Commission rendered a decision, and if successful, the tenant was issued the LCA. Finally, to relinquish any government interest in the

property, the holder of a LCA obtained a Royal Patent Grant from the Minister of the Interior upon payment of the commutation fee.

The 1929 Indices of Awards identifies the names of two individuals who were awarded kuleana lots in Kamehame; however, it does not indicate if the awarded lots were in Kamehamenui (also Kamehame 1) or Kamehameiki (Kamehame 2). Similarly, the names of six individuals are listed as receiving lands in Kealahou; however, the indices does not specify which of the four Kealahou their lands were located in (Commissioner of Public Lands 1929). As such, the information in the indices does not provide sufficient data to determine the exact location of these kuleana. The issue of locating these kuleana is further compounded by a lack of historical maps that show the location of any kuleana awards in both Kamehame and Kealahou. The names of the eight individuals who were reported to have received kuleana lands in Kamehame and Kealahou are listed below in Table 4.

Although locational information for the kuleana awards in Kamehame and Kealahou is lacking, a review of geospatial data of kuleana awards (found on the Office of Hawaiian Affairs Kīpuka Database), for the adjacent ahupuaʻa in Kula shows that the kuleana awards are distributed between 2,200 and 4,000 feet elevation. As such, if there were any kuleana in Kamehamenui and Kealahou 3rd and 4th, they would have likely been in the western portion of the project area or extending northwest toward present-day Kula Highway.

Table 4. List of *Kuleana* awardees in Kamehame and Kealahou.

Ahupuaʻa	*ʻIli ʻĀina*	*Awardee*	*LCAw.*	*Royal Patent Grant*	*Acres*	*No. of parcels awarded*
Kamehame	Helani	Kuapuu	9027	4771	2.68	1
Kamehame	Peeluakolo	Kalaulaula	8816	5145	8.33	2
Kealahou	n/a	Kekapai	8653	5176	10.25	6
Kealahou	Hanamulei		"	4752	0.69	1
Kealahou	Kaopupololu		"	"	0.58	1
Kealahou	Kaulaula		"	"	4.26	2
Kealahou &	n/a	Manaole	10145	6907	7.01	3
Waiakoa	Hanamulei		"	"	2.30	1
Kealahou						
Kealahou	n/a	Naha	10482	4817	1.40	1
Kealahou	Hanamulei		"	7883	4.78	1
			"	"	2.60	1
Kealahou	Aipuaa	Pii	5488	5510	4.38	2
Kealahou	Pawali		"	"	4.04	2
Kealahou	Hanamulei	Makahiki	10144	3396	2.87	1
Kealahou	Kunanaualii		"	5396	0.84	1
Kealahou	Paliku		"	"	6.71	1
Kealahou	Kaulaula	Kapaole	8654	7967	2.11	1

Government Land Grants and Land Ownership Changes Post-Māhele

In conjunction with the Māhele, the King also authorized the issuance of Royal Patent Grants to applicants for tracts of land, larger than those generally available through the Land Commission. The process for applications was clarified by the "Enabling Act," which was ratified on August 6, 1850. The Act resolved that portions of the Government Lands established during the Māhele of 1848 should be set aside and sold as grants ranging in size from one to fifty acres at a cost of fifty cents per acre. The stated goal of this program was to enable native tenants, many of whom were not awarded kuleana parcels during the Māhele, to purchase lands of their own. Despite the stated goal of the land grant program, this provided the mechanism that allowed many foreigners to acquire large tracts of Government Lands. Unlike in the kuleana claims process, where claimants stated their use of the land, the land grant records are silent regarding the grantees' intended use. The Royal Patent deeds and survey notes do contain some limited information about geographical features, vegetation, and survey markers, but they generally do not say anything about improvements to the land or land use. As Kamehamenui and Kealahou 3rd and 4th were an aliʻi award, no government land grants were sold in these ahupuaʻa. However, several land grants were sold in the adjacent ahupuaʻa of Kamehameiki-Pūlehuiki and Waiakoa.

In November of 1890, John Tamatoa (given name Timoteo) Baker purchased the 268-acre Grant 3502 in Pūlehuiki and Kamehameiki, along the northwest boundary of the subject parcel (Office of Hawaiian Affairs 2018; see Figure 14). Born on Oʻahu in 1852, Baker (who was of part Hawaiian, Tahitian, and English descent) attended

Lāhaināluna and shortly after became involved in plantation work on Maui. Baker later became attached to the court of King David Kalākaua, and in 1884 became Captain of the king's household guards and a member of the Privy Council. When the statue of King Kamehameha I was commissioned in 1879, Baker and his brother Robert Hoapili Baker served as models for the sculptor. Between 1887 and 1893, during Baker's acquisition of the 268-acre land grant, he served as High Sheriff and, later, Governor of Hawai'i Island. Throughout his lifetime, Baker was a noted scholar in the both the English and Hawaiian languages and was involved in Kingdom politics (Honolulu Advertiser 1921).

In the neighboring ahupua'a of Waiakoa, sixteen individuals purchased twenty individual grant parcels. None of the grant parcels sold in Waiakoa were adjacent to the subject parcel. Of the sixteen individuals who purchased grant parcels, thirteen had Hawaiian surnames (Kaai, Kaauwai, Kahoopaki, Kahue, Kaneala, Kaniau, Kapai, Kawaalau, Maia, Napela, Nauliuli & Kahina, Nauliuli & Kamalo) and the remaining three were sold to foreigners, including D.P. Eldredge, Antone de Medirsh Pirsh, and Randall von Tempsky. These grants were sold between 1853 and 1892, and they ranged in size from 0.84 acres to 113 acres.

According to an unpublished manuscript of the Kama'āina Carousel provided to ASM staff by the von Tempsky family (von Tempsky n.d.), following the Māhele, Kamehamenui and Kealahou 3rd and 4th were placed into the estate of Keohokālole, with Charles R. Bishop named as the trustee of the queen's estate. Bishop sold Kamehamenui and Kealahou 3rd and 4th to James Louzada for $800. By September 1864, Louzada sold half of his interest to his brother-in-law, William Henry Cornwell, for "one dollar and love."

Additional research into W. Henry Cornwell revealed that he was born in New York in 1842, and, at the age of fifteen, he arrived in Hawai'i with his father, also named William Henry Cornwell. The Jr. Cornwell married New York native Adelia Louzada, who was the younger sister of James Louzada. James Loudaza had preceded Henry Cornwell in coming to Hawai'i, and during that time, he helped start the Pu'uloa Sheep Station on Hawai'i Island. After the elder Cornwell arrived in Hawai'i (c. 1857), the father-son pair started the Waikapu Sugar Plantation and later the Haiku, Makee, and Campbell plantation. In 1876, when the elder Cornwell retired, the junior Cornwell, along with G. W. Macfarlane, purchased the Waikapu Sugar Plantation. After selling his share in that plantation, Henry Cornwell leased a large tract of land in Kula, Maui, from King David Kalākaua for ranching purposes (Hawaiian Gazette 1903b). The article does not specify exactly where in Kula Henry Cornwell conducted his ranching operations; however, it may be within the project area.

The unpublished von Tempsky manuscript (von Tempsky n.d.) clarifies that on May 10, 1888, a Kapua Louzada and four of the Cornwell heirs sold their interest in the property to Adelia Louzada Cornwell. In this same year, these lands were sold to Louis von Tempsky for $8,000.

The Von Tempsky Legacy and Erehwon Cattle Ranch

The land in and surrounding the proposed project area is deeply connected with the brothers Louis and Randal von Tempsky, the sons of Prussian noble Gustavus Ferdinand von Tempsky, and his wife Amelia Ross (nee Bell). The eldest of the brothers, Randal, was born in 1856 in Bluefields, Nicaragua (von Tempsky 1979). After a short while, the family relocated from Nicaragua to Glasgow, Scotland, where Louis was born two years later in 1858 (Siddall 1917; von Tempsky 1979). In 1879, at the age of 21, Louis (Figure 15) was the first of the brothers to come to Maui, stopping on the island while en route to Alaska for the gold rush. A year later, Randal joined his brother, and they both established themselves in ranching. On his arrival, Louis found himself at Captain James Makee's Rose Ranch (now 'Ulupalakua Ranch), which had been sold to James Isaac Dowsett a year prior (Taylor 1949a; 1949b; von Tempsky 1979). It was there that Louis became involved with cattle and pasturage.

As for Randal, he managed Burkhardt's estate, and in 1887 became a partner in the Kaho'olawe Ranch Company (Molina 2021; von Tempsky 1979). In 1888, Louis acquired 5,000 acres of Kula lands from Adelia Cornwell for $8,000. With these lands, Louis established Erehwon ('nowhere' spelled backwards) Cattle Company and served as the manager. In 1891, Louis married Amy Wodehouse (the daughter of Major James H. Wodehouse), and together they had four children: Armine, Gwendolyn, Lorna, and Errol. A year later, Randal married Dora Dowsett (Figure 16), and they had two children of their own: Alexandrea and Robert (Molina 2021; Hawaiian Star 1898).

Preceding the land purchase, in 1886 Louis formed a ranching partnership with an Australian named William Williams. But, by 1896, this partnership was dissolved (Honolulu Advertiser 1922; Independent 1896). Louis continued to oversee the lands of Erewhon up until 1897, at which point he sold his portion of shares to Randal and was hired as the manager of Haleakalā Ranch in 1898. Prior to his employment with Haleakalā Ranch, Louis had purchased Burchardt Dairy (Maui News 1922). During Louis's management of Erehwon, he leased acreage to truck farmers who grew crops of corn, potatoes, and beans that were shipped to the west coast. These leases remained in

effect years after Randal's death and well into Dora's overseeing of the ranch (von Tempsky n.d.). In 1889, Louis published his intent to fence off portions of Erehwon Cattle Station situated "along the boundary of Waiakoa and Kealahou 3 and 4 from Puuluoho to the Clinkers" in The Hawaiian Gazette newspaper (1889:10). Louis remained at Haleakalā Ranch, tending cattle, cows, horses, pigs, sheep—as well as working to reforest the land—until his death in 1922 (Molina 2021).

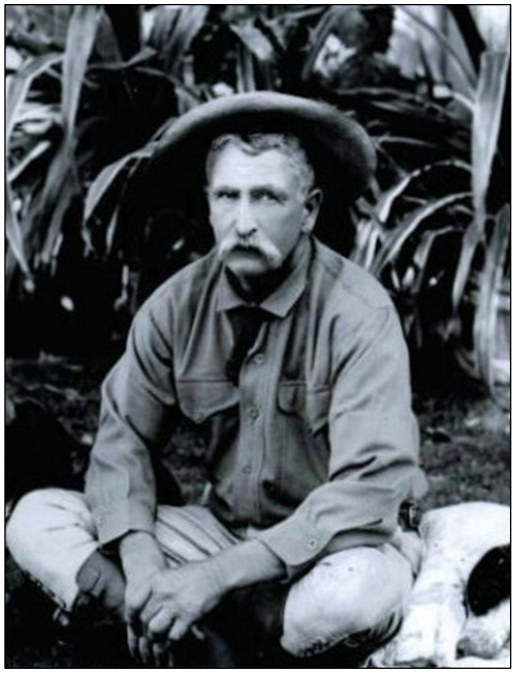


Figure15. Louis von Tempsky. Photo courtesy of Hawaii Cattlemen's Council.



Figure16. Dora Dowsett. Photo courtesy of von Tempsky family collection.

Upon purchasing the land in 1897, Randal became the sole administrator of Erehwon Cattle Station. But, just a year later, he suffered a sudden brain aneurysm and passed away. He was "buried near a grove of trees above the house" on a hillside on Erehwon Ranch (Hawaiian Gazette 1898; Hawaiian Star 1898). Following Randal's death, his wife, Dora Melville Dowsett von Tempsky, took over management of the ranch. Dora, being a socialite, was fond of hosting social events at her Erehwon home, and in 1900, she hosted a "big feast to her tenants on the Erehwon Cattle Station in Kula, to which over 100 people" attended (Hawaiian Star 1900; von Tempsky 1979). The ranch first functioned as a dairy, where foreman Antone Gouveia would "hookup the wagon and hauled butter to Kahului" that was sold locally at the Maui Soda and Ice Works (Molina 2021; Maui News 1905).

Mrs. von Tempsky expanded from commercial butter production into the realm of diversified agriculture in the early 1900s. It was around this time that potatoes were being cultivated throughout the property, although many were washed away during a large storm that occurred in 1901 (Independent 1901). During March of the following year, portions of the ranch were set aside by Mrs. von Tempsky to allow for a preliminary study of the Quick Blight disease that had been affecting the success of Irish potato cultivation in the islands since the late 1800s (Hawaiian Gazette 1903a; U.S. Department of Agriculture 1903). The experiment was conducted by the United States Department of Agriculture agricultural experimentation station and involved the experimental planting of forty-five potato varieties in three distinct plots throughout Erehwon Cattle Station, which were described in The Hawaiian Gazette (1903a) as follows:

> . . . The land chosen was under the control of Mrs. Randal Von [sic.] Tempsky and was situated at an elevation of between 3,500 and 4,000 feet. Three plots were laid out for the experiment. Plot 1 was in a gulch partly protected from the wind; the soil was rich and the previous year a crop of beans had been planted there. Plots 2 and 3 were on a ridge unprotected from the wind. The soil was of fair quality and had been planted to corn and potatoes for a number of seasons. Plots 2 and 3 were adjacent. In Plots 1 and 3 the soil was dug to the depth from 5 to 7 inches (the usual depth for this district); that is Plot 2 was dug to the depth of 12 inches bringing up to the surface some of the yellow sub-soil. The 45 varieties of potatoes used in the experiment were Northern Beauty, Gem of Aroostook, Early Harvest, Early Northern, New Queen, the Minister, Carman No. 1, Green

> Mountain, Beauty of Hebron, Pearl of Savoy, Black Christy, White Elephant, Dakota Red, Early Rose, Early Fortune, Early Six Weeks, L X L, Pride of the South, The June, Acme, Bovee, Breck's Chance, Burpee's Extra Early, Cambridge Russet, Early Ohio, Early Michigan Fillbasket, Honeoye Rose, Hammond's Wonderful, Irish Cobbler, Long Keeper, Carman No. 3, Mill's Banner, Mill's Prize, Maui's Thoroughbred, Manun's Enormous, Nott's Peach, Prolific Rose, Rural New Yorker No. 2, Sir Walter Raleigh, Stephens, Steuben, Twentieth Century, Uncle Sam, and Wonderful Clay Rose.

In 1906, management of the cattle station transferred from Antone Gouveia to George Copp (Honolulu Advertiser 1906). Around this time, Erehwon's butter, produced by hand-milking rather than with the aid of a milking machine, fetched "forty-five cents a pound, which was an abnormal price for butter in those days," and they produced roughly 800 pounds of butter per week (von Tempsky 1979:12). In 1911, Mrs. von Tempsky initiated the construction of a dairy barn (Figure 17) to accelerate the production of butter, the development of which, according to the Maui News (1912) was completed in 1912:

> The dairy barn of Mrs. Dora von Tempsky is completed. It is a large and dairy building. The floor is cemented, and the yard is paved with stones to prevent the cows from bringing filth into the barn. The many patrons of this dairy will be pleased to learn that the butter is made in a neat and sanitary condition.



Figure 17. Erehwon dairy barn situated to the right of fencing ca. 1980s. Photo courtesy of von Tempsky family collection.

By the latter part of 1911, Kula remained immersed in drought, which—combined with the spread of blight—resulted in a scarcity of potatoes (Maui News 1911). At Erehwon, like most of Kula, water was insufficient and a scarce commodity, so dams were constructed in the gulches to capitalize on water security. As described by Robert "Boy" von Tempsky (Randal and Dora's second child) (1979:10), water catchment efforts in the early part of the 1900s were quite involved:

> We used to dam up these gulches and—small dams, so we wouldn't collect too much silt in each one. And we used to have runs at least three or four times a year. These would run and fill these dams up. And there was only one that was saved for the house. When that went dry, we had to move out. So we had to watch everything, of course, naturally. There wasn't any irrigation of plants or anything else. Just what the Old Man on top gave us, that was all. (laughter) And then the pipeline was put in in 1912. ing else. Just what the Old Man on top gave us, that was all. (laughter) And then the pipeline was put in in 1912.

Though the pipeline helped, according to Hosmer (1912:277), Mrs. von Tempsky felt that more needed to be done, so in 1913 she had a water tunnel constructed in the lands above Erehwon:

> Kula is unfortunate in the scarcity of its natural supplies of water. Between the battery of small springs at Polipoli and the Waihou Spring on the boundary of the government land of Makawao, on the Haleakala Ranch, 10 miles or more distant, there is, save for the intermittent flow from a tunnel constructed by Mrs. Dora von Tempsky above Erehwon, no living water anywhere in the district. The local water situation as regards domestic supply has, of course, been relieved in the last two years by the construction of the Kula pipe line, but that does not change the lack of local sources of supply.

Boy von Tempsky was born in 1896. At the time of Randal's passing, he was only two years old, however, like his father, he had a passion for ranching. Around 1914, the management of Erehwon was transferred to Boy from his mother Dora. At age 17, Boy began working to transform the dairy ranch into a cattle ranch because the competition from California butter arriving in Hawai‘i was fierce due to the increased importation California butter to Hawai‘i. Boy continued to diversify with the cultivation of various corns, beans, cabbage, potatoes, and onions on about 400 acres of land (Molina 2021). By 1916, the ranch was producing prize-winning crops. Placing first and second at the annual Maui County Fair's agronomy competition for Maui red beans, calico type, and white navy beans and taking first place for flint shelled corn and second for their entry in the division of pasture grasses and legumes (Maui News 1916). In 1917 Boy sold their Jersey-Holstein cross cattle and purchased fifty heads of Hereford stock from Hawai‘i Island-based, Parker Ranch (Star-Bulletin 1967). At this point, Boy had built a successful beef production at Erehwon, and he was eventually able to make it rentable (Figure 18). By 1919, Boy married Mary "Mamie" Sophia Scharder, who would follow in her mother-in-law's footsteps and host social events at their Erehwon home (Molina 2021).



Figure 18. Cattle ranching on Erehwon lands in Kamehamenui. Photo courtesy of von Tempsky family collection.

Boy was also involved with ‘Ulupalakua Ranch as an assistant manager. Between 1920 and 1929, he established a successful slaughtering operation at Erehwon, and by 1931, ‘Ulupalakua Ranch was the first to lease land from Erehwon. Under ‘Ulupalakua Ranch, Erehwon became a complete ranch: raising, slaughtering, shipping, and selling beef cattle to the market in Honolulu. Eventually, foreign cattle imports started making their way to Hawai‘i and began to encroach upon Erehwon's local beef market share. This prompted the transition from breeding, killing, and selling cattle to a new method of feeding and raising younger animals into the grading of beef under federal standards. At this point, cold storage facilities began to emerge on the ranch (Molina 2021).The management of ‘Ulupalakua soon lost interest in the land Erehwon offered because it was a burden to transport cattle from a detached piece of land to the rest of ‘Ulupalakua Ranch. Upon ending this lease, Boy leased Erehwon to Haleakalā Ranch, which—being adjacent—did not face the same transportation obstacles as ‘Ulupalakua Ranch. Boy eventually worked at Kaupo Ranch, where he was contracted for five years to help pull the ranch out of financial troubles (Molina 2021).

The lands of Erehwon Ranch were extensively utilized under the management of the von Tempsky family, ranging from dairy and cattle ranching to diverse vegetable farming and even as a place of social leisure. Indeed, Alexa Zabriskie, Boy's sister, managed the exclusive Puʻu Lani Ranch Hotel, which was situated on Erehwon lands on the slopes of Haleakalā (Honolulu Star-Bulletin 1948). Erehwon was also known for being a rest stop for World War II soldiers, who took to signing their names and leaving photographs on a wall there (Molina 2021). When Boy died in 1976, management of Erehwon went to his son, Robert Gordon "Ski" von Tempsky Jr., who proposed a tramway through Erehwon Ranch lands up to Haleakalā Crater. This idea was met with strong opposition, and the proposal was abandoned. Finally, in 1993, Ski put the Erehwon Ranch lands up for sale, in order to ease the burden of future estate taxes (Honolulu Advertiser 1993).

Road Construction in Kula

Ala Hele (a Hawaiian term referring to trails and byways) are the links that connect communities to cultural and natural resources within and between an ahupuaʻa. In Precontact times, these trails were for foot traffic. Later, with the introduction of horses and cars, these trails were modified and/or made into vehicular roads. The ala loa is a coastal trail encircling most of the island and the ala nui aupuni (Government Road) is like the ala loa in that it encircles the island, but is situated mauka (inland) of the coastal area (Apple 1994). Through historical map research, a basic understanding of which trails and roads were utilized within the project area (and vicinity) has been identified.

Hawaiʻi Registered Map No. 1268, prepared by surveyor F.S. Dodge in 1885, depicts the "Haleakalā Trail" extending along the eastern boundary of the subject parcel (Figure 19). This trail originates in Makawao, and then ascends the leeward slopes of Haleakalā in a southeasterly direction until it reaches the crater's edge in Kalialinui Ahupuaʻa, located to the north of the project area. The trail continues south, where it meanders along the mauka boundary of Pūlehunui, Kamehamenui, and Kealahou 3rd and 4th before making an easterly turn into the crater near Pākaoao (also known as White Hill). This 1885 map also shows a secondary branch of the Haleakalā Trail extending to the upper boundary of Kalialinui Ahupuaʻa.

Additionally, Dodge's 1885 map shows the alignment of the ala nui aupuni, a Government Road which encircles the island, but situated mauka from the coast, through the Kula District. This road was known as the Kula Government Road and, at that time, was the only means of moving resources from Kula across various ahupuaʻa (see Figure 19). In the early 1890's, brothers Randal and Louis von Tempsky were heavily involved with government agencies, such as the Makawao Road Board, the board of Fence Commissioners, and Louis as a government agent for homesteads (Thrum 1892; 1893; 1894). In 1891 correspondence between Randal, as chair of the Makawao Road Board, and the Interior Department proposed to open roads through the Waiakoa Homesteads, thus, starting the construction of a series of new road in Kula. Two years later, when Louis joined the Makawao Road Board, the Department of Interior decided to adopt these proposals (HSA 1891; 1893). Various articles were published in newspapers indicating the construction of a new Kula homestead road, or the upper Kula Road.

The Honolulu Advertiser (1892:6) wrote, "The Makawao Road Board have done fine work on the Kula road as far as Pulehu iki." The construction of roads happened in phases, and in 1895, an agent of the Interior Department accompanied members of the Makawao Road Board to examine the roads that intersected Kula homesteads. Unfortunately "he found the grades bad and the roads poor," which would push completion of these roads further back (Honolulu Advertiser 1895). Finally in 1897, The Hawaiian Star (1897:1) recorded a completed section of this road:

> The new government road to run through the Kula corn fields to Makawao is now completed from a point on the old road below Younge Hee's Kaonoulu ranch to a point near R. von Tempsky's house, Waiakoa. This road is much needed and when fully completed will make travel through the cornfields comparatively easy.

The lower and upper Kula roads run parallel to each other through the majority of the Kula Corn Fields (see Figure 19). The upper Kula Road is situated right below the proposed project area and is known today as Kekaulike Avenue. This name change was designated by road supervisor H. L. Holstein in 1938. The Honolulu Star-Bulletin (1938:9) reported on the origin of this name:

> The road variously known as the Upper Kula road and the Kula homestead road, from its junction with the crater road to the junction of the upper and lower Kula roads, becomes Kekaulike Ave. Kekaulike was the next to the last Maui king and ancestor of many of Maui's leading chiefs.

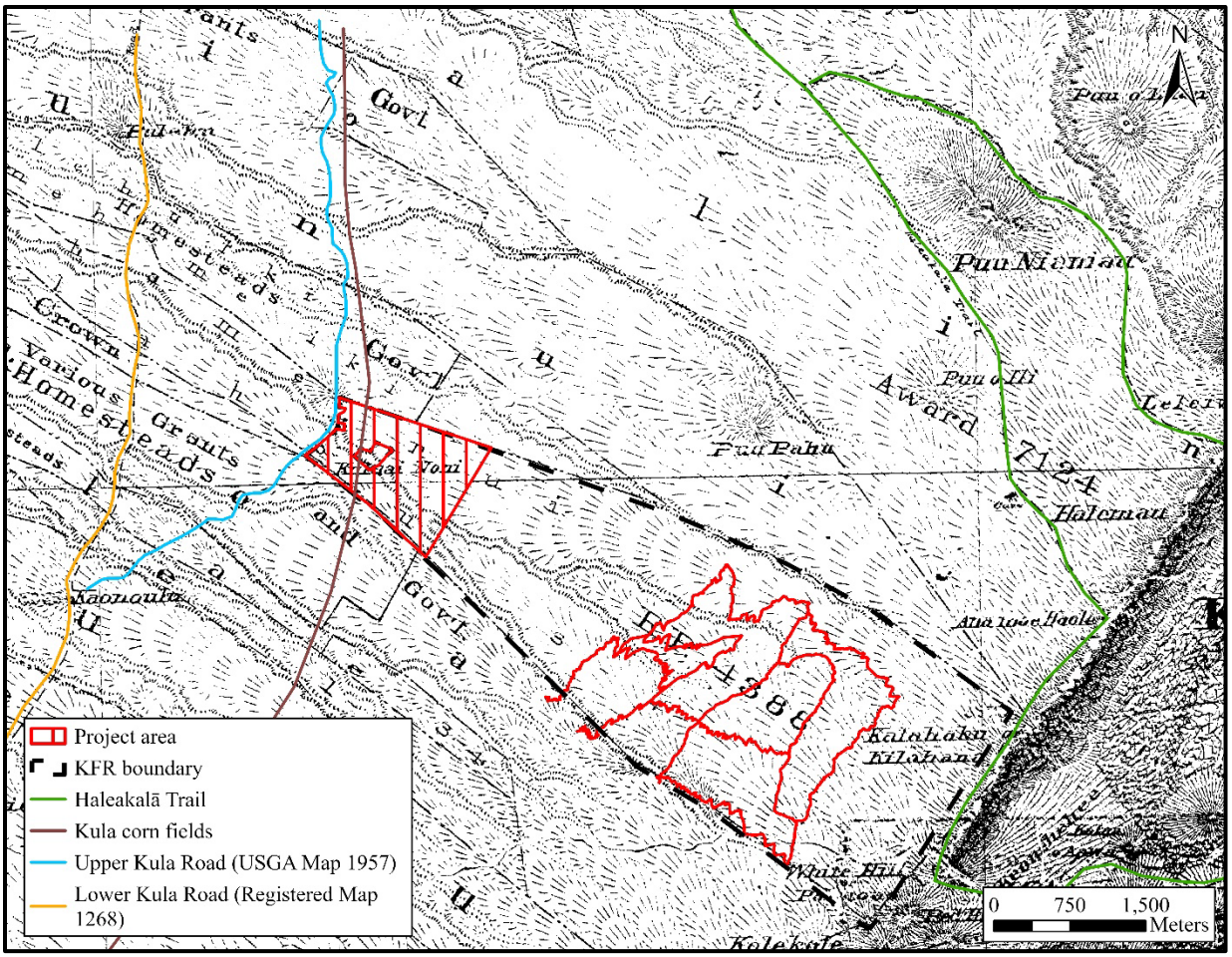


Figure 19. Hawai'i Registered Map No. 1268 prepared by surveyor F.S. Dodge in 1885 showing location of the "Haleakala Trail" mauka of the project area and Government Roads makai of the project area.

Transition from Erehwon Ranch to Forest Reserve

After the von Tempsky family put the Erehwon Ranch lands up for sale in the 1990's, it was purchased by Shizuka Asakawa of Shizuka Asakawa Revocable Trust Agreement. Around 2018, the Asakawa Trust put the property up for sale, at which time the DLNR-DOFAW, in close partnership with the Trust for Public Lands (TPL) and the National Park Service, began fundraising to acquire the 3,276-acre property for public purposes and to protect native sub-alpine ecosystems and formerly forested grasslands. In July of 2020, the TPL purchased the property and conveyed ownership of the property to the DLNR-DOFAW on August 31, 2020. At the time of purchase, an "Amended and Restated Grazing Lease and Hunting License Agreement" was in effect between Asakawa and lessee Brendan Balthazar for the subject parcel (DLNR-DOFAW 2018).

The property is currently management by DOFAW's Forest Reserve system as the Kamehamenui Forest Reserve, providing a wide range of public benefits, such as increasing water recharge to aquifers for drinking water, preserving open space, and allowing access to recreational opportunities. The authority to administer existing grazing and hunting lease with Brendan Balthazar was transferred to DOFAW (DLNR-DOFAW 2018).

PREVIOUS ARCHAEOLOGICAL STUDIES

There have been 12 archaeological investigations, of varying scope and intensity, in the past nearly 120 years within the project area or nearby (within 500 meters) (Figure 20; Table 4). From these investigations, 47 historic properties have been identified (Figure 21; Table 6). While only seven of these historic properties have been identified within the boundaries of the KFR, the nearby sites are discussed to provide examples of possible site types that may be present within the boundaries of the KFR and the project area.

Table 5. Previous archaeological studies conducted within or near the project area

Year(s)	*Author(s)*	*Type of Study*	*Summary of Results*
1908a, 1908b	Thrum	Island-Wide Overview Survey	Various *heiau*
1921	Emory	Regional Overview Survey	Various surface sites
1931	Walker	Island-Wide Overview Survey	Within Kula and Honua‘ula Districts: Various sites, including *heiau*, fishponds, and habitation sites
1963	Soehren	Reconnaissance Survey	Various sites/features, including C-shape and circular stone enclosures, cairns, lithic scatters, caves and rockshelters used as temporary camps
1977	Dye & M. Rosendahl	Inventory Survey	Various sites/features, including C-shape and circular stone enclosures, stone walls, stone platforms, cairns, lithic scatters, caves and rockshelters used as temporary camps, trails
1991	Chatters	Inventory Survey	4 Sites: SIHP 50-50-11-2805 (1 enclosure); Site-2806 (1 outcrop shelter with stacked-stone wall at its entrance); Site-2807 (1 stacked-stone wall and 14 enclosures); and Site-2808 (3 enclosures)
2003	Bushnell & Hammatt	Inventory Survey	2 Sites: SIHP 50-50-11-4835 (2 enclosures) and Site-4836 (1 terrace, 1 enclosure, 1 wall)
2003	W. Fredericksen & D. Fredericksen	Inventory Survey	10 Sites, which include the following features: 41 stone enclosures, seven stone terraces/platforms, one stone mound, one stone alignment, one concentration of stones, one elongated cleared area, and two petroglyphs. A few coral pebbles and *Cypraea* sp. marine shells were recovered from two of the 22 test excavations.
2007	Carson & Mintmier	Inventory Survey	57 Sites: Various Precontact sites (temporary camps, basalt tool manufacturing locales, bird collection sites, trail markers, and possible ritual sites) and Historic sites (temporary camps, cattle ranching activity site)
2010	Cochrane	Reconnaissance Survey	22 new features: 10 rock walls, 6 rock piles, 3 rock enclosures, 1 upright stone/*ahu*, 1 retaining wall, and 1 historic survey marker; and 6 previously known features: 4 terraces, 1 rock enclosure, and 1 rock wall **Note that sites were not designated at the time of report publication*
2013	Cochrane	Inventory Survey	17 new sites were identified and 3 previously documented sites were relocated.
2022*	Moore	Reconnaissance Survey	3 Sites: 2 rock walls (temporary camp sites), 1 rock pile (marker)

*Located within the boundaries of KFR

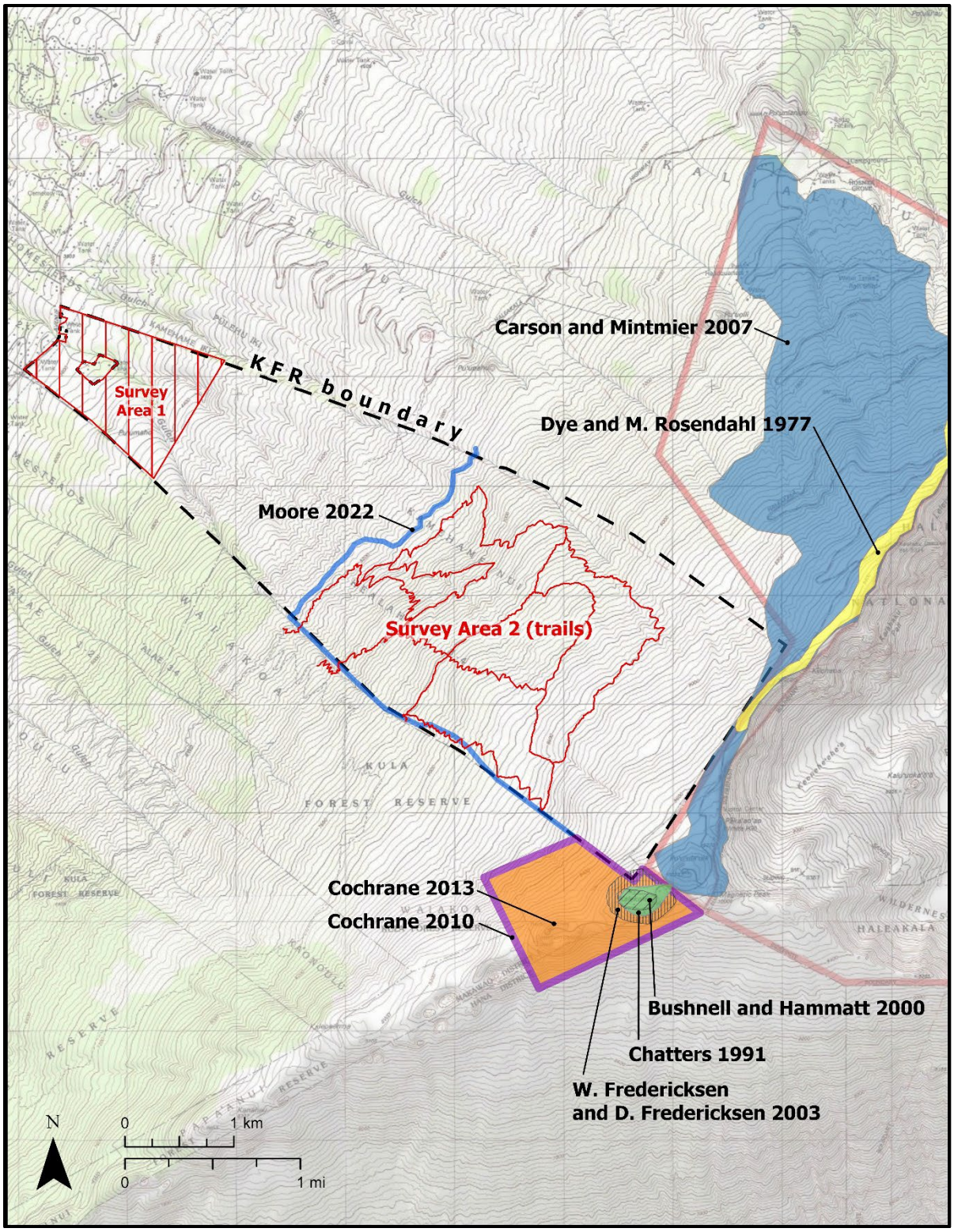


Figure 20. Previous archaeological investigations with or near (within 500m) the project area.

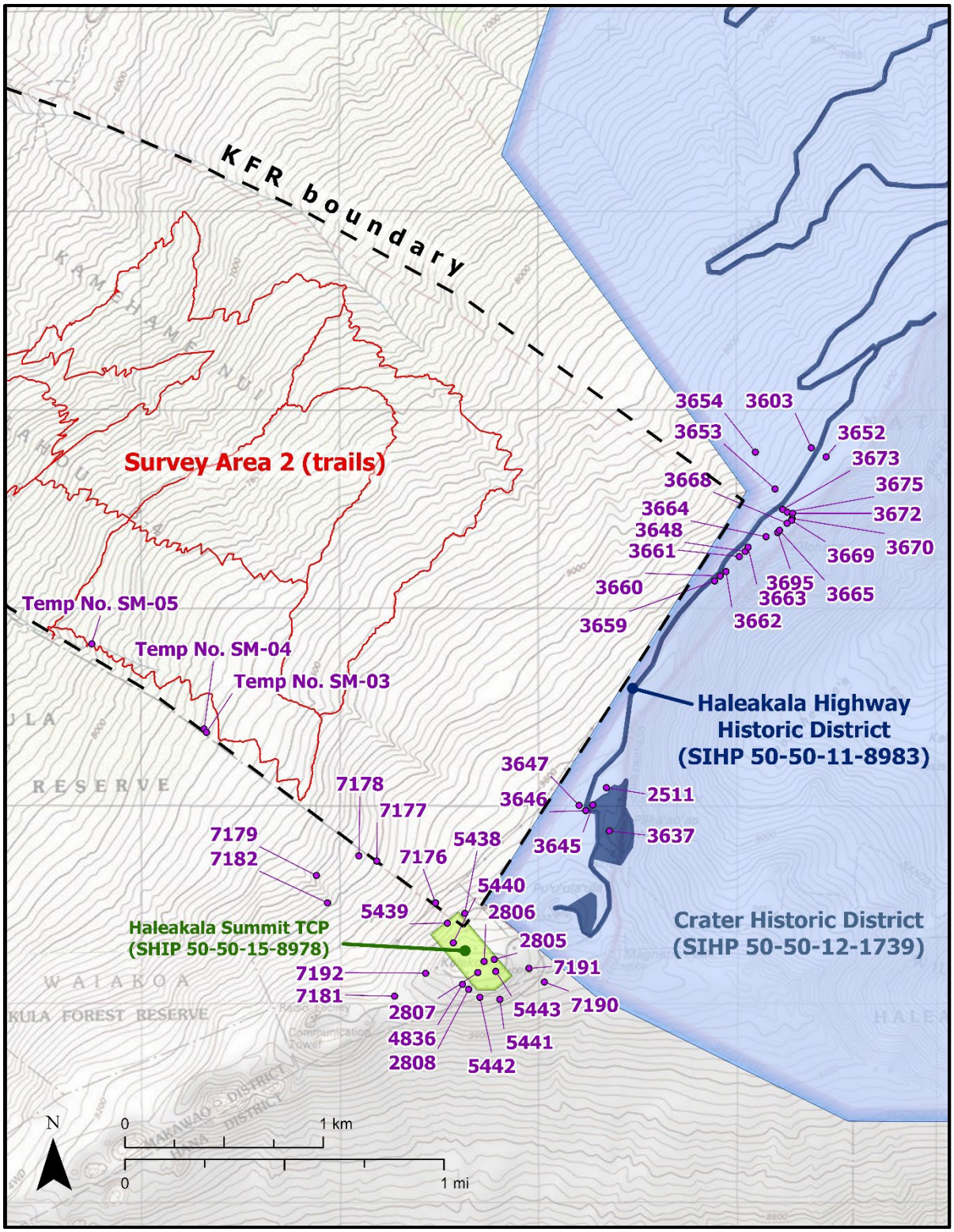


Figure 21. Locations of known archaeological sites and special historic preservation areas within or near (within 500 meters of) the KFR.

Table 6. Previously identified historic properties within KFR

Identification #	*Site Type*	*Function*	*Source*
SIHP 50-50-11-05438	Complex consisting of enclosure, terraces and rock mounds	Temporary habitation	Fredericksen and Fredericksen (2003) and Cochrane (2013)
SIHP 50-50-11-07176	Complex of walls	Temporary habitation and hunting	Cochrane (2013)
SIHP 50-50-11-07177	Complex consisting of walls and a rock pile	Temporary habitation and hunting	Cochrane (2013)
SIHP 50-50-11-08978	Haleakalā Summit Traditional Cultural Property	Traditional cultural place	DLNR-SHPD (2024)
SM-03	Rock wall	Temporary habitation	Moore (2022)
SM-04	Rock wall	Temporary windbreak	Moore (2022)
SM-05	Rock pile	Marker	Moore (2022)

Previous archaeological investigations within the proposed project area are limited to a single archaeological reconnaissance survey. In 2021, archaeologists at International Archaeological Research Institute, Inc. conducted a reconnaissance-level survey for the Kamehamenui Forest Protective Fence project (Moore 2022). Three new cultural resources were identified including two rock walls and one rock pile. At the time of report publication, SIHP numbers had not yet been assigned, so temporary numbers were given. SM-03 and SM-04 are both rock walls interpreted as temporary camp sites, while SM-05 is a rock pile interpreted as a marker of some kind (Moore 2022:21–24). The proposed fence line was rerouted 10 feet south to avoid impacting these sites (see Figure 21). All the sites are located within the boundaries of the KFR; however, only one site, SM-03, is within the project area, being located along the route of one of the proposed trails in Survey Area 2.

Previous archaeological investigations near the proposed project area (within 500 meters of the KFR) include various studies, many of which are located at or near the summit of Haleakalā or along its western rim. The earliest study, however, was a broad, island-wide overview of heiau structures. Part of a series of articles covering multiple islands, Thrum compiled information about numerous heiau on Maui (Thrum 1908). Focusing on named heiau, the information he reported included such details as, but not limited to, the size and shape of the heiau; who was said to have built it and in what year; any significant historical events that were said to have taken place there; and its general condition (Thrum 1908). Thrum (1908) did not identify any heiau within or near the boundaries of KFR.

Following Thrum in time but narrowing their geographical focus to the regional scale, in 1920, archaeologists from the Bishop Museum (Emory 1921) conducted what would be recognized today as a reconnaissance-level survey, including limited test excavations, of Haleakalā's summit and crater regions. They recorded sites and features from both the pre-Contact and Historic time periods, including heiau and other stacked-stone structures (platforms/terraces, enclosures, shelters, walls, and mounds/piles/cairns/ahu), caves/rockshelters used as temporary camps, fire features, a "paved with stones" area, segments of a traditional paved road, and several human burials. Additionally, they recorded the presence of several artifact types, including slingstones, branch coral, ritually placed human umbilical cords (wrapped in cloth or housed into glass jars), and wood and decaying gourd remnants from human burials (Emory 1921).

Of specific relevance to the current study, Emory (1921:3–4) notes how the Bishop Museum received certain information about potential historic properties that were present at Haleakalā:

> Early in 1920 the Museum received from C. S. Judd, Territorial Forester, a photograph of a walled enclosure on the floor of the crater, and later in the year information from Miss Armine Von Tempsky, transmitted to the Museum by Mr. L. A. Thurston, led to the organization of a field party to investigate reported discoveries.

He continues:

> The [Bishop] Museum is under special obligation to members of the Von Tempsky family, who have thoroughly explored the crater on their many hunting and camping trips. Their guidance and assistance are largely responsible for the results obtained [in this 1921 survey report].

This suggests that potential historic properties may have been observed in the greater vicinity of the von Tempsky family ranch and pasturelands (in addition to farther afield in the crater), and that these potential features may have been subsequently recorded during Emory's survey. The site and/or feature types he reported from this broader region include various pre-Contact and Historic sites/features, such as a heiau (at the summit) and other stacked-stone

structures (platforms/terraces, enclosures, shelters, walls, and mounds/piles/cairns/ahu) and fire features. Additionally, he recorded the presence of two artifact types, slingstones and branch coral (Emory 1921:19–20). Many of these sites/features are located on and near the summit, not far from the eastern boundary of the KFR.

In a 1931 report, Walker provides an island-wide overview of Maui archaeology, including a heiau at the summit of Haleakalā, likely the same one identified by Emory in 1921. The next significant archaeological study wouldn't take place for another three decades.

In 1962, archaeologists from the Bishop Museum (Soehren 1963) conducted a reconnaissance-level survey, which included limited test excavations, of Haleakalā's summit and crater regions. Their goal was to re-locate and update sites/features first reported by Emory (1921). They successfully recorded fifty-seven sites, many of which were re-recordings from Emory's (1921) survey. These sites included heiau, various stacked-stone structures, caves and rockshelters that were used as temporary camps, basalt quarries, lithic scatters, trails, and human burials (Soehren 1963:104–188). None of these sites are within the boundaries of the KFR.

Although not taken from within or near the current project area, it should be noted that Soehren reported the first radiocarbon date from the region. The charcoal sample analyzed was obtained from a large cave used as a temporary camp site (SIHP 50-50-11-03604), located on the inner western slope near the crater floor. The sample was sent to Gakushuin laboratory for analysis. The result was a date of 1160+/-100 BP (lab sample ID: GaK 325), which calibrates (at 2 sigma/95% confidence) to approximately AD 660-1030 (Carson and Mintmier 2007). However, this date is potentially problematic because results from early analyses at Gakushuin laboratory have often proved anomalous and unreliable (see e.g., Spriggs and Anderson 1993). Additionally, as Tomonari-Tuggle and Tuggle (2007) point out, early dates such as this should be questioned due to the possibility of in-built age from old wood specimens.

Dye and M. Rosendahl (1977) conducted an inventory-level survey of portions of the West Rim of Haleakalā crater, not far from the eastern border of the KFR. They documented various sites, including stacked-stone structures (platforms, enclosures, walls, cairns), basalt lithic scatters, caves/rockshelters that were used as temporary camp sites, and trails. None of these sites were recorded within the boundary of the KFR; however, 7 are within 500 m of the northeast corner of the subject parcel. These include SIHP 50-50-11-03665, -03668 through -03670, -03672, -03673, and -0367.

In 1990, archaeologists from Pacific Northwest Laboratory (Chatters 1991) conducted an inventory-level survey for a U.S. Air Force expansion of the Maui Space Surveillance Site at the summit of Haleakalā, near the southeastern corner of the KFR. They documented four sites: SIHP 50-50-11-02805, -02806, -02807, and -02808. SIHP 2805 is a single stacked-stone enclosure/shelter. SIHP 2806 is an outcrop shelter with a stack-stone wall at its entrance. SIHP 2507 consists of 15 features: one stacked-stone wall and 14 stacked-stone enclosures/shelters. A single sling stone was documented at this site. SIHP 2508 consists of three stacked-stone enclosures/shelters. A single limpet shell was found at this site (Chatters 1991:9–14). None of these sites are within the boundary of the KFR.

Bushnell and Hammatt (2000) conducted an inventory-level survey of a 1.5-acre area at the University of Hawai‘i Facility near the summit of Haleakalā, near the southeastern corner of the KFR. They documented two sites: SIHP 50-50-11-04835 (two stacked-stone enclosures) and SIHP 50-50-11-04836 (one terrace, one enclosure, and one wall). They excavated one test unit at SIHP 4836, which yielded only a single metal nail (Bushnell and Hammatt 2000). Neither SIHP 4835 nor SIHP 4836 are within the boundaries of KFR.

W. Fredericksen and D. Fredericksen (2003) conducted an inventory-level survey of an 18.1-acre area at Science City near the summit of Haleakalā, near the southeastern corner of the KFR. They documented ten sites: SIHP 50-50-11-2805, -02806, -02807, -04836, -05438, -05439, -05440, -05441, -05442, and -05443. These sites included the following features: 41 stone enclosures, seven stone terraces/platforms, one stone mound, one stone alignment, one concentration of stones, one elongated cleared area, and two petroglyphs. A few coral pebbles and Cypraea sp. marine shells were recovered from two of the twenty-two (22) test excavations (Fredericksen and Fredericksen 2003). Most of these sites lie outside of the KFR; however, one site, SIHP 5438, lies within the KFR, while SIHP 5439 lies immediately outside of the boundary of the forest reserve. SIHP 5438 is a temporary habitation site consisting of an enclosure, terraces and rock mounds. SIHP 5439 is also a temporary habitation site comprising of consists of rock shelters, walled leveled areas, rock mounds, and c-shaped enclosures.

In 2005, archaeologists at International Archaeological Research Institute, Inc. (Carson and Mintmier 2007) conducted an inventory-level survey for the Haleakalā National Park Front Country Site Documentation project. Fifty-seven (57) sites were documented (some were newly identified, while others were known but had limited prior documentation). These sites included pre-Contact sites (temporary camps, basalt tool manufacturing locales, bird collection sites, trail markers, and possible ritual sites) and Historic sites (temporary camps, cattle ranching activity sites) (Carson and Mintmier 2007:iii, 25–143). None of these sites were recorded within the boundary of the KFR;

however, 19 are within 500 m of the northeast corner of the subject parcel. These include SIHP 50-50-11-03603, -03648, -03652 through -03655, -02659 through -03665, -03668 through -03670, -03672, -03673, -03675, and -03695.

In 2010, archaeologists at International Archaeological Research Institute, Inc. (Cochrane 2010) conducted a reconnaissance-level survey of a fence corridor for the Advanced Technology Solar Telescope (ATST) Predator Control Fence project. Twenty-two (22) features were newly identified and recorded, including ten rock walls, six rock piles, three rock enclosures, one upright stone/ahu, one retaining wall, and one Historic survey marker (Cochrane 2010:13–15). Additionally, six previously identified features were relocated and their records updated. These features included four terraces, one rock enclosure, and one rock wall (Cochrane 2010:12). Note that sites were not designated for the newly identified features, so SIHP numbers were not assigned at that time.

In 2013, archaeologists at International Archaeological Research Institute, Inc. (Cochrane 2013) conducted an inventory-level survey of the 320-acre area enclosed by the predator control fence for the Advanced Technology Solar Telescope (ATST) Predator Control Fence project. Seventeen (17) new historic properties were identified and three (3) previously documented historic properties were relocated. Three of these sites (SIHP 50-50-11-05438, -07176, and -07177) are located within the KFR, while 2 sites are located outside but immediately adjacent to the boundary of the subject parcel. SIHP 5438 and -5438 are both temporary habitation sites, previously identified by Frederickson and Frederickson (2003). SIHP 7176 consists of two features interpreted as an ʻuaʻu (Hawaiian dark-rumped petrel, *Pterodroma sanwichensis*) trap and a temporary habitation structure. SIHP 7177 consists of two features interpreted as a windbreak or temporary habitation structure located within an area containing numerous ʻuaʻu nests and rock piles, as well as two isolated fine-grained basalt artifacts. SIHP 7178 consists of several rock walls and rock piles, also surrounded by ʻuaʻu nests. In addition, 7 historic properties are located further from the KFR's boundary but within 500 m of the study parcel. These include SIHP 50-50-11-05440, -07179, -07181, -07182, -07190 through -07192. These sites included ax temporary habitation sites (SIHP 5440, 7181, 7192), a ritual or boundary marker (SIHP 7179), a location marker (SIHP 7182), a coral scatter (SIHP 7190), and a ritual complex (SIHP 7191).

Special Historic Preservation Areas

Three special historic preservation areas are located within or near the KFR, including two Historic Districts and one Traditional Cultural Property (see Figure 21). The Crater Historic District (SIHP 50-50-12-1739) is located, in part, near the KFR's eastern border, within Haleakalā National Park (see Figure B). This Historic District was listed in the National Register of Historic Places (NRHP) on November 1, 1974, and in the Hawaiʻi Register of Historic Places (HRHP) on January 1, 1992, for its significance in Polynesian prehistory and history (National Register of Historic Places 1974). Despite the limited number of archaeological surveys conducted at the time of nomination, numerous traditional Hawaiian archaeological sites were nonetheless identified, including religious/ceremonial sites, temporary habitation sites, and sites indicating extensive quarrying and stone working activity, all of which largely centered around the crater (National Park Service 1995:23).

The Haleakalā Highway Historic District (SIHP 50-50-11-08983) is located, in part, near the eastern boundary of the KFR (see Figure 21). It includes the last 10.6-mile segment of the highway within the borders of the Haleakalā National Park, as well as the development nodes along its route, notably the White Hill (Pākaʻoao) and Red Hill (Puʻuʻulaʻula) nodes. This segment was constructed between 1933 and 1935, with modifications and improvements occurring up until 1941 (prior to the United States entering World War II) and then again after WWII as part of the Mission 66 Program; thus, the period of significance for this historic district is from 1933 to 1966 (National Park Service 2008:2–3).

The Haleakalā Summit Traditional Cultural Property (TCP) (SIHP 50-50-15-08978) is located near the eastern border of the KFR (see Figure 20). It is significant because of its association with the legend of Maui and how he lassoed the sun (see above), as well as for its association with traditional astronomical observation and related ceremonial practices (DLNR-SHPD 2024).

3. STUDY AREA EXPECTATIONS

Based on the above information, we potentially expected to find artifacts, deposits, and/or features that represent human activity spanning from pre-Contact to Historic times. While a cultural assemblage representing Historic Period ranching and agricultural activity was considered likely to predominate, other activities were also expected to be represented. These activities included traditional Hawaiian astronomical observation, bird meat and feather collection, lithic tool production, location marking, military defense, ritual practice, temporary camping, and pedestrian transiting.

A note before proceeding: When temporally diagnostic cultural materials and/or radiocarbon dates were unavailable, we used the phrase "traditional Hawaiian" to describe artifacts, features, sites, deposits, and/or cultural practices that likely originated during the pre-Contact (prior to 1778) or Early Historic (1778 - c. 1850) periods. This phrasing encompasses indigenous cultural materials/practices that may date to after 1778 but that are distinct from Western cultural materials/practices (see Bayman 2009; 2010; 2014).

SURVEY AREA 1

Previous research suggests that features/sites associated with pre-Contact activities may have been severely modified, damaged, and/or destroyed by Historic period agricultural cultivation and cattle ranching. As such, field personnel are more likely to find features/sites associated with these activities in Survey Area 1. Specifically, it is expected that various features related to the residents of and operations at the Erehwon cattle ranch will be identified during the survey. These could include—but are not limited to—residential buildings, dairy production and cattle ranching structures, water management infrastructure, and crop cultivation features.

SURVEY AREA 2

Previous research suggests that various pre-Contact and Historic period activities took place in this vicinity, including astronomical observation, bird meat and feather collection, lithic tool production, location marking, military defense, ritual practice, temporary camping, and pedestrian transiting (Figure 22). Field personnel could find sites and features associated with these activities.

Note that, although forestry experimentation activity is represented by one site (SIHP 50-50-11-3654) located near the northeast corner of the KFR, field personnel should not expect to find features or sites associated with this activity. Carson and Mintmier (2007:10) summarize the broader forestry experiment associated with Site -3654:

> In 1909 through 1911, Ralph Hosmer planted various trees as forest experiments on the slopes of Haleakalā (Kraebel 1922). Two of those experiment locations are considered historic sites in the project area. One (Site 50-50-11-3699) is around 8300 ft (2515 m), and the other (Site -3654) is around 9050 ft (2742 m). Eucalyptus sp. trees and some conifers continue to grow at the lower elevation, whereas Eucalyptus sp. trees appear to have been the only successful plantings at the higher elevation.

Within Survey Area 2 specifically, Moore (2022) documented two rock walls associated with temporary camping and one rock pile, interpreted as a location marker of some kind, which could potentially be associated with pedestrian transit or boundary demarcation (see sites labeled Temp No. SM-03, SM-04, and SM-05 on Figure 21). Temporary camping and location marking are the two most common activities represented in the general vicinity, so field personnel might expect to identify such features/sites during surveying more so than, for example, astronomical observation, military defense, or ritual practice, which are largely located further mauka at the summit or along the crater rim.

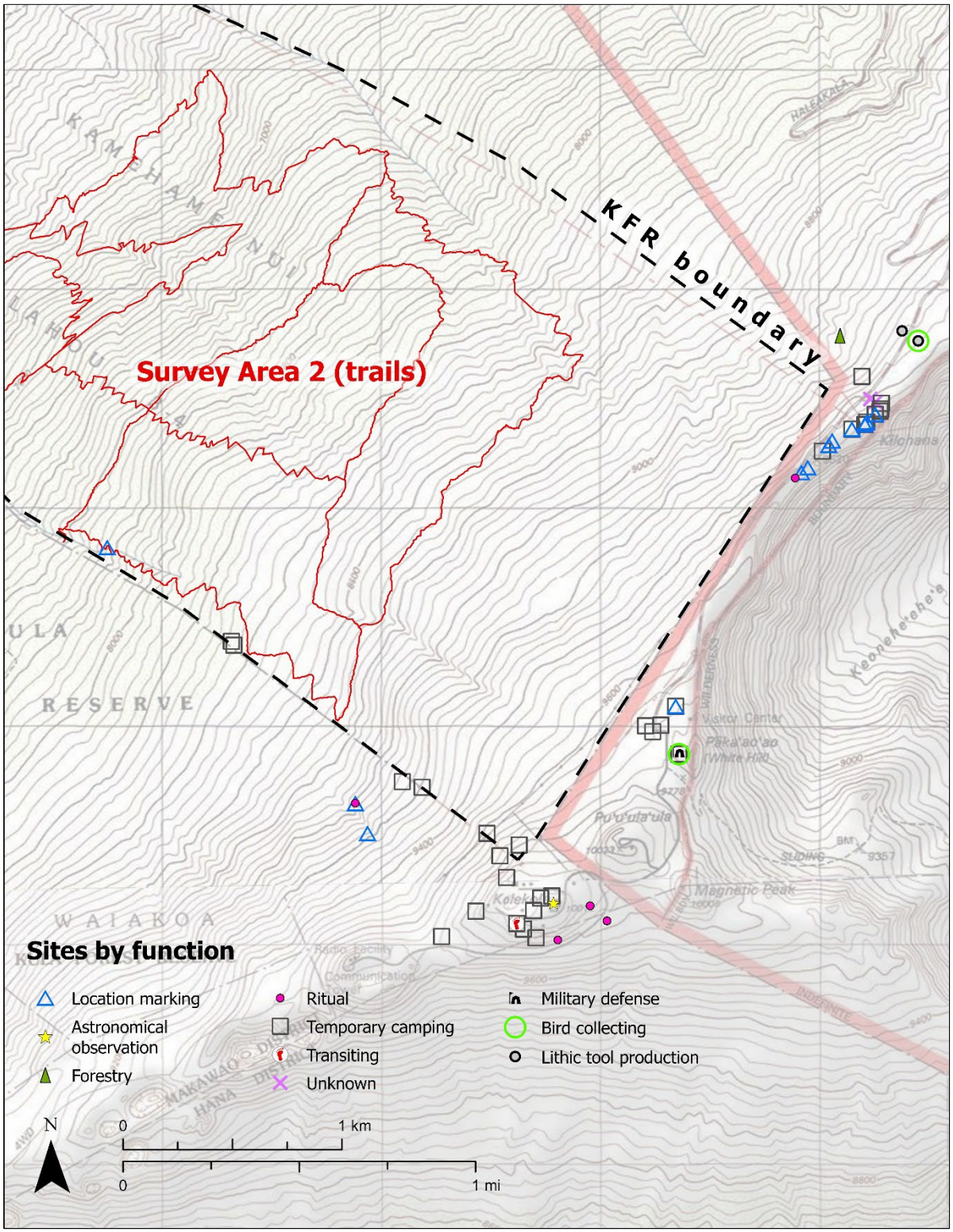


Figure 22. Archaeological sites within or near (within 500 meters) the KFR showing activities represented.

4. FIELDWORK

Fieldwork for Survey Area 1 was conducted between April 25and May 5, 2022, by Lauren Kepa'a-Tam Sing, B.A., Johnny R. Dudoit, B.A., Robynn Namnama, B.A., Candace Gonzales, B.A, and Matthew R. Clark, M.A. (Principal Investigator). Fieldwork for Survey Area 2 was conducted between July 25 and 27, 2022, by Johnny R. Dudoit, B.A., and Matthew R. Clark, M.A.

FIELD METHODS

The fieldwork for the two Survey Areas was undertaken using different methodology to account for the contrasting layouts of the two areas. During the archaeological fieldwork of Survey Area 1, the entire (100%) ground surface of study area was visually inspected for archaeological features by field technicians, walking transects oriented north-south, spaced at no more than 20 meters apart. In contrast, the fieldwork for Survey Area 2 was conducted as a reconnaissance survey as the routes of the trails had not been finalized at the time of the survey. To ASM's knowledge, the trail routes have not been altered since the fieldwork. Field technicians walked the proposed routes of the trails, inspecting the ground surface within the trails' footprint as well as a 10-foot-wide corridor extending 5 meters from either side of the trail for archaeological features.

The locations of the cultural features identified during the pedestrian transects were collected using Arrow GPS units capable of submeter accuracy. Each feature was then assigned a temporary field number; following the fieldwork, the field feature numbers were grouped into temporary site designations when appropriate and assigned sequential numbers by parcel. Once adequately cleared of vegetation, the identified features were photographed and documented by ASM field supervisors using handheld tablet computers (5th-generation Apple iPad minis) running ESRI's Field Maps Application and connected to EOS Arrow 100 Global Navigation Satellite System (GNSS) receivers with sub-meter accuracy (set to the NAD 83 Zone 4 North). Each feature was described using standardized record forms and when appropriate, hand-drawn maps of specific features were created using a tape and compass to depict the feature and the surrounding context. A total of 6 archaeological features was hand-mapped.

No subsurface testing was conducted during the fieldwork component of the current AIS.

DEFINITION OF FEATURE TYPES

To help alleviate the hindrance of conflicting terminology, a set of feature type definitions, specific to the current Project Area—but keeping in mind previous archaeological work—is presented below. The definitions referenced here rely only on morphological attributes and do not include presumed function or age. A single feature type, as defined in this section, may have multiple functions. Given the necessary limitations of the surface survey and the lack of subsurface testing at newly recorded archaeological features, all interpretations of feature function are to be considered conditional pending archaeological subsurface testing or consultation with Native Hawaiian cultural practitioners.

Alignment

An alignment is a low-lying, linear or curvilinear arrangement of stones that is considerably longer than it is wide. Alignments are informally constructed using stones of various types and sizes depending on the source material. Unlike walls, alignments are rarely stacked and typically contain a single course of stones that may be level with the ground surface. In some cases, alignments may consist of single stones placed end to end in a row. Alignments may form adjoining or shaped segments.

Berm

A berm is a linear strip of flat or gently sloping raised land that is considerably longer than it is wide. Berms are artificially constructed of earth, rock or stone, sand, vegetation, man-made materials such as concrete or a combination of these materials. They typically have sloping sides and flat or gentling curved crests.

Depression

A depression is a sunken area on the ground surface. In contrast to a pit, which is created by intentionally removing material to a certain depth, a depression is created through natural alterations to the ground surface. As an archaeological feature, a depression may represent a previously excavated pit or other cavity infilled through natural means. In such a case, the morphology and attributed function would depend on the type of feature from which the depression is derived.

Enclosure

An enclosure is a collection of walls, wall remnants, or alignments that surround an interior space on at least three sides (roughly 75% of the feature's perimeter). Construction materials vary by type and size depending on the source of the material. An enclosure may incorporate natural formations (i.e., bedrock outcrops, boulders, etc.) or other formal feature types into its construction. Both the size and shape of an enclosure (i.e., square, rectangular, three-sided, many-sided, circular, oval, irregular, etc.) vary considerably depending on the natural topography and the feature's intended function. The perimeter walls or alignments or some enclosures have no openings, while others have an open side or have an intentionally created small opening in one or more of the perimeter constructions. The interior of the enclosure may contain rubble, cleared space, or sediment; an enclosure may surround additional enclosures or other features. It may be isolated or associated with other enclosures or features. An enclosure with a habitation function may serve as either the foundation for a pole-and-thatch structure or as the perimeter of a house lot containing a house foundation and potentially other associated features. Habitation enclosures serving as foundations may exhibit formal construction (i.e., neat stacking or facing) of walls and enclose an area about the size of a pole-and-thatch house, i.e., about 10 to 15 square meters. Such features may be built atop bedrock outcrops and situated on high points with good views; they may also contain an interior hearth or midden remains or other artifacts on the ground surface nearby. An enclosure with an animal husbandry function (a livestock enclosure) may lack a visible entry and have noticeably high walls. An enclosure with an agriculture function would likely have been intended to delineate or protect a garden plot and thus may enclose a larger area than one used for habitation or animal husbandry functions. An enclosure with a storage function, which within the current Study Area have been linked to sweet potato and Irish potato production (see Titchenal 1996).

Modified Outcrop

A modified outcrop is a natural rock formation that has been altered or shaped by human activities. Within Hawai'i, this modification is usually comprised of rock stacking or piling that is supported by the natural rock formation. The number of stacked rocks is usually far less than the amount of bedrock rock present within the modified outcrop. Other modifications to modified outcrops may include leveling uneven area, the evidence of a raw material collection, or the carving of the natural rock; however, these types of modification are usually referred to as different site types within a Hawaiian context.

Mound, Rock Pile, and Cairn

Mounds, rock piles, and cairns are small collections of stones (and sediment in the case of a mound) with irregular surfaces. These features may be intentionally constructed by heaping or stacking stones at a specific location or incidentally created by mechanical disturbance. Mounds, rock piles, and cairns vary considerably in size and shape depending on the amount of material they contain; they may be either piled or stacked, or a combination of both. Mounds are generally found on surfaces of exposed sediment, while rock piles and cairns are generally found on bedrock surfaces; mounds are generally more carefully constructed than rock piles, which are informal constructions. Cairns are typically smaller than the other two feature types and typically involves vertical stacking of stones; cairns used as markers may be found on a topographic high point or along a trail or other transportation route. Mounds or rock piles used for agricultural functions may be in close proximity to other agricultural features and are typically small in size (as compared to the human body). Mounds or rock piles used as burial markers may be comparable in size to or slightly larger than the human body.

Terrace

A terrace is an artificially leveled surface on a slope. Typically, a terrace consists of a linear or curvilinear stone construction (often, a retaining wall) built perpendicular to a natural slope that retains a fill of stones or sediment behind it. The stones of the retaining construction may be piled, stacked, or collapsed (piled edges are sloped, stacked edges are nearly vertical, and collapsed edges were formerly stacked but now resemble piled edges). Terraces vary in size and shape depending on the terrain and the individual purpose of construction. Terraces with an agricultural function may be informal, low constructions that match the contour of the slope and may be up to several hundred meters long. Terraces with a habitation function may have formal construction features and have a retained sediment area large enough to create a living space. They may be associated with midden remains or other surface artifacts nearby.

Wall

A wall is a linear or curvilinear alignment of stones (at least two courses high) that is considerably longer than it is wide. Walls are constructed using stones of various types and sizes depending upon the source material. They generally have sloped sides, although in neatly stacked walls the slope approaches vertical. Walls encountered within the Project Area take on three general forms; collapsed (no formal placement of stones evident) or stacked (stones placed on top of one another). Walls may also form adjoining or shaped segments (i.e., L-shaped, T-shaped, U-shaped, etc.). Walls can either be free-standing (with heights along both edges) or retaining (with height along one edge and a level surface along the other edge, i.e. a terrace). When not specified, walls can be assumed to be free-standing. Many of the retaining walls recorded within across drainages and functioned as dams or weirs for water management.

SURVEY AREA 1 FINDINGS

As a result of the fieldwork within Survey Area 1, one newly identified site was recorded and designated as Site 50-50-11-T-1 (Table 7 and Figure 23). Site T-1 is the Historic Erehwon Cattle Ranch and contains 82 features associated with the operation of the ranch between the mid-19th century through 1990. The Erehwon Cattle Ranch can be considered a Historic Vernacular Landscape. The National Park Service defines a Historic Vernacular Landscape as "a landscape whose use, construction, or physical layout reflects endemic traditions, customs, beliefs, or values; expresses cultural values, social behavior, and individual actions over time; is manifested in physical features and materials and their interrelationships, including patterns of spatial organization, land use, circulation, vegetation, structures, and objects" (Page et al. 1998:12). A detailed description of Site T-1 that meets the standards of HAR §13-276 and which considers the site as a cultural landscape follows below. Detailed descriptions of the 82 features of Site T-1 are presented in Appendix A of this report.

Site 50-50-11-T-1

Site 50-50-11-T-1 is Erehwon Cattle Ranch consisting of 82 features spread throughout the lower 320-acre portion of TMK: (2) 2-3-005:002 (Survey Area 1) and located in the northwestern part of the KFR (see Figure 23). These features include concrete rubble masonry (CRM) walls (consisting of mortar and concrete), dry-stacked walls, pillars, terraces/berms, rock piles, concrete structures, wooden structures, a cattle chute, concrete foundations, concrete remnants, a lava tube, enclosures, rock mounds, rock and mortar foundations, a wooden trough, alignments, and a cattle cage (see Table 7 and Appendix A). In addition, there are several modern cattle troughs (made of both metal and plastic) throughout, with a few accompanying water catchment systems consisting of galvanized and PVC waterlines that transport water across the pastures to select cattle troughs. These modern features (not assigned feature designations) remain in active use today (Figures 24 and 25). These features contribute to the interpretation of Site T-1 as a Historic vernacular landscape. To develop a comprehensive understanding of Site T-1 and its Historic vernacular landscape, presented is an overview of traditional agricultural practices involving ʻuala (sweet potatoes), the impact of foreign arrivals on Hawaiʻi, and the resulting economic and cultural shifts. It also covers the transition from traditional land tenure to Western-style ownership, followed by the historical background of the von Tempsky Legacy and Erehwon Cattle Ranch. Finally, this summary summarizes the archaeological features identified during the current study, which reflect the site's Historic vernacular landscape.

Survey Area 1 is roughly within the kula zones, which during the Precontact Period were utilized by native inhabitants for traditional agricultural practices, particularly the cultivation of ʻuala. However, dryland farming in Kula was difficult for a variety of reasons including the absence of perennial streams, pests, extreme weather, and soil conditions. However, native Hawaiian's implemented a variety of techniques to modify the landscape and successfully cultivate Kula lands. These practices included slash and burn methods to clears forests for planting, rainwater irrigation, field rotation, and the construction terraces for soil retention, water runoff absorption and the delineation of fields. Ultimately, native farmers in Kula became known for their agricultural expertise and these practices persisted into the 19th century, enabling native farmers to participate in the market economy.

In the mid-19th century Kula became a key agricultural producer with wheat being from the dominate crop cultivated between 1843 and 1852. As wheat declined, demand for foreign potato varieties increased, shifting Kula's agricultural focus to the large-scale cultivation of Irish potatoes (Kuykendall 1938). In 1888, Louis von Tempsky established the Erehwon Cattle Station as a dairy farm on 5,000 acres of Kula land. In the early 1900s, operations were expanded to include to diversified agriculture including experimentation with Irish potatoes. In 1914, Boy von Tempsky took over the management at Erehwon and began transitioning the dairy ranch into a cattle ranch; however, he continued the cultivation of diversified agriculture (Molina 2021). Ranching transformed the Kula landscape as dairy farm infrastructure, cattle management infrastructure, transportation routes, and water infrastructure was

constructed to aid the various ranch operations. Any Precontact features of agricultural purposes were heavily diminished Historic agriculture and cattle ranching. However, Historic ranching created the landscape as it is today. This physical landscape tells the story of ranching and other historic activities that once occurred within the boundaries of Site T-1 and thus represent a Historic vernacular landscape.

Table 7. Archaeological features of Site T-1.

Feature #	*Formal Type*	*Function*
001	CRM wall	Water management
002	CRM wall	Water management
003	CRM wall	Water management
004	CRM wall	Water management
005	CRM wall	Water management
006	Pillar	Water management
007	CRM wall	Water management
008	CRM wall	Water management
009	Terrace/berm	Agriculture
010	Terrace/berm	Agriculture
011	Dry-stacked	Agriculture
012	Dry-stacked wall	Agriculture
013	Terrace/berm	Agriculture
014	Dry-stacked wall	Livestock management
015	Rock pile	Water management
016	Rock pile	Water management
017	Dry-stacked wall	Water management
018	Dry-stacked wall	Water management
019	Concrete structure	Dairy farm infrastructure
020	Wooden structure	Dairy farm infrastructure
021	Cattle chute	Dairy farm infrastructure
022	Concrete foundation	Dairy farm infrastructure
023	Concrete remnants	Dairy farm infrastructure
024	Lava tube	Indeterminate
025	Rock pile	Water Management
026	Dry-stacked wall	Habitation
027	Dry-stacked wall	Habitation
028	Enclosure	Habitation
029	Alignment	Habitation
030	CRM wall	Water management
031	Dry-stacked wall	Water management
032	Rock pile	Water management
033	Dry-stacked wall	Water management
034	Rock pile	Livestock management
035	Rock pile	Indeterminate
036	Rock pile	Indeterminate
037	Rock pile	Indeterminate
038	Rock mound	Staging area
039	Rock mound	Staging area
040	Enclosure	Indeterminate
041	Dry-stacked wall	Indeterminate

Feature #	*Formal Type*	*Function*
042	Enclosure	Indeterminate
043	Rock pile	Indeterminate
044	Wall	Staging area
045	Dry-stacked wall	Livestock management
046	Enclosure	Livestock management
047	Dry-stacked wall	Livestock management
048	Rock mound	Indeterminate
049	Rock pile	Indeterminate
050	Rock and mortar foundation	Water management
051	Rock and mortar foundation	Water management
052	Rock pile	Indeterminate
053	Wooden trough	Dairy farm infrastructure
054	Rock pile	Indeterminate
055	Circular depression	Dairy farm infrastructure
056	Rock pile	Indeterminate
057	Dry-stacked wall	Livestock management
058	Dry-stacked wall	Livestock management
059	Terrace/berm	Agriculture
060	Dry-stacked wall	Livestock management
061	Dry-stacked wall	Livestock management
062	Alignment	Livestock management
063	Dry-stacked wall	Livestock management
064	Dry-stacked wall	Livestock management
065	Dry-stacked wall	Livestock management
066	Terrace/berm	Agriculture
067	Dry-stacked wall	Agriculture
068	Alignment	Agriculture
069	Terrace/berm	Agriculture
070	Rock pile	Indeterminate
071	Core-filled rock wall	Water management
072	CRM wall	Water management
073	CRM wall	Water management
074	Cattle squeeze	Dairy farm infrastructure
075	Rock pile	Livestock management
076	Rock pile	Indeterminate
077	Dry-stacked wall	Livestock management
078	Dry-stacked wall	Livestock management
079	Dry-stacked wall	Livestock management
080	Rock and mortar foundation (4)	Water management
081	Wooden structure (3)	Water management
082	CRM wall	Water management

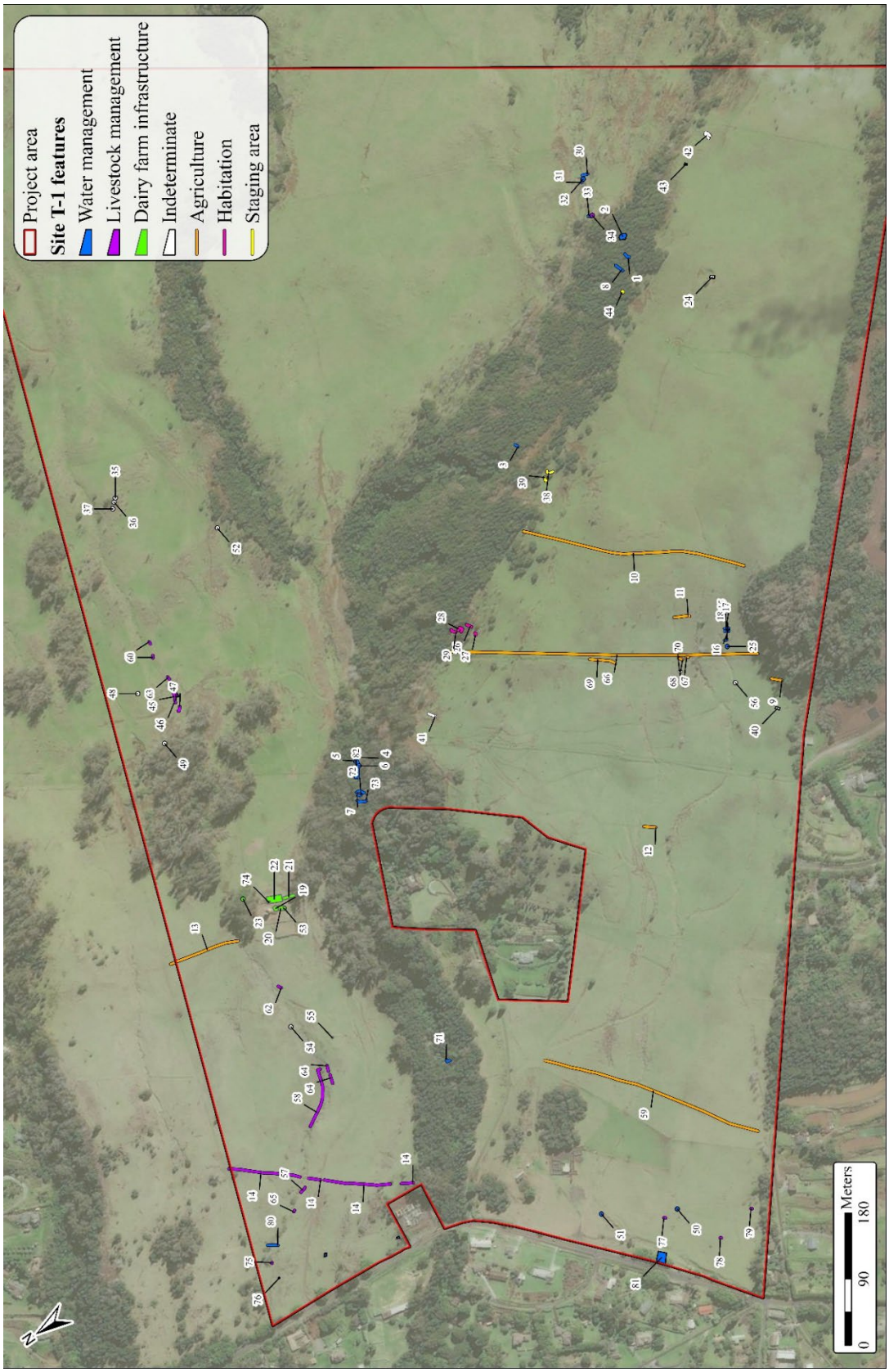


Figure 23. Map of features within Site T-1.



Figure 24. Plastic trough, view to the west.



Figure 25. Metal water tank, view to the east.

Water Management Features within Keāhuaiwi Gulch and Other Natural Drainages

Twenty-five features related to water management by the Erehwon Cattle Ranch were identified within and along the banks of Keāhuaiwi Gulch and other minor drainages that meander through Survey Area 1 (see Figure 23). Twelve such features are located within Keāhuaiwi Gulch, mainly concentrated within two areas in the western extent of the gulch and in the central portion of the gulch within Survey Area 1. In addition, 12 other water management features are located within a minor drainage throughout Survey Area 1, including 5 features concentrated in a minor gulch that flows into Keāhuaiwi Gulch, 4 features in a drainage in the south-central portion of the survey area. The features within the natural drainages represent a range of water management strategies to control water by reducing the velocity of water flow, controlling the direction of water, or by retaining water. Twelve features consist of CRM walls that are built across the width of the gulch or drainage and functioned either as weirs to prevent erosion and slow the velocity of the water flow (see Features 1 4, 30, 33; Figures 26 and 27) or as dams to retain water up stream during periods of reduced water flow (Feature 3, 5, 8; Figure 28). Two series of check dams (one series comprised of Features 7, 72 and 73 and one comprised Feature 17 and 18) are present within Survey Area 1. These check dams were placed in succession of each other within the stream which would have slowed the velocity of the flow of water in the streams (Figure 29). In addition to dams and weirs, several walls and rock pile (Feature 2, 15, 16, 31, 32, 71) were built along the banks of and occasionally within the natural drainages to modify the natural to prevent erosion and possibly alter the natural flow of water (Figures 30 and 31). Feature 6 is a CRM pillar located along the bank of the stream, which is likely associated with water management, but its exact function is unknown.

In addition to the water infrastructure identified within the gulch and other natural drainages, there are four water features situated along the western boundary of the Survey Area 1, situated in open pasture lands. Features 50, 51 and 80 consist of the remnants of are rock and mortar foundations (Figure 32), while Feature 81 consists of three wooden pump houses (Figure 33). Unlike the features discussed above which represent attempt to control natural ground water through Kula, these features are interpreted as the remnant infrastructure related to the Kula water pipeline, which was built in 1912 to more activity deliver water to the cattle ranch.

Lastly, in addition to the water management features, evidence of the construction and maintenance of the water management systems is evident along the banks of Keāhuaiwi Gulch. Three features (Feature 38, 39 and 44) are interpreted as staging areas for materials used to build the water infrastructure within the gulch and other minor drainages.

Water in Kula was scarce due to the absence of permanent streams through the area and the Erehwon Cattle Ranch had to implement various water management strategies to secure access to water. One strategy included the modification of natural drainages to slow the velocity of water, alter the direction of water and retain water with weirs, dams, and strategically placed rock walls and mounds. According to Robert “Boy” von Tempsky (1979), cattle runs occurred 3 to 4 times a year and once the cattle had used all the water retained by the dams in an area, the ranchers would move the cattle along. In addition, the water in one dammed area was reportedly reserved for use by the house (von Tempsky (1979). The features recorded in Keāhuaiwi Gulch and other minor drainages likely represent the remnants of this system. Eventually, in 1912, the von Tempsky family worked to construct a pipeline which would more actively pump water to their Kula lands and relieve some of the water scarcity. Water infrastructure was further developed when a water tunnel was constructed in 1913. Only three features were identified that relate to the Kula water pipeline within Survey Area 1 and no evidence of the water tunnel was present within the current study area. These identified ground water management features remained represent the continued attempt to control and secure water access by the Erehwon Cattle Ranch from the mid-19th century through the 20th century.



Figure 26. Example of CRM wall (Feature 001) built across gulch that as a weir, view to the south.



Figure 27. Example of CRM wall (Feature 001) built across gulch that as a weir, view to the southwest.



Figure 28. Example of remnants of CRM wall (Feature 008) which formerly functioned as a retaining dam, view to the northwest.



Figure 29. Check dam series with Features 007 (top of frame), Feature 072 (center of frame), and Feature 073 (bottom of frame), view to the east.



Figure 30. Example of wall (Feature 016) built along bank of drainage to prevent erosion and direct water flow, view to the southeast.



Figure 31. Example of rock pile (Feature 032) built along bank of drainage to prevent erosion, view to the north



Figure 32. Example of rock and mortar foundations (Feature 80) supporting Kula water pipeline, view to the north.



Figure 33. Northwesternmost water pump shed associated with Feature 081, view to the south.

Agricultural Features in Open Pasture Lands

Within the open pasture lands in the project area, 10 features (Features 9 through 13, 59, 66 through 69) associated with agriculture, particularly the cultivation of Irish potatoes were identified (see Figure 23). These features consist of north-south oriented terraces and berms of various lengths that extend north to south across the pasture lands south of Keāhuaiwi Gulch (Figure 34 and 35). Only one of these terraces/berms, Feature 13, was identified north of the gulch, suggesting that the land south of the gulch was more extensively utilized for agricultural production than the land north of the gulch (which contains greater evidence of livestock management and dairy operations). These terraces and berms are interpreted as retaining soil and defining field boundaries used for to potatoes farming during the mid-19th century through the 20th century.

Prior to the establishment of Erehwon Cattle Ranch in 1888, the area within Survey Area 1 was a part of the belt of land along the slopes of Haleakula known for being good agricultural land. Wheat and ʻuala maoli (a native potato,) were the primary crops cultivated in Kula in the first decade of the 19th century. however, beginning in the 1849, the slopes of Haleakala became the center of extensive Irish potato cultivation as the demand for exported potatoes skyrocket as a result of the California Gold Rush. Early farming in Kula was largely completed by native Hawaiians but as the demands outpaced production, Chinese farmers were brought in to increase productivity. These Chinese farmers further diversified the agriculture grown in Kula, introducing the largescale cultivation of corn, beans, cabbage, onions, wheat, and cotton. The Irish potato boom lasted until 1854, when and production shifted to domestic markets. Erehwon Cattle Ranch continued smaller scale agriculture through at least the first decades of the 20th century. Dora Melville Dowsett von Tempsky even allowed for experimentation regarding Quick Blight and Irish potato cultivation on lands owned by the cattle ranch. Boy von Tempsky, who took over the management of the farm, in 1915, continued to diversify agriculture on the farm with the cultivation of various corns, beans, cabbage, potatoes, and onions on about 400 acres of land. Eventually, the ranch shifted towards primarily beef production and diversified agriculture became less of a focus for the farm.



Figure 34. Example of terrace/berm features (Feature 010) in open pastureland, view to the north.



Figure 35. Example of dry-stacked terrace (Feature 011) in open pasturelands, view to the northeast.

Livestock Management Along Drainages and in Pasture Lands

In addition to agricultural features, 17 features (Features 14, 34, 45 through 47, 57, 58, 60 through 65, 75, 77 through 79) related to livestock management were identified within the project area (note that this count excludes those the eight features associated with dairy farm operations; see Figure 23). Fifteen of these 17 features (Features 14, 34, 47, 57, 58, 60 through 65, 75, 77 through 79) consist of dry stacked walls or rock piles interpreted as the remnants of a fence line associated with managing the movement livestock or defining agricultural/pasture field boundaries. The majority of these features are located north of Keāhuaiwi Gulch, including eleven of which are located along the edge of a minor natural drainage running through the area north of Keāhuaiwi Gulch; these features likely were once a part of a fence line that prevented cattle from enter into the drainage. Another fence line, Feature 34, is evident along the minor drainage that flows into Keāhuaiwi Gulch in the southeast quadrant of Survey Area 1. Only three fence line features (Feature 77 through 79), are located south of Keāhuaiwi Gulch in the southwest corner of Survey Area.

In addition to the dry stacked walls interpreted as the remnants of fence lines, there are two additional features associated with livestock management located in open pastureland in the north central portion of Survey Area 1. Feature 45 consists of "L"-shaped dry-stacked wall, located directly north of Feature 46, a dry stacked u-shaped enclosure. Feature 45 is interpreted as having been built to prevent erosion of an embankment onto the enclosure, while Feature 45 is assumed to be related to cattle ranching in the area.



Figure 36. Example of dry-stacked wall (Feature 58) which supported former fence line along drainage, view to southeast.



Figure 37. Example of dry-stacked wall (Feature 58) which likely served as a former fence line, view to the east.

Habitation Features South of Keāhuaiwi Gulch

Four features (Feature 26 through 29) associated with Historic habitation are concentrated in the central portion of Survey Area, immediately south of a wooded area and Keāhiuaiwi Gulch (see Figure 23). Features 26 and 27 are dry stacked walls that retain soil to the south (Figure 38 and 41). Approximately 18 m north of the retaining walls is Feature 28, a u-shaped enclosure (Figure 42) and Feature 29, an alignment of basalt cobbles (Figure 43). Ceramic sherds and glass fragments likely dating to the late nineteenth century were observed around these features leading to the interpretation that these features constitute a habitation site used during the 19th century, possibly by laborers working in the nearby agricultural field or by ranchers as they ran cattle through the area.



Figure 38. Feature 026, view to south.

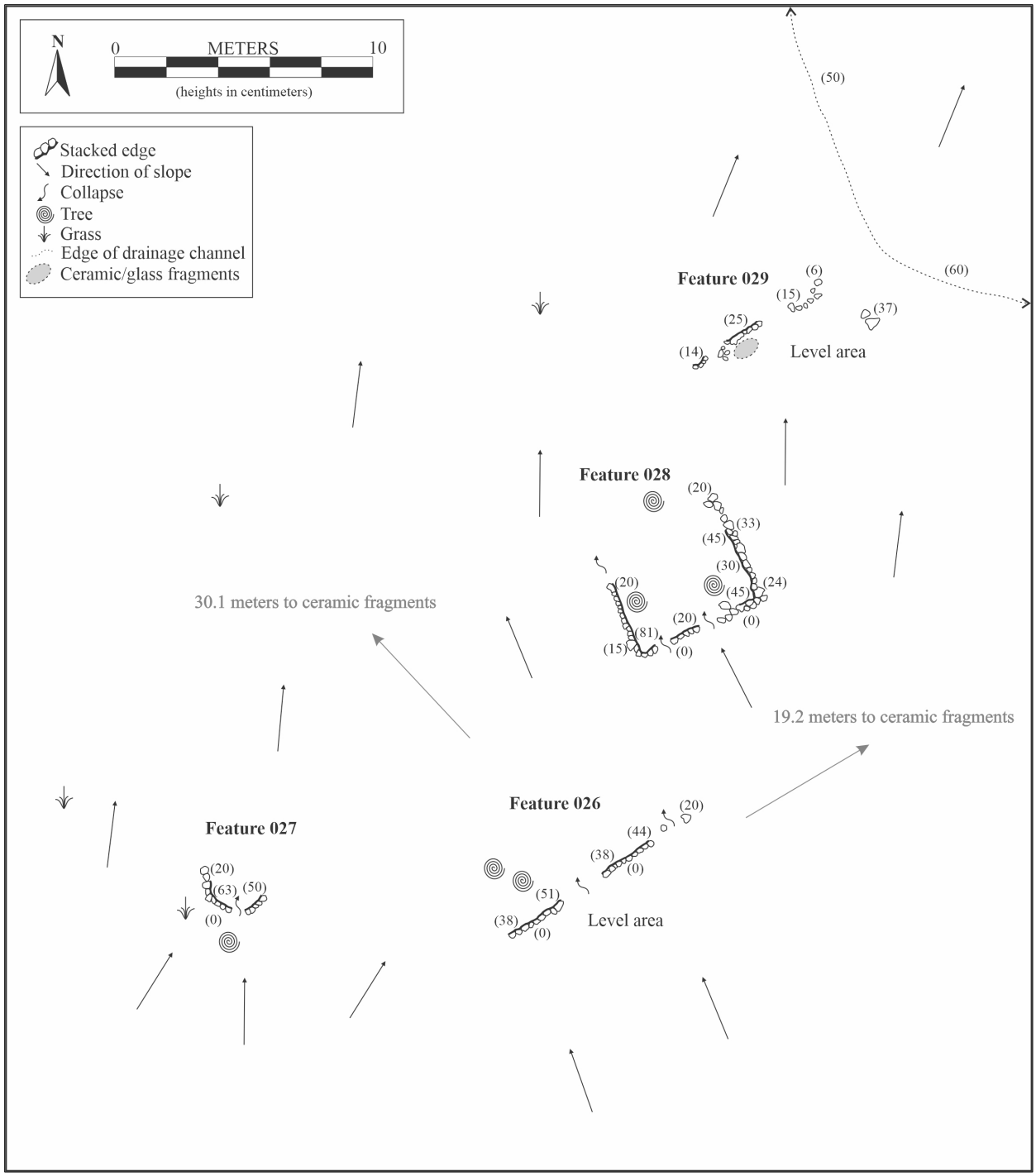


Figure 39. Plan view of Features 026, 027, 028, and 029.



Figure 40. Habitation features located south of Keāhuaiwi Gulch.



Figure 41. Feature 027, view to the southwest.



Figure 42. Feature 028, walls and interior portion of enclosure, view to the northwest.



Figure 43. Feature 029, view to the southeast.

Dairy Farm Infrastructure North of Keāhuaiwi Gulch

Eight features, interpreted as related to dairy operations at Erehwon Ranch, were identified concentrated in the north central portion of Survey Area 1 (see Figure 23), north of Keāhuaiwi Gulch (Figures 44 and 45). Feature 019 is a concrete that once served as the silo for the Erehwon Dairy (Figure 46). Adjacent to Feature 19, Feature 20 is a wooden structure interpreted as a potential barn (Figure 47). A wooden trough, labeled Feature 053, is located approximately15.5 meters west/southwest of the Erehwon Dairy Barn (Figure 48). Another watering hole, Feature 55, comprised of a circular earthen depression, is located 180 meters west of the dairy farm infrastructure (Figure 49). Directly east of the silo and barn is a large concrete foundation, comprised of a concrete slab and two concrete troughs which was designated as Feature 22 (Figure 50). This concrete is interpreted as a feeding and water station for cattle. A cattle chute, designated as Feature 021, provides access to the feeding and watering area from the southern end of the foundation (Figure 51). In the northwest corner of Feature 22, a cattle squeeze, designated as Feature 074, is located (Figure 52). This cattle cage is constructed with metal bars, plates, and chains and has manufacturer's plaque depicting cartoon a cow and an inscription which reads: "PORTABLE / CATTLE / SQUEEZE / AND / DEHORNING GATE / PATENT NO. …90…3 / TECO PRODUCT / MANUFACTURED BY / THOMPSON & GILL, INC. / … CALIFORNIA / MODEL SERIAL NO. / 68R SERIAL NO. 12209 (Figure 53). North of the feeding and watering area, three concrete remnants, consisting of a concrete ring, a concrete trough, and a concrete foundation, were recorded as Feature 23 and interpreted as the possible remnants of a former outbuilding (Figure 54).

Following the establishment of Erehwon Cattle Station (later Erehwon Cattle Ranch) in 1888, one of its primary products was dairy products which would be sold in Kahului. Butter was initially produced by hand-milking rather than with the aid of a milking machine (von Tempsky 1979:12). In 1911, Dora von Tempsky initiated the construction of a dairy barn to accelerate the production of butter; construction was completed in 1912. However, when Boy von Tempsky took over management of the cattle station, he worked to transform the dairy ranch into a cattle ranch focus on beef production as competition within the dairy market had increased due to increased importation California butter to Hawai'i. The silo, the feeding and water area, the barn and the other outhouse are all interpreted as part of the dairy operations on the Erehwon Cattle Station during the first decades of the 20th century.

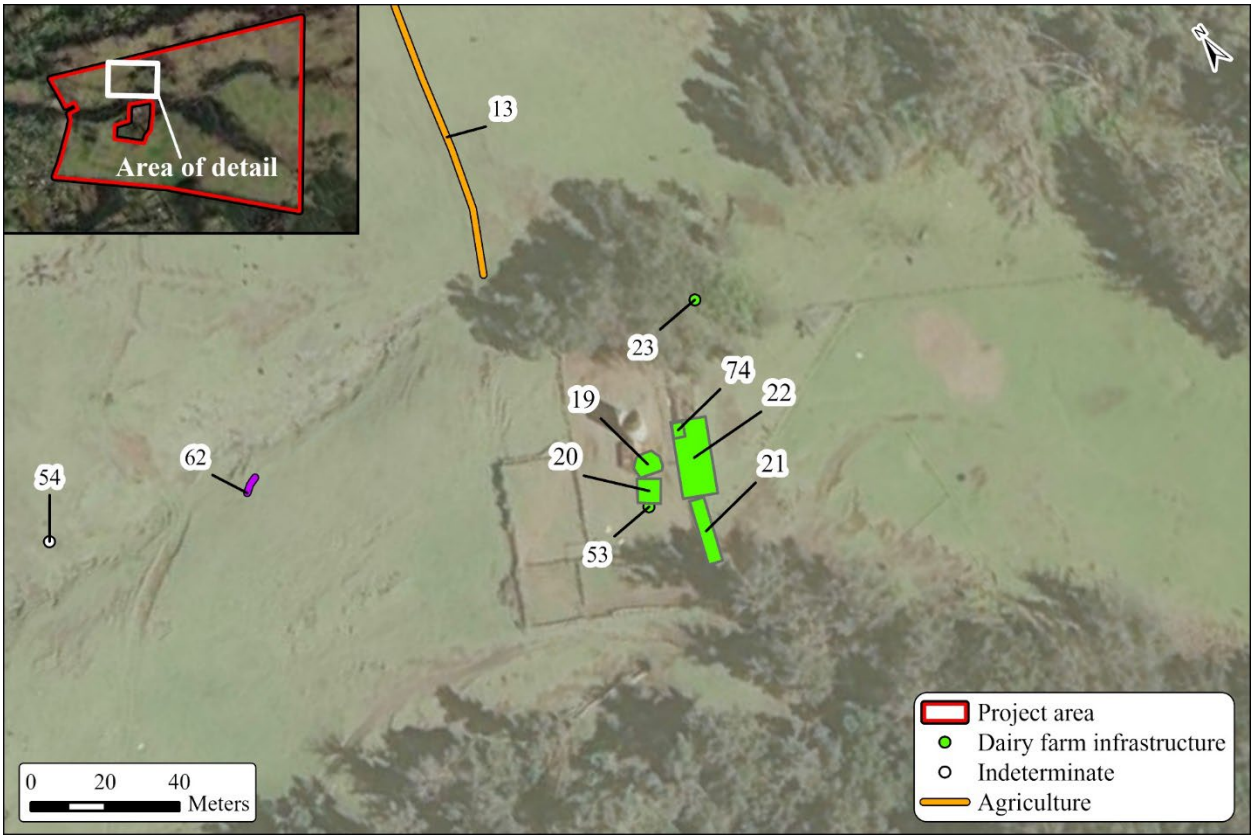


Figure 44. Dairy farm infrastructure north of Keāhuaiwi Gulch.

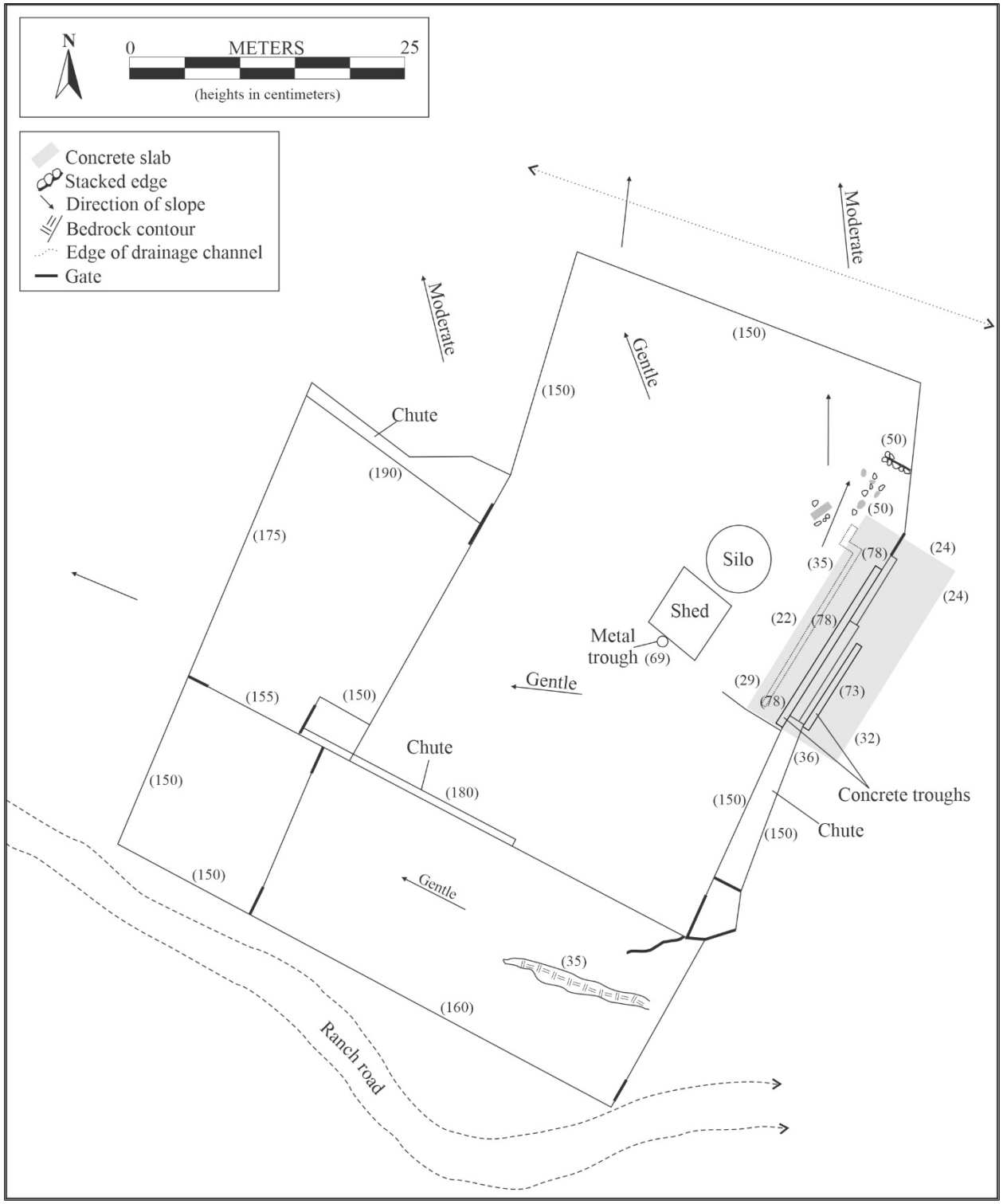


Figure 45. Plan view of Feature 19 in relation to nearby features.



Figure 46. Feature 019, view to the southwest.



Figure 47. Feature 020, view to the southeast.



Figure 48. Feature 053, view to the northwest.



Figure 49. Feature 055, view to the north.



Figure 50. Feature 022, view to northeast.



Figure 51. Feature 021, view to the south.



Figure 52. Feature 074, view to the southwest.



Figure 53. Feature 074, close-up of manufacturer's plaque.



Figure 54. Feature 023, concrete slab in between concrete ring and trough, view to the southwest.

Features with Indeterminate Function

There are 14 features identified south of Keāhuaiwi Gulch whose function is indeterminate (see Figure 23). Feature 24 is a lava tube opening surrounded by fencing and situated in open pasture in the southwest quadrant of Survey Area 1 (Figure 55). The fencing likely served to prevent cattle from falling into the lava tube, but it is unknown if the tube may have been used during the Precontact or Historic Periods for other functions. Ten rocks piles (Feature 43, 35 through 37, 48, 39, 52, 54, 56, 70) were observed in various locations across the Survey Area 1, whose function is indeterminate (Figure 56 and 57). Two enclosures were identified: Feature 40, comprised of a rectangular enclosure with no opening, in the south-central border of Survey Area 1 (Figure 58) and Feature 42, comprised of a u-shaped enclosure, along Survey Area 1's southeast border (Figure 59). These enclosures were likely built during the historic period; however, their function is indeterminate. Lastly a dry stacked wall, designated Feature 41, was identified central portion of Survey Area 1 (Figure 60). The retained soil upslope from the wall and glass, metal and red brick fragments were located nearby. The exact function of the wall is indeterminate.



Figure 55. Overview of Feature 024, view to the southwest.



Figure 56. Example of rock pile (Feature 043) identified within Survey Area 1, view to the northeast.



Figure 57. Example of rock pile (Feature 036) identified within Survey Area 1, view to the northeast.



Figure 58. Feature 040, view to the north.



Figure 59. Feature 042, view to the northwest.



Figure 60. Feature 041, view to the southwest.

SURVEY AREA 2 FINDINGS

During the reconnaissance survey in Survey Area 2, three newly identified sites were recorded and assigned temporary site numbers (Table 8 and Figure 61). These include a modified outcrop (Site T-2), a cairn/rock mound (Site T-3), and a cairn (Site T-4). These sites were all located in the central portion of Kamehamenui Forest Reserve. In addition, three previously recorded sites, consisting of two rock walls (Temp No. SM-03 and SM-04) and a rock pile (Temp No. SM-05) were noted during the background research as being located along the proposed trail route along the southwest boundary of the forest reserve. These sites were previously recorded by Moore (2022) nearby one of the trail routes and are also discussed below.

Table 8. Sites identified in Survey Area 2

Site No.	*Type*	*No. of Features*	*Age*
T-2	Modified Outcrop	1	Indeterminate
T-3	Cairn/Mound	1	Indeterminate
T-4	Cairn	1	Indeterminate
SM-03	Rock wall	1	Indeterminate
SM-04	Rock wall	1	Indeterminate
SM-05	Rock pile	1	Indeterminate

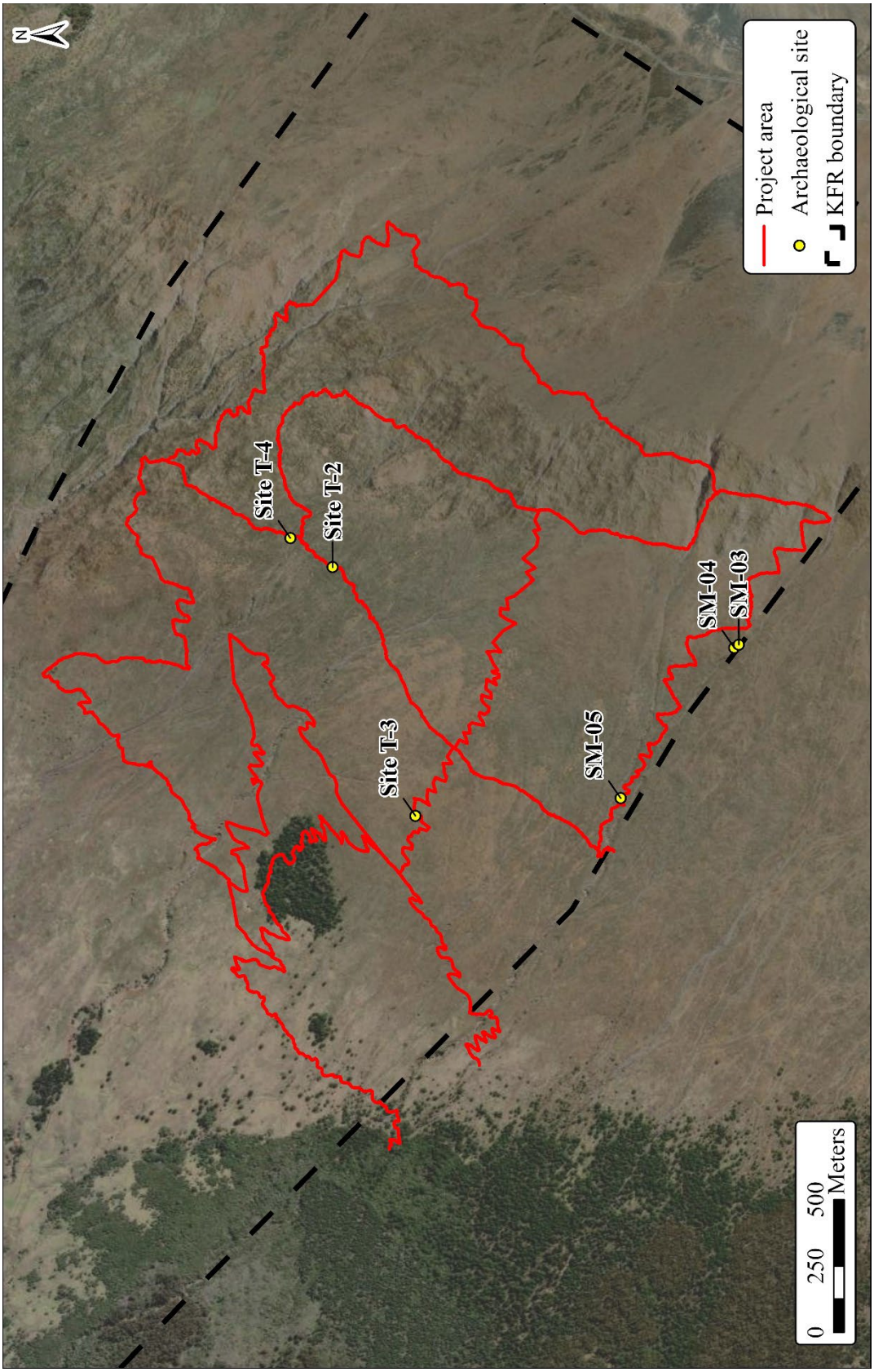


Figure 61. Archaeological sites identified in Survey Area 2.

Site T-2

Site T-2 is a modified outcrop located in the central portion of Survey Area in a sparsely vegetated upland terrain that slopes west/southwest (see Figure 61). The feature is built off the southwestern edge of a bedrock outcrop and constructed with small to large-sized basalt cobbles (Figure 62). It measures 2.2 meters long (northwest to southeast) by 1.2 meters wide with heights ranging between 40 and 80 centimeters tall (Figure 63). The northern end is much lower with a single slab, and it appears to be a possible entry way. The interior of the enclosure consists of soil. With minimal to no collapse or erosion, Site T-2 is in good condition. The function of Site T-2 is indeterminate.

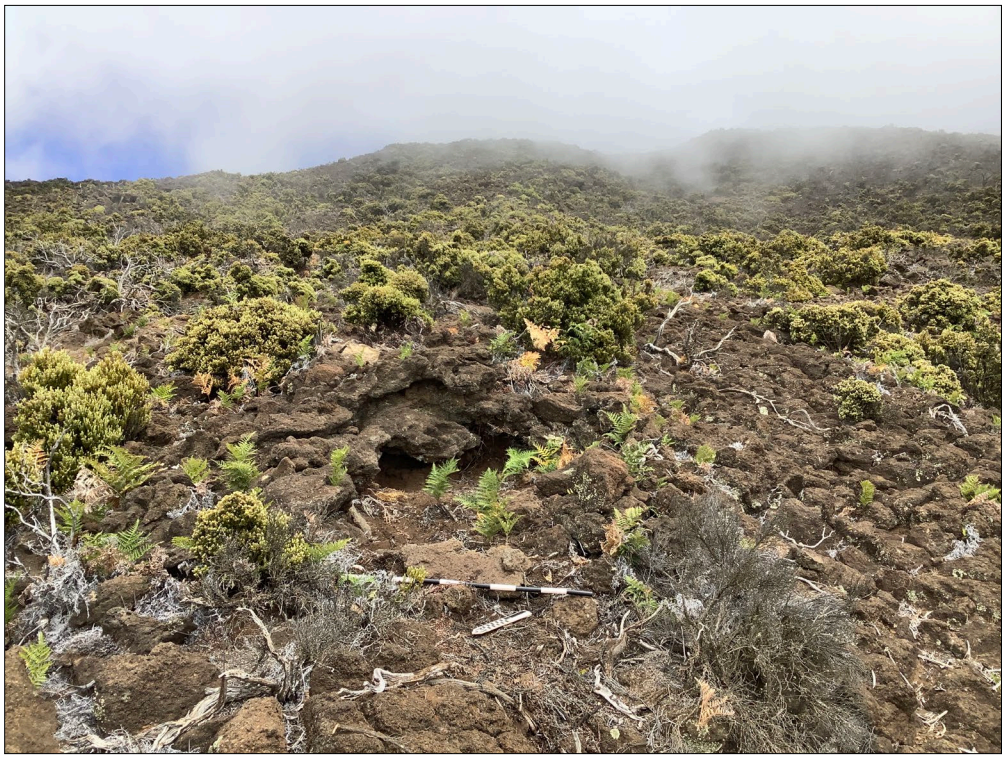


Figure 62. Site T-2, view to the southeast.

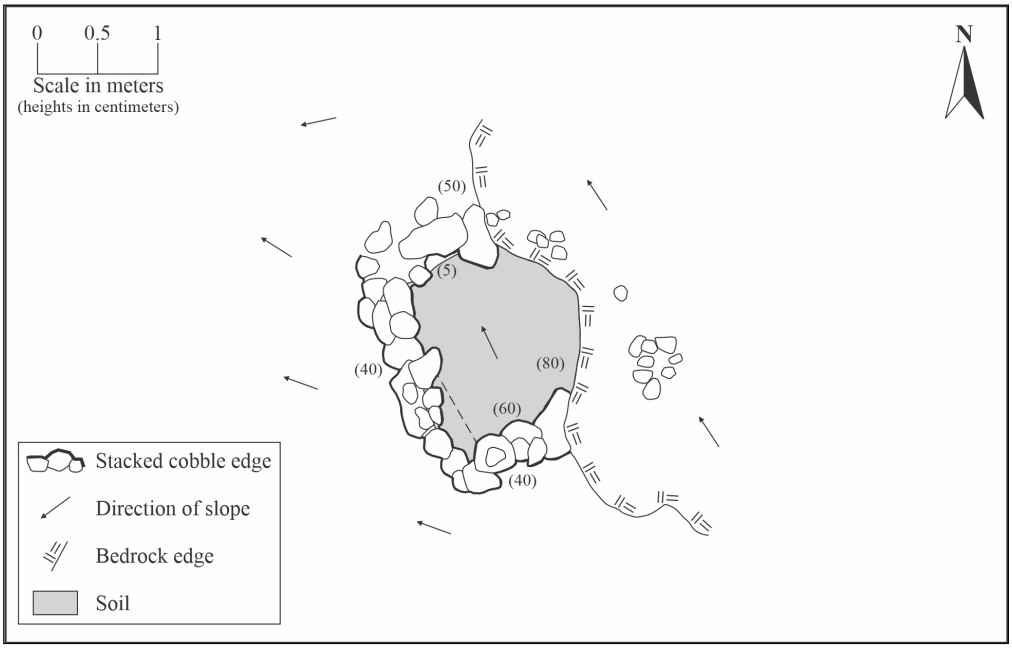


Figure 63. Plan view of Site T-2.

Site T-3

Site T-3 is a cairn/mound located in the central portion of Survey Area 2, approximately 990 meters southwest of Site T-2. It is situated in a sparsely vegetated upland terrain that slopes west/southwest. The feature is constructed with small to large-sized basalt cobbles and small-sized boulders that have been roughly stacked one to three courses high on a pāhoehoe outcrop (Figures 64 and 65). It measures 3.5 meters long by 2.5 meters wide and stands at 50 centimeters tall. Roughly 2 meters northwest (downslope) of this feature is a broken colorless glass jar. Overall, this cairn/mound is in good condition. The function of Site T-3 is indeterminate.



Figure 64. Site T-3, view to the west.



Figure 65. Site T-3, view to the east.

Site T-4

Site T-4 is a cairn located in the central portion of the Survey Area 2, approximately 200 meters northeast of Site T-2. It is constructed with three large-sized basalt cobbles that have been stacked on top of a natural basalt outcrop at roughly 95 centimeters all. The base of the cairn measures approximately 80 centimeters long, while the top of the cairn is roughly 40 centimeters long. Based on construction methods and feature morphology, Site T-4 most likely is a modern construction.



Figure 66. Site T-4, view to the northwest.

SM-03

SM-03 is a rock wall located along the southwest boundary of the KFR, approximately 750 meters south of Site T-3. The site was previously identified by Moore (2022:21), who described it as follows:

> It is slightly curved and measures 2.1 m long and 0.7 m high. The rock wall is informally stacked; 2–3 courses are present. The wall is constructed of basalt boulders and cobbles placed on the ground surface and is 3.9 m north of Temporary Site No.SM-04. It is upslope from a roughly circular flat area measuring approximately 2 m in diameter. The site is interpreted as a temporary habitation.



Figure 67. SM-3, a rock wall. Reproduced from Moore (2022:23).

SM-04

SM-04 is a rock wall located along the southwest boundary of the KFR, approximately 4 m south of SM-03. The site was previously identified by Moore (2022:22), who described it as follows:

> It measures 2.2 m long and 0.6 m high; 1–3 informally stacked courses are present. The wall is constructed of basalt boulders and cobbles placed on the ground surface…The site is interpreted as an informal windbreak.



Figure 68. SM-3, a rock wall. Reproduced from Moore (2022:23).

SM-05

SM-05 is a rock pile located along the southwest boundary of the KFR, approximately 700 meters northwest of SM-3 and SM-04. The site was previously identified by Moore (2022:22), who described it as follows:

> It measures 0.5 m wide and 0.6 m high. The rock pile is constructed of basalt boulders and cobbles placed on a large boulder. The site is interpreted as a marker.



Figure 69. SM-3, a rock wall. Reproduced from Moore (2022:23).

5. SIGNIFICANCE EVALUATIONS AND TREATMENT RECOMMENDATIONS

The archaeological sites are assessed for their significance based on criteria established and promoted by the DLNR-SHPD and contained in the Hawai‘i Administrative Rules §13-275-6. For a resource to be considered significant it must possess integrity of location, design, setting, materials, workmanship, feeling, and association and meet one or more of the following criteria:

a Be associated with events that have made an important contribution to the broad patterns of our history;

b Be associated with the lives of persons important in our past;

c Embody the distinctive characteristics of a type, period, or method of construction; represent the work of a master; or possess high artistic value;

d Have yielded, or is likely to yield, information important for research on prehistory or history;

e Have an important traditional cultural value to the native Hawaiian people or to another ethnic group of the state due to associations with traditional cultural practices once carried out, or still carried out, at the property or due to associations with traditional beliefs, events or oral accounts—these associations being important to the group’s history and cultural identity.

The significance and recommended treatment for the SIHP site recorded as part of the AIS of Survey Area 1 is presented below, followed by recommendations for the treatment of the six temporary sites documented within Survey Area 2 which are not assessed for significance here.

Survey Area 1

One historic property, Site 50-50-11-T-1, was identified within Survey Area 1 during the archaeological inventory survey fieldwork (Table 9). Site T-1 is a 320-acre portion of the Erehwon Cattle Ranch, comprised of 82 distinct features documented within Survey Area 1. The features consist of a variety of site types (CRM walls, dry-stacked walls, terraces, rock piles, historic structures, enclosures, etc.), which were interpreted as related to the operation of the historic ranch, including water management, livestock management, erosion control, dairy farming, habitation, and agriculture. An evaluation of the site’s significance and the recommended treatment follows below.

Table 9. Site significance and treatment recommendations for Survey Area 1.

Site #	*Site Type*	*Temporal Affiliation*	*Significance*	*Recommended Treatment*
T-1	Erehwon Ranch	Historic	b, d	Preservation

Site 50-50-11-T-1

Site T-1 is Erehwon Cattle Ranch, consisting of 82 features spread throughout the 320 acres that comprise Survey Area 1. The features are in various conditions ranging from good to poor, but the overall site retains integrity and is considered significant under Criterion b for the association of the site with the von Tempsky family, who established the Erehwon Cattle Ranch on the slopes of Haleakalā, and under Criterion d for information yielded relative to Historic agriculture and ranching in Kula.

The recommended treatment for Site T-1 is the preparation of a preservation plan for the continued protection and maintenance of the feature within the site in accordance with HAR §13-277. In addition, it is recommended that the recreational infrastructure proposed by DOFAW avoid impacting any of the extant features located nearby. Figure 70 shows the proposed infrastructure in relationship to the recorded Site T-1’s features and demonstrates where the proposed infrastructure developments could impact archeological features. For example, the boundaries of the proposed archery range along the northern boundary should be adjusted so that Feature 48 is avoided. Additionally, the proposed access road and trails should follow existing ranch roads and trails and should avoid impacts to any of the documented features. For example, the proposed archery access road is close to Feature 45 through 47. In order to avoid impacting these features, the proposed road should follow the existing dirt road which is in the same area. Similarly, the road to the 51-stall parking lot is proposed to run near, if not through Feature 21. However, there is an existing ranch road south of the dairy farm infrastructure, which the future road should plan to follow. Lastly, the equestrian access route intersects with Features 10, 59, and 66. However, there are existing horse and pedestrian trails through these features which the future equestrian trail should use to avoid creating new breaches through those

features. Lastly it is recommended that if any repairs or improvements that could impact the existing architectural components of Site T-1, such as Feature 19 (silo) and Feature 20 (barn), that DOFAW prepare additional architectural documentation of those structures under HRS 6E, such as a Reconnaissance Level Survey (RLS), in consultation with the DLNR-SHPD.

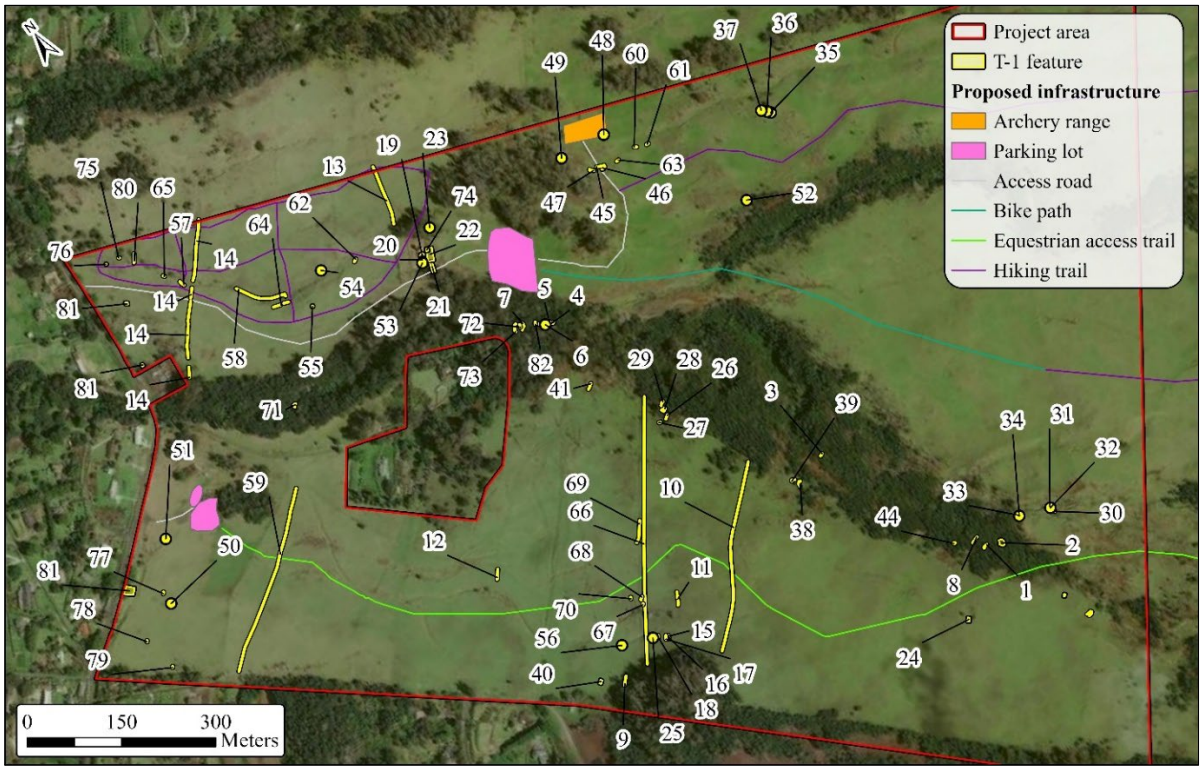


Figure 70. Proposed infrastructure shown in the management plan in relation to the features of Site T-1.

Survey Area 2

Six archaeological features were assigned temporary site designations within Survey Area 2 (see Figure 61 and Table 10). These sites represent a more ephemeral use of the upper elevations of the KFR as compared to the makai region. The sites consist of a modified outcrop (Site T-2), a cairn/ mound (Site T-3), a cairn (Site T-4), two rock walls (SM-03 and SM-04) and a rock pile (SM-05). Three of these sites (Site T-2, Site T-3, and Site T-4) were identified and recorded during the reconnaissance survey field work. The remaining three sites (SM-03, SM-04, and SM-5) were previously identified by Moore (2020). The significance of these sites was not evaluated dure to the reconnaissance nature of the survey conducted for the 25 miles of trails, however, it is recommended that DOFAW avoid these sites when finalizing the route of the trails in Survey Area 2. Furthermore, once the trail routes and the location of the camp sites have been finalized and confirmed, it is recommended that more intensive archaeological survey should be conducted to ensure no additional sites are within the boundaries of the trail corridors nor within the footprints of the proposed camp sites.

Table 10. Recommendations for sites documented within Survey Area 2.

Site #	*Site Type*	*Temporal Affiliation*	*Significance*	*Recommended Treatment*
T-2	Modified Outcrop	Indeterminate	n/a	Avoidance and conservation
T-3	Cairn/Mound	Indeterminate	n/a	Avoidance and conservation
T-4	Cairn	Indeterminate	n/a	Avoidance and conservation
SM-03	Rock wall	Indeterminate	n/a	Avoidance and conservation
SM-04	Rock wall	Indeterminate	n/a	Avoidance and conservation
SM-05	Rock pile	Indeterminate	n/a	Avoidance and conservation

6. DETERMINATION OF EFFECT

As a result of the AIS, one archaeological site was documented within the current project area. The site, Site T-1, consists of 82 features associated with Erewhon Cattle Ranch and spread throughout the 320-acre Survey Area 1. Archival research indicates that the Erehwon Ranch utilized the area for cattle ranching and agriculture from the mid-19th century through 1990. These activities likely disturbed any evidence of Precontact and early Historic agriculture or habitation; however, Historic Period ranching infrastructure, including features related to water management, livestock control, and potato cultivation remains present. The 320-acre portion of the Erehwon Ranch situated within Survey Area 1 was fully documented as a result of the current AIS and is recommended for preservation. As such, the recommended determination of effect for the portion of the proposed project that is to occur within makai portion of the KFR (within Survey Area 1), pursuant to HAR §13-275, is "Effect, with proposed mitigation commitments." An archaeological preservation plan meeting the standards of HAR §13-277 should be prepared for Site T-1and submitted to DLNR-SHPD for review and acceptance as part of the future implementation of the development activities specified in the management plan. Additionally, as discussed above, impacts to the 6 features identified within Survey Area 2 should be avoided, and once the trail routes and the locations of the camp sites in that area have been selected and finalized, additional archaeological survey should occur to ensure no additional features are present within the proposed development footprint.

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APPENDIX A.

SITE 50-50-11-T-1 FEATURE DESCRIPTIONS

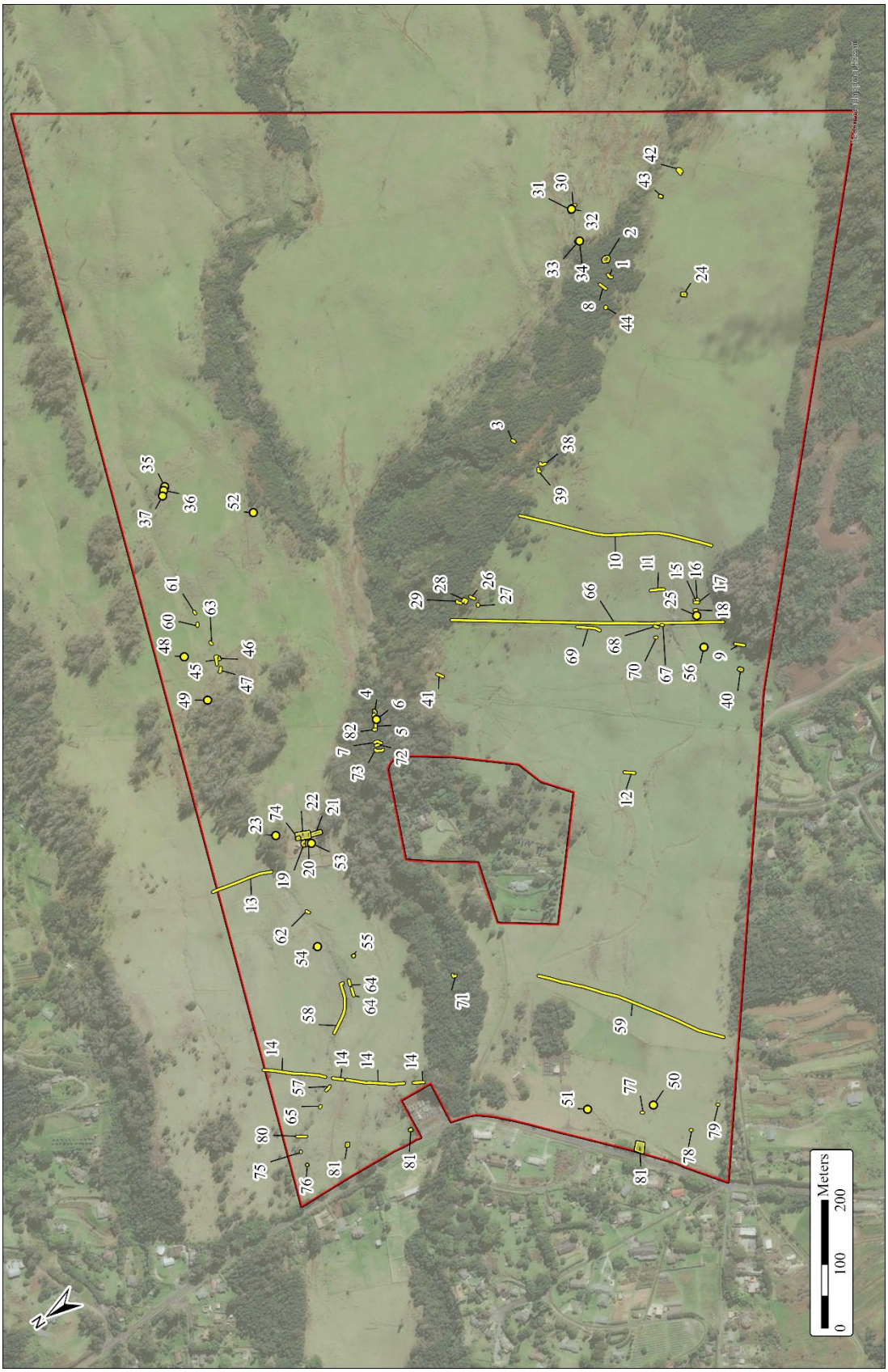


Figure 1. Map of features within Site T-1.

FEATURE 001

Feature 001 is a CRM wall constructed across Keāhuaiwi Gulch in the southeastern quadrant of Survey Area 1 (see Figure 1). It has been constructed with small to large-sized basalt cobbles and small-sized basalt boulders stacked roughly four to five courses high (56 to 120 centimeters tall) and mortared together (Figure 2 and 3). The wall measures 7.6 meters long and has varying widths ranging between 0.67 and 0.89 meters. The eastern end of the wall terminates before reaching the eastern bank. Despite signs of weathering due to water damage, Feature 001 is in good condition. Based on its construction methods and feature morphology, Feature 001 was most likely constructed for water management within Keāhuaiwi Gulch during the Historic Period.



Figure 2. Feature 001, view to the south.



Figure 3. Feature 001, view to the southwest.

FEATURE 002

Feature 002 is a CRM wall in the southeastern quadrant of Survey Area 1 within Keāhuaiwi Gulch (see Figure 1). The wall has been constructed along the southwestern edge of a large natural circular basin in the middle of the gulch (Figure 4). The wall measures 8.25 meters long (north to south) and 0.2 meters wide and has been constructed of small and medium cobbles stacked roughly two to three courses high (30 to 57 centimeters tall). The cobbles have been mortared together and capped with a thin layer of cement (Figure 5). Despite exposure to water, Feature 002 is in fair condition. Based on its construction methods and feature morphology, Feature 002 was likely constructed during the Historic Period to increase the height of the basin for better water retention and water management within Keāhuaiwi Gulch.



Figure 4. Feature 002 along the southwestern edge of gulch, view to the southeast.



Figure 5. Feature 002, view to the southwest.

FEATURE 003

Feature 003 is a CRM wall in the southeastern quadrant of Survey Area 1 within Keāhuaiwi Gulch (see Figure 1). The drainage has been modified by the construction of a wall, which is now only partially intact. The wall remnant is constructed of medium and large-sized basalt cobbles that have been stacked up to three courses high (60 centimeters tall) and mortared together (Figures 6 and 7). It extends 4.9 meters from the western wall of the gulch and measures 0.6 meters wide. The eastern termination of the wall is damaged, but likely continued for at least another 40 centimeters. Despite evidence of erosion and damage due to water exposure, the remaining portion of Feature 003 is in fair condition. Based on its construction methods and feature morphology, Feature 003 was most likely constructed during the Historic Period to control the movement of water within the Keāhuaiwi Gulch.



Figure 6. Feature 003, view to the northwest.



Figure 7. Feature 003, view to the southwest.

FEATURE 004

Feature 004 is a CRM wall remnant in the approximate center of Survey Area 1 within Keāhuaiwi Gulch (see Figure 1). The remains of a former wall are present on top of a natural bedrock bridge. The wall remnant is constructed with primarily small-sized basalt cobbles have been stacked up to two courses high (ranging from 10 and 20 centimeters tall) and mortared together. It measures approximately 0.3 meters long and 0.3 meters wide (Figure 8). It is probable that the wall extended across the natural bedrock bridge and may have been taller at one point in time but has since collapsed. Residual evidence of mortar was observed at the southwestern end of the bedrock bridge. With significant signs of weathering due to water damage, Feature 004 is in poor condition. Based on its construction methods and feature morphology, Feature 004 was most likely constructed during the Historic Period to control the movement of water within Keāhuaiwi Gulch.



Figure 8. Feature 004, mortared section, view to the north.

FEATURE 005

Feature 005 is a CRM wall located in the approximate center of Survey Area 1 within Keāhuaiwi Gulch (see Figure 1). Feature 005 seals the underside of a natural bedrock bridge which spans the gulch and thus, creates a large basin area which can retain water. A wall has been constructed following the natural curvature of the basin to block off the opening below the natural bridge. It is constructed with small and medium-sized basalt cobbles, stacked to a height of approximately 260 centimeters and mortared together (Figure 9). The western face of the wall is partially coated with a layer of plastered mortar. Despite signs of weathering due to water damage, Feature 005 is in good condition. Based on its construction methods and feature morphology, Feature 005 was most likely constructed during the Historic Period to create a retention pond for water management within Keāhuaiwi Gulch.



Figure 9. Feature 005, view to the east.

FEATURE 006

Feature 006 is a pillar in the approximate center of Survey Area 1 along the southern bank of Keāhuaiwi Gulch (see Figure 1). The structure is constructed with small to large-sized basalt cobbles that have been stacked approximately four to seven courses high (74 centimeters tall) and mortared together (Figure 10). It measures 0.8 meters long and 0.8 meters wide. With minimal signs of weathering and collapse, Feature 006 is in good condition. Feature 006 was likely constructed during the Historic Period and may have been associated with water management within Keāhuaiwi Gulch.



Figure 10. Feature 006, view to the east with Feature 005 in background to the left.

FEATURE 007

Feature 007 is a CRM wall located in the approximate center of Survey Area 1 within Keāhuaiwi Gulch (see Figure 1). The wall consists of large-sized basalt cobbles and small-sized basalt boulders that have been stacked approximately three to four courses high (ranging from 23 and 80 centimeters tall) and mortared together (Figure 11 and 12). It measures 10.6 meters and 0.48 meters wide. The wall has been built perpendicular to and across the gulch and is one of three in succession extending downstream (Features 007, 072, and 073). With minimal signs of weathering and collapse, Feature 007 is in good condition. Based on construction methods and feature morphology, Feature 007 was constructed during the Historic Period for water management within Keāhuaiwi Gulch.



Figure 11. Feature 007 located at the top center of the frame, view to the east.



Figure 12. Overview of Feature 007, view to the south.

FEATURE 008

Feature 008 is CRM wall located in the southeast quadrant of Survey Area 1 within Keāhuaiwi Gulch (see Figure 1). The wall is constructed across the gulch with large-sized basalt cobbles and small to large-sized basalt boulders that have been stacked approximately five to six courses high (ranging from 100 to 140 centimeters tall) and mortared together (Figure 13, 14, and 15). It measures 12.1 meters long and 1.4 meters wide. The center portion of the wall has collapsed. The wall was originally covered in a layer of mortar but much of it has broken off. Feature 008 is in poor condition due to the collapsed middle section. Based on construction methods and feature morphology, Feature 008 was most likely constructed during the Historic Period for water management within Keāhuaiwi Gulch.



Figure 13. Feature 008, with collapse shown, view to the northwest.



Figure 14. Feature 008, view to the southeast.



Figure 15. Feature 008, surface (top) of wall, view to the southwest.

FEATURE 009

Feature 009 is a terrace/berm located in the south-central portion of Survey Area 1 and situated in open pasture/field land (see Figure 1). It is constructed with soil and possibly stone, but no formal stacking is evident (Figure 16 and 17). It measures 14.7 meters long. During the time of the fieldwork, the berm was covered by an overgrowth of grasses, such that the width and height of the berm is indetermined. At the southern end of the berm, a rock pile was noted, likely a bulldozed push pile. It is constructed with small to large-sized cobbles and small-sized boulders. It measures two meters long and 0.7 meters wide and has heights ranging from 26 and 59 centimeters tall. Due to signs of weathering and grasses that have grown over and around the feature, Feature 009 is in poor condition. Based on construction methods and feature morphology, Feature 009 may have been a terrace at one point in time utilized for potato cultivation during the Historic Period.



Figure 16. Feature 009, view to the northeast.



Figure 17. Rock pile at south end of Feature 009, view to the southeast.

FEATURE 010

Feature 010 is a terrace/berm located in the south-central portion of Survey Area 1 and situated in open pasture/field land (see Figure 1). It is constructed with soil and possibly stone, however, due to the overgrowth of grasses at the time of the fieldwork, stones were not visible (Figures 18 and 19). The feature measures an overall length of 310 meters. A single ceramic fragment and a metal (iron) tool were observed approximately between 14 and 24 meters east/northeast of this berm (Figures 20 and 21). As previously mentioned, due to the overgrowth of grasses, it was difficult to determine the width and height of this berm, as well as its condition. Based on construction methods and feature morphology, Feature 010 may have been a terrace at one point in time utilized for potato cultivation during the Historic Period.



Figure 18. Feature 010, view to the south.



Figure 19. Feature 010, view to the north.



Figure 20. Feature 010, overview of ceramic fragment (circled in yellow).



Figure 21. Feature 010, overview of metal (iron) tool.

FEATURE 011

Feature 011 is a dry-stacked retaining wall located in the south-central portion of Survey Area 1 and situated in open pasture/field land (see Figure 1). This wall is constructed with medium and large-sized basalt cobbles and small-sized basalt boulders that have been dry-stacked stacked one to three courses high (Figures 22 and 24). It measures 21.2 meters long (northeast to southwest) by 0.94 meters wide and stands at 69 centimeters tall. The wall retains soil to the east creating a level terraced area. Despite some collapse along its length, Feature 011 is in good condition. Based on construction methods and feature morphology, Feature 011 may have been used for potato cultivation during the Historic Period.



Figure 22. Feature 011, view to the northeast.



Figure 23. Collapsed section of Feature 011, view to the southeast.



Figure 24. Feature 011, view to the northeast.

FEATURE 012

Feature 012 is a dry-stacked wall located in the southwest quadrant of Survey Area 1 and situated in open pasture/field land (see Figure 1). It is linear in shape and constructed with soil and primarily small-sized boulders that are partially buried in grass. It measures approximately15.9 meters long (Figure 25). The area to the east and west of the feature is relatively level and cleared of cobbles. Due to the overgrowth of the grasses, it was difficult to determine the width and height of this feature, as well as its condition. Based on construction methods and feature morphology, Feature 012 may have been a terrace at one point in time utilized potato cultivation during the Historic Period.



Figure 25. Feature 012, view to the southeast.

FEATURE 013

Feature 013 is a terrace/berm located in the northeast quadrant of Survey Area 1 and situated in open pasture/field land (see Figure 1). It is constructed with soil and possibly stone, however, due to the overgrowth of grasses at the time of the fieldwork, stones were not visible (Figure 26). It measures 78 meters long. Due to the overgrowth of the grasses, it was difficult to determine the width and height of this feature, as well as its condition. Based on construction methods and feature morphology, Feature 013 was likely utilized for potato cultivation during the Historic Period.



Figure 26. Feature 013, at center of frame running from bottom to top toward the fence in the background, view to the northeast.

FEATURE 014

Feature 014 is dry-stacked wall situated in open pasture/field land within the northeast quadrant of Survey Area 1 (see Figure 1). It has been constructed perpendicular to the slope and sometimes retains soil on the east side creating, a terrace-like appearance. Portions of the wall are collapsed resulting in a single alignment of cobbles (Figure 27) and some portions of the wall are covered in thick vegetation giving the appearance of a berm (Figure 28). The wall measures approximately 224 meters long and ranging widths between 0.3 and 0.83 meters. Intact sections of the wall stand between 16 and 90 centimeters in height (Figure 29). An approximate six-meter-section of the wall has collapsed likely due to bulldozing activities as there is no cobbles east and west of the wall (Figure 30). A gully passes through the wall; however, the wall does not cross it (Figure 31). The wall continues onward from the southern edge of the gully but is bisected by an approximate six-meter-wide road (Figure 32). Overall, Feature 014 is in fair to poor condition. Feature 014 may have marked a route of a former fence line associated with ranching and/or agricultural purposes during Historic Period.



Figure 27. Collapsed section of Feature 014, view to the south.



Figure 28. Feature 014, soil berm east of the substation, view to the north.



Figure 29. An intact section of Feature 014 by the road, view to the southeast.



Figure 30. Feature 014 impacted by mechanical disturbance, view to the north.



Figure 31. Feature 014 stopping at north edge of a gully and continuing upslope, view to the north.



Figure 32. Feature 014 bisected by a dirt road, view to the west.

FEATURE 015

Feature 015 is a rock pile located in the south-central portion of Survey Area 1 (see Figure 1). The pile is situated along the northeastern edge of a naturally occurring drainage gully within the pasture lands, approximately 2.3 meters across the gully from Feature 016 (Figure 33). It measures 1.7 meters long and 0.7 meters wide has been constructed with medium and large-sized basalt cobbles that have been dry-stacked between two to four courses high (50 centimeters tall). With minimal signs of collapse, Feature 015 is good condition. Based on construction methods and feature morphology, Feature 015 was likely constructed during the Historic Period for water management purposes.



Figure 33. Feature 015, view to the southeast.

FEATURE 016

Feature 016 is a rock pile located in the south-central portion of Survey Area 1 (see Figure 1). The pile is situated along the southeastern edge of a naturally occurring drainage gully within the pasture lands approximately 2.3 meters across the gully from Feature 015 (Figure 34). Features 015 and 016 may have at one time been a single feature that has since had the middle section washed away. It measures 2.5 meters long and one meter wide has been constructed with medium and large-sized basalt cobbles that have been dry-stacked between two to three courses high (69 centimeters tall). With minimal signs of collapse, Feature 016 is good condition. Based on construction methods and feature morphology, Feature 016 was likely constructed during the Historic Period for water management purposes.



Figure 34. Feature 016, view to the southeast.

FEATURE 017

Feature 017 is a dry-stacked retaining wall located in the south-central portion of Survey Area 1, approximately four meters downslope from Features 015 and 016 (see Figure 1). The wall has been constructed across a naturally occurring drainage gully. It consists of medium and large-sized basalt cobbles that have been dry-stacked between two to three courses high (50 centimeters tall) (Figure 35). The wall measures 5.6 meters long and 1.15 meters wide and creates a level surface upstream. With minimal signs of collapse, Feature 017 is good condition. Based on construction methods and feature morphology, Feature 017 was likely constructed during the Historic Period for water management purposes.



Figure 35. Feature 017 in the foreground with Features 015 and 016 in the background, view to the southeast.

FEATURE 018

Feature 018 is a dry-stacked retaining wall located in the south-central portion of Survey Area 1, approximately 12 meters downstream of Feature 017 (see Figure 1). The wall has been built across a naturally occurring drainage gully and creates a level surface upstream retains. The wall measures 3.8 meters long and has a width of 0.28 meters (Figure 36) and is constructed with medium and large-sized basalt cobbles that have been dry-stacked on top of several large basalt boulders (95 centimeters tall). With minimal signs of collapse, Feature 018 is in fair condition. Based on construction methods and feature morphology, Feature 018 was likely constructed during the Historic Period for water management purposes.



Figure 36. Feature 018 in the foreground with Feature 017 in background, view to the east.

FEATURE 019

Feature 019 is a concrete structure located in the northwest quadrant of Survey Area 1 that once served as the silo for the Erehwon Dairy (see Figure 1). It is cylindrical in shape and constructed of concrete. The “ring-like” seams around the feature indicate that the concrete forms were precast and then assembled on site (Figure 37). It is seven meters in diameter (23 feet) and stands approximately 16 meters tall (52.5 feet). A concrete plaque on the northwestern face reads: “SEPT 1913” (Figure 38). It shows signs of weathering and is no longer in use, therefore it is in fair to poor condition.



Figure 37. Feature 019, view to the southwest.



Figure 38. Close-up of Feature 019 with date marker that reads: “SEPT 1913”.

FEATURE 020

Feature 020 is a wooden structure located in the northwest quadrant of Survey Area 1, immediately adjacent (southwest) of Feature 019 (see Figure 1). The structure is constructed with wood planks that have been arranged vertically, and is covered by a corrugated tin roof (Figures 39 and 40). It measures 6.5 meters (21.3 feet) long and 6.5 meters (21.3 feet) wide with a height of approximately seven meters (23 feet) tall. Given that there were sections of where the wooden planks have been removed and/or fallen off, and that it is no longer in use, Feature 020 is in fair to poor condition. Feature 020 was constructed during the Historic Period and due to its proximity to the silo (Feature 019), the structure was likely associated with the Erehwon Dairy and may have served as a barn.



Figure 39. Feature 020, view to the southeast.



Figure 40. South face of Feature 020 with trough, view to the northeast.

FEATURE 021

Feature 021 is a cattle chute located in the northwest quadrant of Survey Area 1, immediately 11.3 meters southeast of Features 019 and 020 (see Figure 1). The cattle chute is oriented in a northeast and southwest direction where the northeastern end connects to the southwestern end of Feature 022 (Feeding/watering station), while the southwestern end is enclosed by a metal gate likely for an entryway for the cattle (Figures 41 and 42). The cattle chute is constructed with metal bars and fencing materials and measures a length of 20.5 meters with ranging widths from three and five meters (three and 16 feet); and heights from 36 and 150 centimeters tall (1.18 and 4.9 feet). Given that there are significant signs of oxidation throughout the length of the cattle chute, it is in fair condition. Based on construction methods and feature morphology, Feature 021 most likely functioned as livestock management associated with Erehwon Dairy.



Figure 41. Feature 021, view to the south.



Figure 42. Gate partition within Feature 021, view to the northeast.

FEATURE 022

Feature 022 is a concrete foundation located in the northwest quadrant of Survey Area 1, directly behind (east) of Features 019 and 020 (see Figure 1). concrete foundation consists of a concrete slab and two concrete troughs, one raised (deeper) and one sunk into the slab (shallower). Metal pipes run vertically up through the slab adjacent to the raised troughs and are spaced at roughly equal intervals along its length (Figure 43). Holes are also present in line with these metal pipes. A flexible, black-colored drisco (made of plastic) pipe runs horizontally through the row of metal pipes. Short concrete posts/stanchions/piers are situated on the opposite side of the slab from the raised troughs, not far from the shallow trough, and are spaced at roughly even intervals along the length of the slab (Figure 44). At the northwestern end, within Feature 022 is Feature 074, a cattle squeeze and dehorning station. The overall dimensions of Feature 022 measures 20.5 meters (67.3 feet) (northeast to southwest) by nine meters (30 feet) wide with varying heights between 24 to 78 centimeters (0.8 to 2.6 feet) tall. Based on construction methods and feature morphology, Feature 022 most likely served as a watering and/or feeding station for livestock at the Erehwon Dairy.



Figure 43. Feature 022, view to northeast.



Figure 44. Feature 022, view to the northeast.

FEATURE 023

Feature 023 consists of three concrete remnants located in the northwest quadrant of Survey Area 1 and approximately 42.2 meters northeast of Feature 019 (see Figure 1). The three remnants consist of a concrete ring, a concrete trough, and a concrete foundation. The concrete ring is constructed with small-sized basalt cobbles that have been mortared with concrete (Figure 45). It measures approximately 1.1 meters in diameter with varying interior depths between 30 to 38 centimeters. A rectangular-shaped trough is noted 4.9 meters to the east of concrete ring. The trough is constructed with small-sized basalt cobbles that have been mortared with concrete (Figure 46). It measures 1.73 and 0.36 meters wide with a maximum height of 30 centimeters (at its northwest end) above the existing ground surface. In between the concrete ring and trough is a concrete slab (Figure 47). It measures 6.53 meters long. During the time of the fieldwork, these features were partially buried beneath soil and duff/leaf litter. With signs of collapse, Feature 023 is in fair to poor condition. Due to its proximity to other features of the Erehwon Dairy the elements of Feature 023 are also likely associated with the dairy and may represent the remnants of a former outbuilding.



Figure 45. Feature 023, concrete remnant, view to the west.



Figure 46. Feature 023, concrete trough in the foreground with concrete ring in the background, view to the west.



Figure 47. Feature 023, concrete slab in between concrete ring and trough, view to the southwest.

FEATURE 024

Feature 024 is a lava tube opening located in the southwest quadrant of Survey Area 1 and situated at a high point in an open pasture field/land (see Figure 1). The opening faces east and measures approximately three meters wide. A combination of wood posts, T-posts, and hog-wire fencing surrounds the feature (Figure 48). It appears to at least extend eight meters deep from the interior ceiling to the floor and likely extends to the west. Rocks and debris have been pushed inside. The lava tube was inaccessible due to the sheer vertical drop and overgrowth of grasses; therefore, presence of cultural material is unknown (Figure 49). Overall, Feature 024 is in fair to poor condition. The function of Feature 024 is indeterminate.



Figure 48. Overview of Feature 024, view to the southwest.



Figure 49. Close-up of Feature 024, view to the west.

FEATURE 025

Feature 025 is rock pile located in the south-central portion of Survey Area 1 and approximately nine meters west of Feature 018 (see Figure 1). It is situated along the southwestern plateau above edge of a gully. The rock pile is constructed with medium and large-sized basalt cobbles and small to large-sized basalt boulders that have been stacked between two to three courses high (Figure 50). The surface of the rock pile is slightly mounded and consists of jumbled medium and large-sized basalt cobbles with a single medium sized boulder. It measures 2.3 meters long by 1.7 meters wide and has ranging heights between 10 and 72 centimeters tall. With some collapse along its eastern edge, Feature 025 is in fair condition. Although the true function of Feature 025 is unknown, based on its proximity to Features 015, 016, 017, and 018, construction methods, and feature morphology, this platform may have been utilized for water management purposes during the Historic Period.



Figure 50. Feature 025, view to the east.

FEATURE 026

Feature 026 is a dry-stacked retaining wall located in the central portion of Survey Area 1, approximately 9.7 meters northeast of Feature 027, and approximately eight meters southeast of Feature 028 (see Figure 1). The wall is situated along the southwestern edge of a wooded area and a drainage channel. It is constructed with medium and large-sized basalt cobbles and several small-sized basalt boulders that have been stacked between two to three courses high (Figure 51). The wall is linear and measures 7.6 meters long and 0.54 meters wide with ranging heights between 20 and 51 centimeters tall and retains soil to the southeast. Ceramic fragments that likely date to at least the early nineteenth century to middle twentieth century were observed in the vicinity (to the northwest and northeast) of Feature 026 (Figure 52). With some signs collapse noted throughout its length, Feature 026 is in fair condition. Feature 026 may be associated with habitation on the Erehwon Ranch during the Historic Period.



Figure 51. Feature 026, view to south.



Figure 52. Ceramic fragment near Feature 026.

FEATURE 027

Feature 027 is a dry-stacked retaining wall located in the central portion of Survey Area 1, approximately 9.7 meters southwest of Feature 026 (see Figure 1). The wall is situated along the southwestern edge of a wooded area and a drainage channel. It is curvilinear in shape and measures 2.8 meters long by 0.2 meters wide and stands between 20 and 63 centimeters in height. It is constructed with small to large-sized basalt cobbles and several small-sized basalt boulders that have been stacked two to three courses high (Figure 53). The wall retains soil to the south. Signs of significant collapse and erosion is evident throughout the length of this feature and is in poor condition. Feature 027 may be associated with habitation on the Erehwon Ranch during the Historic Period.



Figure 53. Feature 027, view to the southwest.

FEATURE 028

Feature 28 is an enclosure located in the central portion of Survey Area 1, approximately 17.7 meters northeast of Feature 027 (see Figure 1). It is situated along the southwestern edge of a wooded area and a drainage channel. The enclosure is three-sided, opening to the northwest and measures 4.7 meters long by 4.7 meters wide. The walls are constructed with small to large-sized basalt cobbles and several small-sized basalt boulders that have been stacked between 20 and 81 centimeters in height (one to four courses high) (Figure 54). With minimal signs of collapse and erosion, this enclosure is in fair condition. Feature 028 may be associated with habitation on the Erehwon Ranch during the Historic Period.



Figure 54. Feature 028, walls and interior portion of enclosure, view to the northwest.

FEATURE 029

Feature 029 is an alignment located in the central portion of Survey Area, 1, approximately 8 meters north of Feature 028 (see Figure 1). Feature 029 is situated along the southwestern edge of a wooded area and a drainage channel. The alignment consists of medium and large-sized basalt cobbles and several small-sized basalt boulders (Figure 55) and measures 7.3 meters (northeast to southwest) by 0.4 meters wide (at its northeastern end). The alignment retains soil to the southeast and has a down slope maximum height of 25 centimeters. Ceramic sherds and glass fragments likely dating to the late nineteenth century were observed to the southeast of the alignment on the level ground surface. Feature 029 is in fair to poor condition. Feature 029 may be associated with habitation on the Erehwon Ranch during the Historic Period.



Figure 55. Feature 029, view to the southeast.

FEATURE 030

Feature 030 is a CRM wall located along the southeastern border of Survey Area 1, approximately 5.4 meters east of Feature 031, and directly east of Feature 032 (see Figure 1). extends for 7.6 meters long (northeast to southwest) across a drainage channel and measures 0.4 meters wide and 240 centimeters tall (Figure 56). It is constructed with medium and large-sized basalt cobbles and small to large-sized basalt boulders that have been stacked approximately eight to 12 courses high and mortared together. In addition, the top surface of the wall has been capped with concrete. With minimal signs of collapse and erosion, this wall is in good condition. Based on construction methods and feature morphology, Feature 030 was constructed during the Historic Period for water management purposes.



Figure 56. Feature 030, view to the east.

FEATURE 031

Feature 031 is a dry-stacked wall located along the southeastern border of Survey Area 1, directly west of Feature 030, and immediately north of Feature 032 (see Figure 1). It is situated on the northern edge of a drainage channel (Figure 57). The wall is constructed with medium and large-sized basalt cobbles that have been stacked 4 to 10 courses high (Figure 58). It measures 4.5 meters long (northwest to southeast) and between 0.3 to 0.46 meters wide and between 32 and 110 centimeters tall. Portions of the wall have collapsed downslope. Feature 031 is in fair to poor condition. Feature 031 was likely constructed during the Historic Period for water management or erosion control purposes.



Figure 57. Feature 031 to the left of the frame and Feature 030 to the right-central of the frame, view to the southeast.



Figure 58. Feature 031, collapse at northern end of feature, view to the northeast.

FEATURE 032

Feature 032 is a rock pile located along the southeastern border of Survey Area 1, directly west of Feature 030, and south of Feature 031 (see Figure 1). It is situated on the northern edge of a drainage channel (Figure 59). The wall is constructed with small to large-sized basalt cobbles and a few small-sized basalt boulders that have been loosely stacked between three to four courses high. It measures 1.8 meters long (northwest to southeast) with varying wall widths and heights between 0.25 to 0.8 meters and 40 to 140 centimeters tall respectively. Throughout the length of this feature, significant collapse has been noted, with a large, breached area. This is evidenced by a collection of jumbled cobbles directly downslope from what would have been the central portion of the wall (see Figure 59). Feature 032 is in poor condition. Based on construction methods and feature morphology, Feature 032 was likely constructed during the Historic Period for water management or erosion control purposes.



Figure 59. Feature 032, view to the north.

FEATURE 033

Feature 033 is a dry-stacked wall located in the southeastern quadrant of Survey Area 1, 1.4 meters north of Feature 034, and approximately 47 meters west of Feature 031 (see Figure 1). The wall extends across a drainage channel for 4.7 meters and has varying widths and heights between 0.25 to 0.8 meters and 40 to 140 centimeters tall respectively. It is constructed with small to large-sized basalt cobbles and a few large-sized basalt boulders that have been dry-stacked between five to 10 courses high (Figure 60). In addition, the top of the wall has been capped with concrete (Figure 61). The wall retains a flat level area upslope that water can flow freely over. A twisted, metal wire was observed protruding from the face of the wall. With minimal signs of collapse, this retaining wall is in fair condition. Based on construction methods and feature morphology, Feature 033 was constructed during the Historic Period for water management purposes.



Figure 60. Feature 033, northwest face of the wall, view to the east.



Figure 61. Feature 033, surface (top) portion of the wall capped with concrete, view to west.

FEATURE 034

Feature 034 is rock pile located along the southeastern border of Survey Area 1, 1.4 meters south of Feature 034, and approximately 47 meters west of Feature 031 (see Figure 1). It is situated along the top southern edge of the gulch, adjacent to the northern edge of a wood-and-post barbed wire fence line, which runs perpendicular to the gulch and extends toward the south (Figure 62). In addition, the feature appears to mark the northern end of the wood-and-post barbed wire fence line. It is constructed of large-sized basalt cobbles and small and medium-sized basalt boulders that have been loosely dry stacked between one to three courses high. It measures 2.3 meters long (north to south) with varying widths and heights between 0.6 to one meter and 43 centimeters to 65 centimeters respectively. With minimal signs of collapse, Feature 034 is in good condition. Feature 034 was constructed during the Historic Period to possibly prevent cattle from falling into the drainage channel.



Figure 62. Feature 034, abutting the northern edge of the wood-and-post barbed wire fence line, view to the northwest.

FEATURE 035

Feature 035 is a rock pile located in the northeastern quadrant of Survey Area 1, approximately 5.9 meters east of Feature 036, and approximately 15.14 meters east of Feature 037 (see Figure 1). The rock pile is situated along the southern edge of a wooded forest area. It is constructed with small to large-sized basalt cobbles that have been loosely dry stacked between one to four courses high (Figure 63). It measures 1.97 meters long (north to south) by 1.4 meters wide and 96 centimeters in height (Figure 64). The southern side of the rock pile has collapsed. Overall, Feature 035 is in poor condition. The function of Feature 035 is unknown.



Figure 63. Feature 035, view to the east.

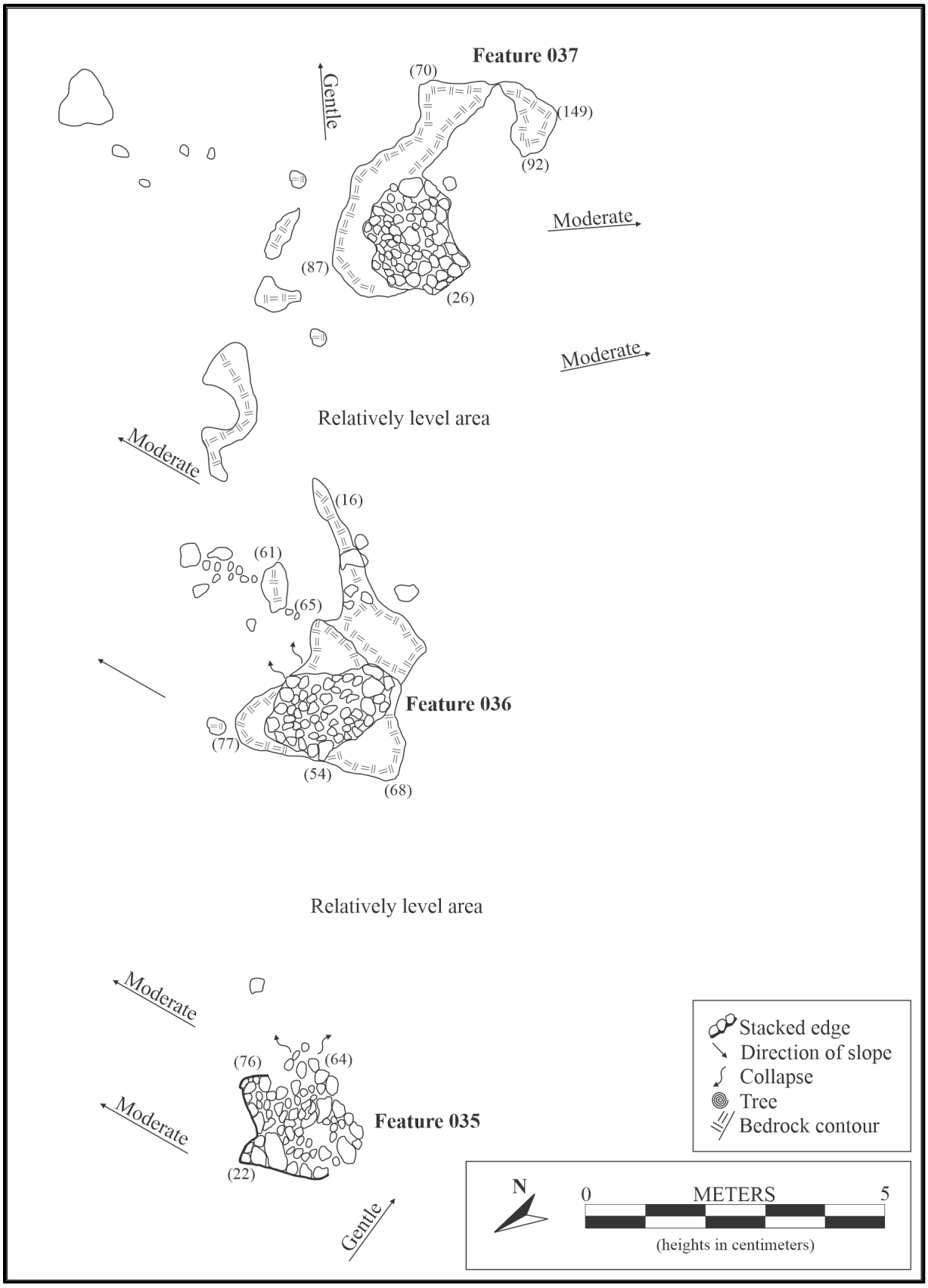


Figure 64. Plan view of Features 035, 036, and 037.

FEATURE 036

Feature 036 is a rock pile located in the northeastern quadrant of Survey Area 1, approximately 5.9 meters west of Feature 035, and approximately 9.6 meters west of Feature 036 (see Figure 1). The feature is situated along the southern edge of a wooded forest area and at a high point surrounded by grazed pasture. The rock pile is constructed with small and medium-sized basalt cobbles and small to large-sized basalt boulders that have been loosely piled between one to three courses high on top of an exposed bedrock outcrop (Figure 65). It measures 2.72 meters long (east to west) by 2.3 meters wide and has varying heights between 70 to 162 centimeters tall (see Figure 64). The northeastern side of the pile exhibits collapse. Overall, Feature 036 is in poor condition. The function of Feature 036 is unknown.



Figure 65. Feature 036, view to the northeast.

FEATURE 037

Feature 037 is a rock pile located in the northeastern quadrant of Survey Area 1, approximately 9.3 meters west of Feature 036, and approximately 15.14 meters west of Feature 035 (see Figure 1). The feature is situated along the southern edge of a wooded forest area and is at a high point surrounded by grazed pasture. The rock pile has been constructed with small and medium-sized basalt boulders that have been loosely piled between one to two courses high on top of an exposed bedrock outcrop (Figures 66 and 67). It measures 2.1 meters long (east to west) by 2 meters wide and varies between 23 and 110 centimeters in height (see Figure 64). With minimal signs of collapse, Feature 037 is in good condition. The function of Feature 037 is unknown.



Figure 66. Feature 037, view to the southwest.



Figure 67. Feature 037, view to the northwest.

FEATURE 038

Feature 038 is a rock mound located in the northeastern quadrant of Survey Area 1 and approximately 7.1 meters east of Feature 039 (see Figure 1). The feature is situated along the southern edge of a forest and at a high point surrounded by grazed pasture. The mounds constructed of small and medium-sized basalt cobbles and medium and large-sized basalt boulders that have been loosely stacked between one to four courses high. It measures 7.7 meters long (northeast to southwest) by 4.4 meters wide and varies between 25 and 74 centimeters in height (Figures 68 and 69). A shallow, rectangular-shaped depression measuring approximately 1-meter by 1.7-meter is present on the surface of the mound, possibly indicating excavation of materials. A single, ceramic bowl sherd was observed on the end. The mound shows significant collapse and is in poor condition. Feature 038 may represent a staging area for materials used during the Historic Period for constructing water management walls throughout Keāhuaiwi Gulch.

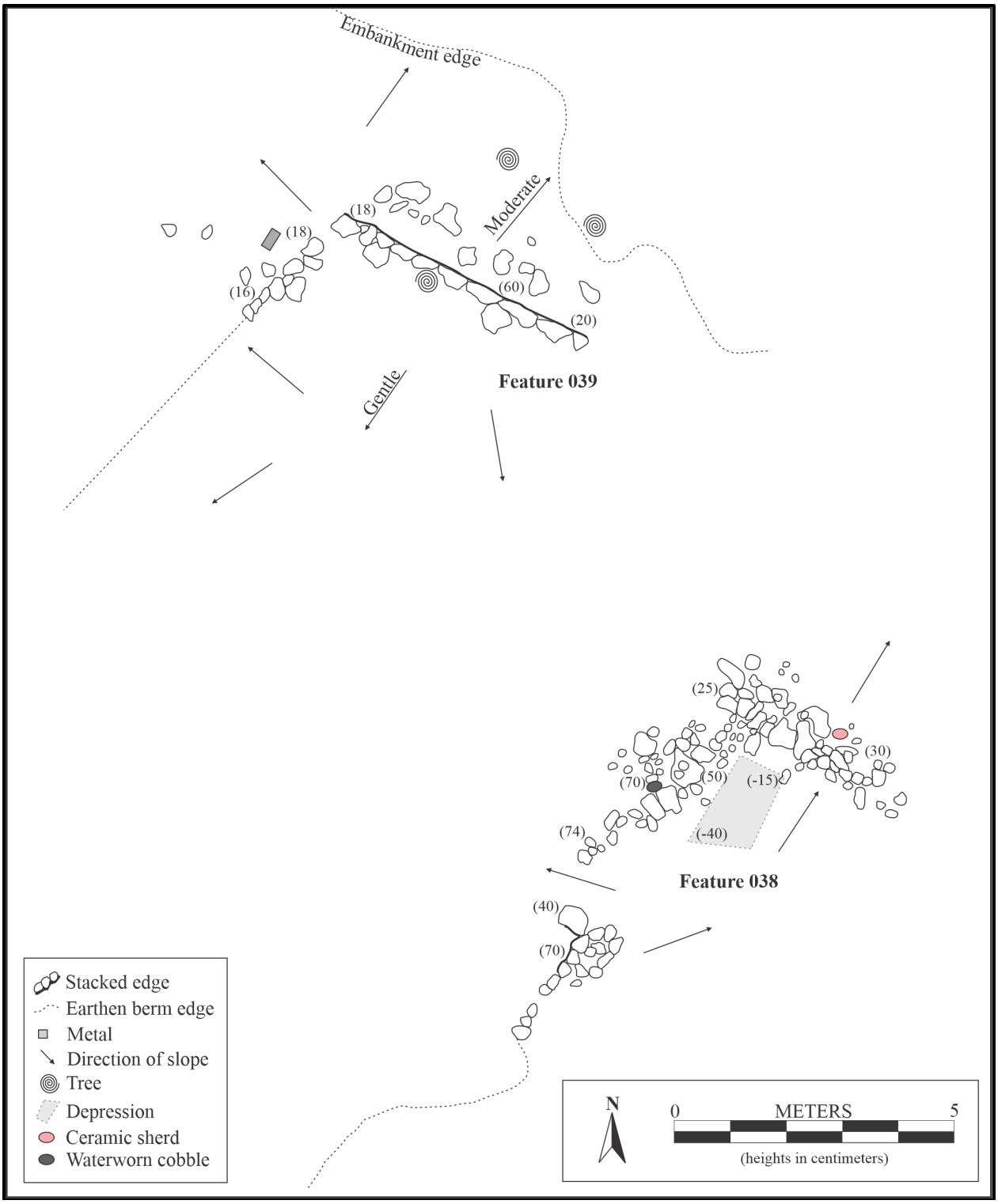


Figure 68. Plan view of Features 038 and 039.



Figure 69. Feature 038, view to the southeast.

FEATURE 039

Feature 39 is a rock mound located in the northeastern quadrant of Survey Area 1 and approximately 7.1 meters west of Feature 038 (see Figure 1). The feature is situated along the southern edge of a forest and at a high point surrounded by grazed pasture. It is constructed with medium and large-sized basalt boulders that have been loosely stacked between one to three courses high (Figure 70). It measures five meters long (northwest to southeast) by 2.5 meters wide and varies between 16 and 60 centimeters in height (see Figure 68). Several fragments of rusted metal were observed along the exterior edges. The mound exhibits multiple areas of collapse and is in poor condition. Feature 039 may represent a staging area for materials used during the Historic Period for constructing water management walls throughout Keāhuaiwi Gulch.



Figure 70. Feature 039, view to the south.

FEATURE 040

Feature 040 is an enclosure located near the south-central border of Survey Area 1, approximately 36.6 meters west of Feature 009, and approximately 26.8 meters north of the southern boundary of the current project area (see Figure 1). It is situated in open pasture/field land and the surrounding ground surface around the feature slopes gently to the northwest and west. The enclosure is rectangular in shape with no opening and measures 4.3 meters (northeast to southwest) by 3.4 meters wide (northwest to southeast). The walls are constructed with medium and large-sized basalt cobbles that have been dry stacked between one and three courses high (Figures 71, 72,and 73). Heights along the interior of the walls varies between 5 and 61 centimeters and height along the exterior of the walls varies between 12 and 62 centimeters. The interior of the enclosure contains displaced and collapsed cobbles. A waterworn cobble was observed northeast of the enclosure. With minimal sings of collapse/erosion, Feature 040 is fair condition. The function of Feature 040 is unknown.



Figure 71. Feature 040, view to the north.

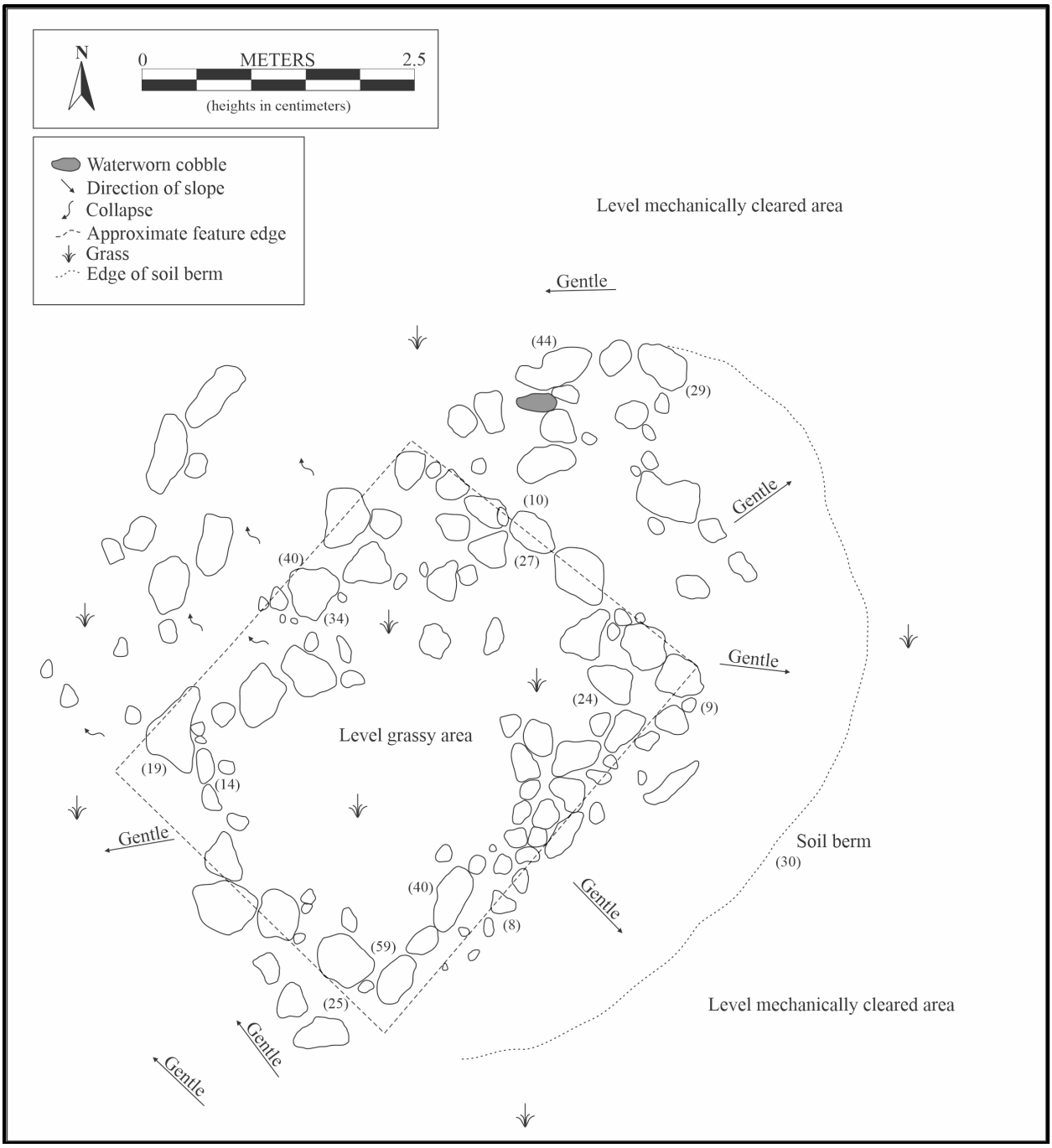


Figure 72. Plan view of Feature 040.



Figure 73. Feature 040, view to the northwest

FEATURE 041

Feature 041 is a dry-stacked wall located in the central portion of Survey Area 1, approximately 87.7 meters west of Feature 066, and approximately 112 meters southeast of Feature 004 (see Figure 1). The feature has been constructed perpendicular to the slope and is surrounded by grazed pasture along the southern edge of a forest. It is constructed with small to large-sized basalt cobbles and small-sized basalt boulders that have been dry stacked between two to seven courses high (24 to 107 centimeter sin height) (Figures 74 and 75). It measures 10.1 meters (north to south) long and between 0.5 to 0.8 meters in width. Retaining soil upslope from the wall, the ground area downslope of the feature is fairly level and slopes gently to the west. Cultural material observed near the wall includes (1) colorless and (1) amber-colored glass bottle fragments, metal fragments, and a single red brick. With some signs of collapse and erosion, Feature 041 is in good condition. The function of Feature 041 is unknown.



Figure 74. Feature 041, view to the southwest.

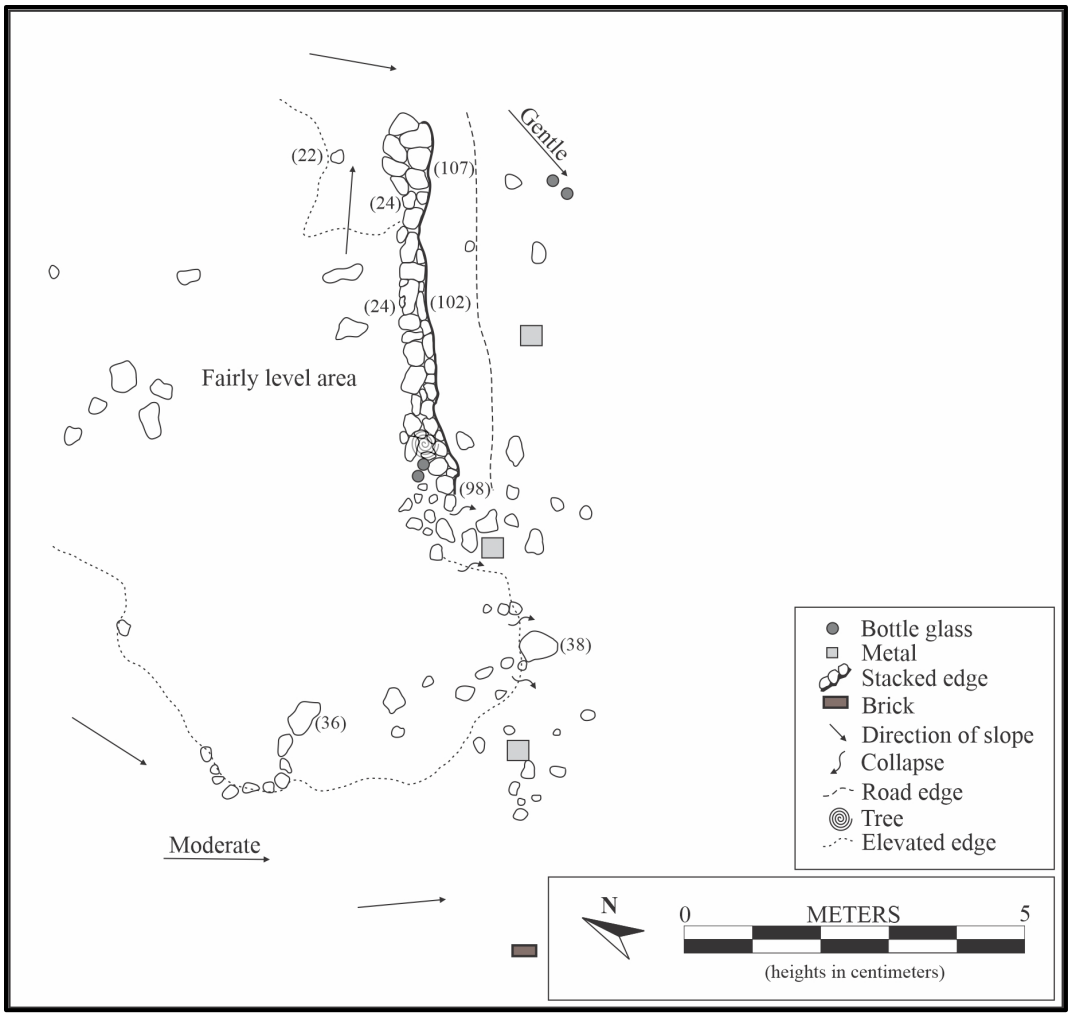


Figure 75. Plan view of Feature 041.

FEATURE 042

Feature 042 is an enclosure located just along Survey Area 1's southeast border, approximately 10 meters southwest of Keāhuaiwi Gulch, and approximately 47 meters east of Feature 043 (see Figure 1). The feature is situated along the southern edge of a forest area and is surrounded by grazed pasture. The enclosure is U-shaped and opens to the southwest. The walls consist of a single course (20 to 24 centimeters tall) of small to large-sized basalt cobbles and small-sized basalt boulders (Figures 76 and 77). It measures 7.5 meters (east to west) by 4 meters wide (north to south) (Figure 78). With minimal signs of collapse and erosion, Feature 042 is in good condition. Feature 042 was likely constructed during the Historic Period and may be associated with ranching activities.



Figure 76. Feature 042, view to the northwest.



Figure 77. Feature 042, view to the southwest.

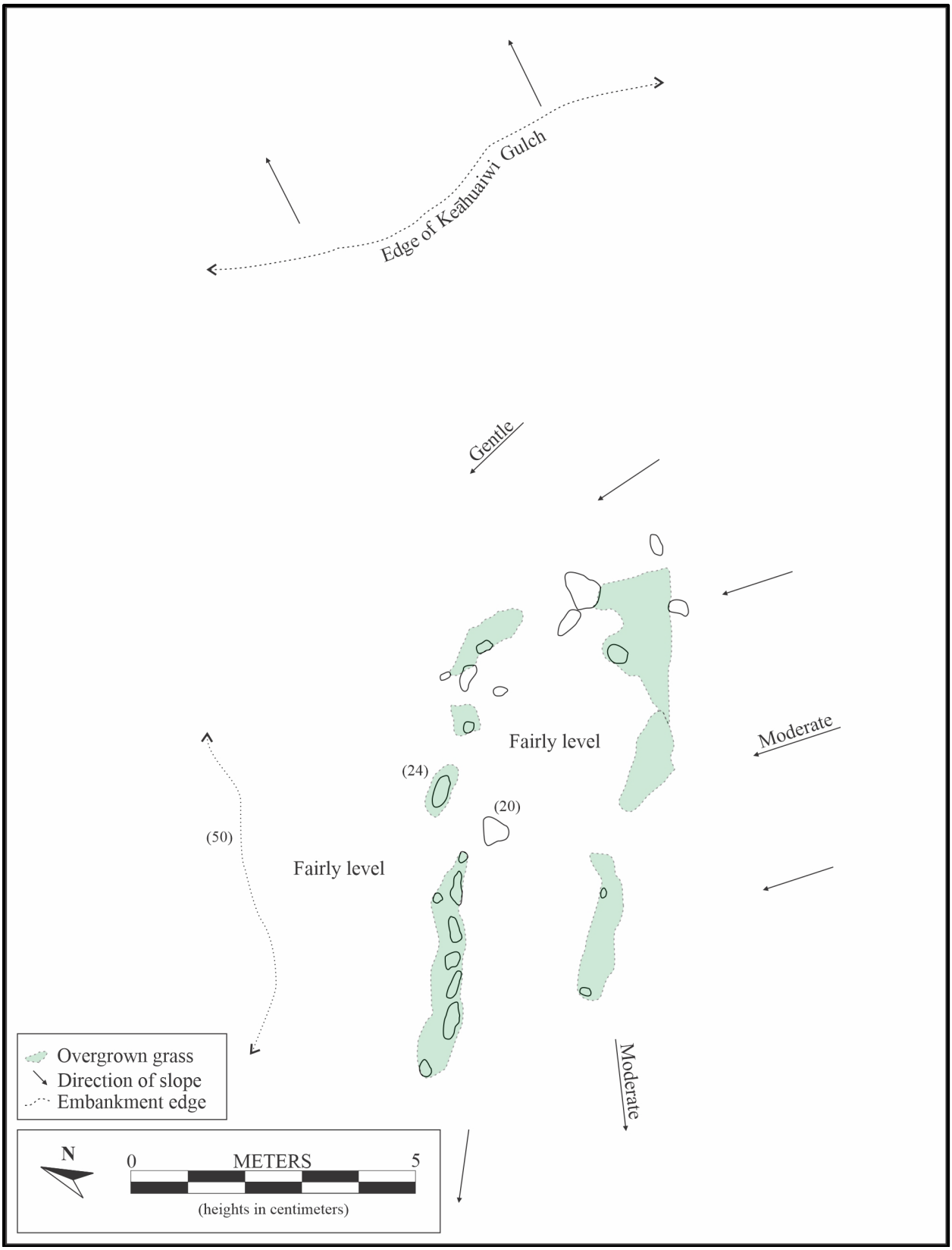


Figure 78. Plan view of Feature 042.

FEATURE 043

Feature 043 is a rock pile located just outside of Survey Area 1's southeast border, approximately 1.3 meters south of Keāhuaiwi Gulch, and approximately 47 meters west of Feature 042 (see Figure 1). The feature is situated along the southern edge of a moderate wooded forest area and surrounded by grazed pasture. It is constructed with a single course of medium and large-sized basalt cobbles (Figure 79). It measures 5.5 meters (northeast to southwest) by 4.9 meters wide (east to west) and 15 to 28 centimeters tall. Due to evidence signs of disturbance likely caused by bulldozing activities, Feature 043 is in poor condition. The function of Feature 043 is unknown.



Figure 79. Feature 043, view to the northeast.

FEATURE 044

Feature 044 is a dry-stacked curvilinear wall located in the southeast quadrant of Survey Area 1, approximately 28.4 meters west of Feature 008, and approximately 12 meters south of Keāhuaiwi Gulch (see Figure 1). The feature is situated roughly at the southern edge of a wooded area and the surrounding ground surface slopes steeply into the gulch. The wall has been constructed against the edges of an embankment, retaining soil to the northeast, northwest, and southeast, thereby creating a level semi-enclosed space to the southwest. It is constructed with small and medium-sized basalt cobbles and small-sized basalt boulders that have been dry stacked between one to three courses high (20 to 60 centimeters) (Figures 80 and 81). The northwest wall measures 1.5 meters long and shows signs of collapse. The northeast wall measures 2.1 meters long and the southeastern wall measures 1 meter long. With minimal collapse and erosion, Feature 044 is in fair condition. Feature 044 may represent a staging area for materials used during the Historic Period for constructing water management walls throughout Keāhuaiwi Gulch.

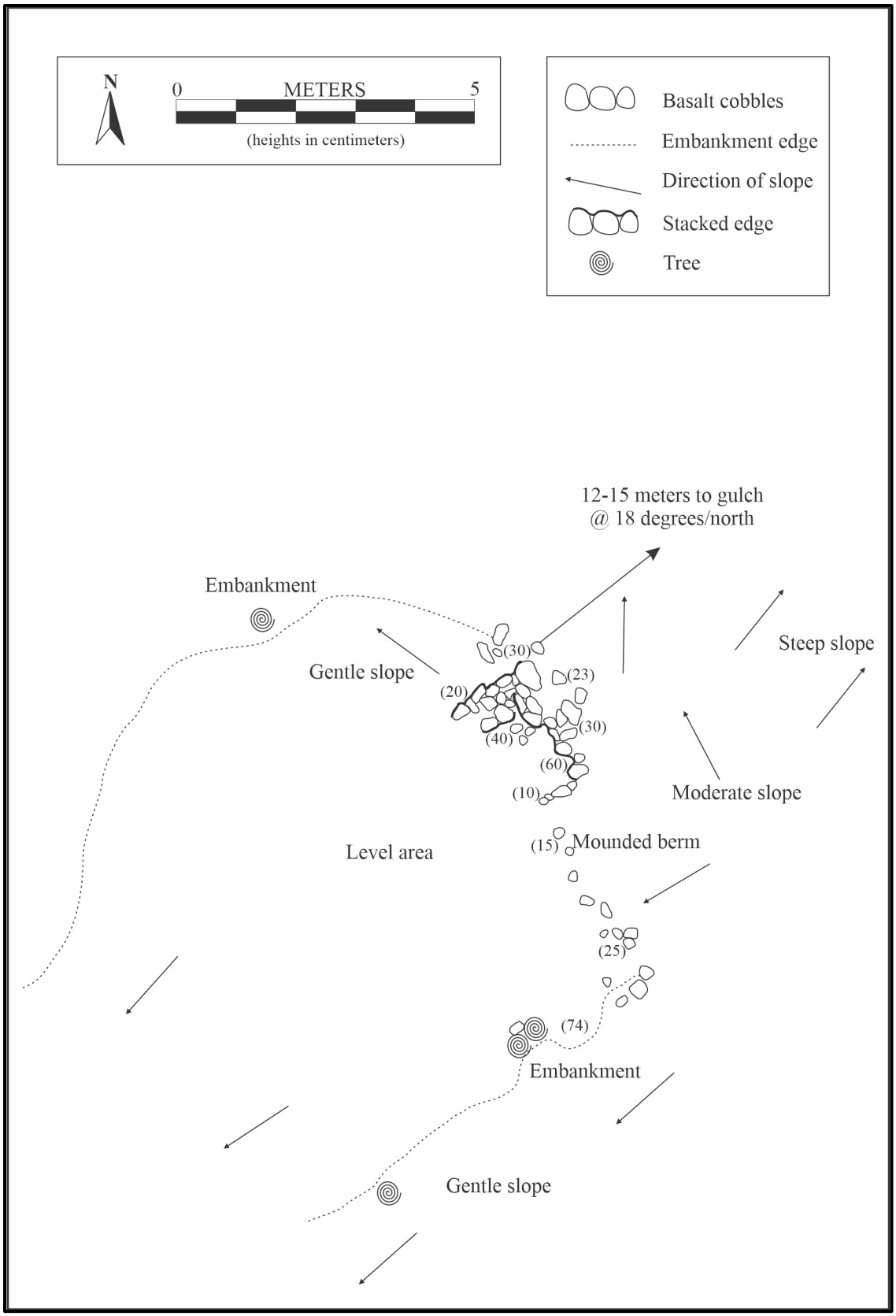


Figure 80. Plan view of Feature 044.



Figure 81. Feature 044, view to the northeast.

FEATURE 045

Feature 045 is an “L”-shaped dry-stacked wall located in the north-central portion of Survey Area 1, immediately 1.8 meters north of Feature 046, and adjacent (east) of an existing dirt road (see Figure 1). It is situated in an open pasture/field land where the surrounding ground surface slopes gently to the south. The wall is constructed of one to three courses of dry stacked small and medium-sized basalt cobbles and medium and large-sized basalt boulders (Figure 82). It measures 13.3 meters (northwest to southeast) with varying widths and heights between 0.25 to 0.5 meters and 23 to 60 centimeters respectively (Figure 83). It appears the wall was built up against an embankment to prevent erosion. With minimal collapse and erosion, Feature 045 is in fair condition. Feature 045 was likely constructed during the Historic Period for livestock management purposes.

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Figure 82. Feature 045, retaining wall in the background with a portion of Feature 046 in the foreground, view to the north.

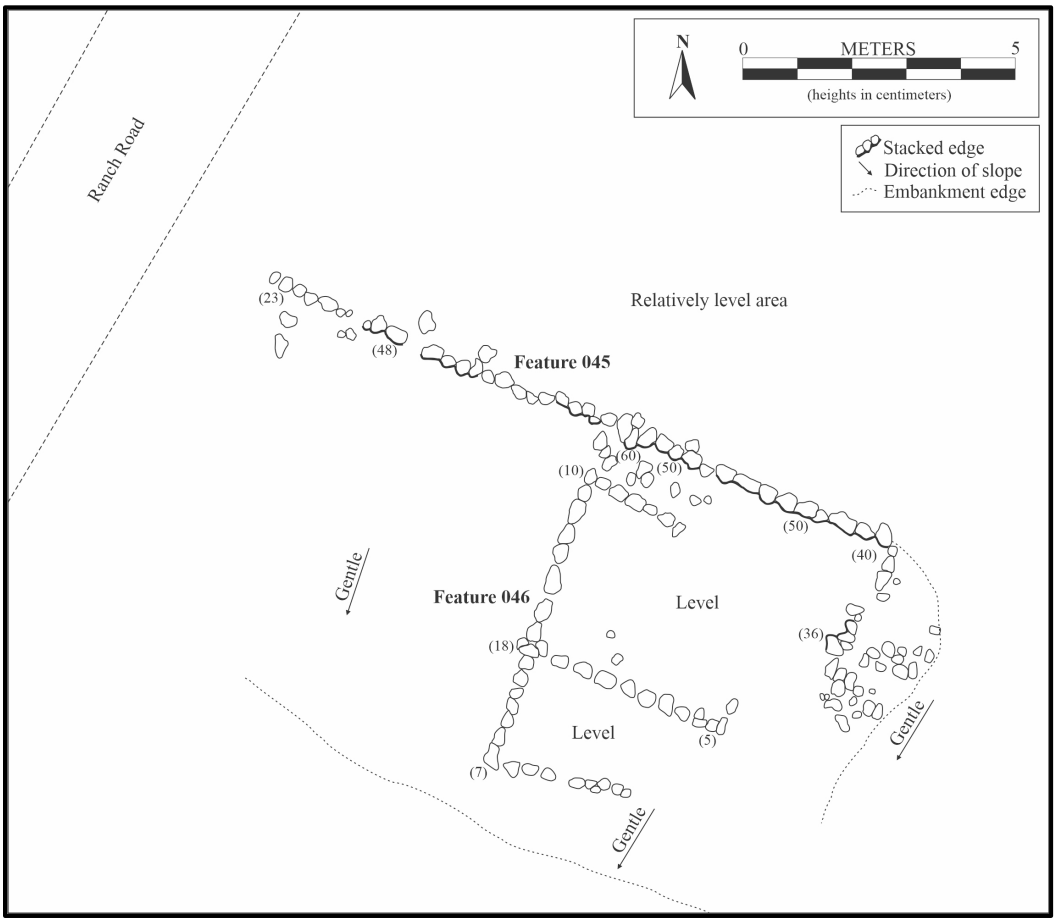


Figure 83. Plan view of Feature 045 and 046.

FEATURE 046

Feature 046 is an enclosure (Figures 84 and 85) located in the north-central portion of Survey Area 1, 1.8 meters south of Feature 045, and adjacent (east) of an existing dirt road (see Figure 1). It is situated in open pasture/field land where the surrounding ground surface slopes gently to the south. The walls are constructed of a single course (7 to 18 centimeters tall) of small and medium-sized basalt cobbles and small-sized basalt boulders. The enclosure measures 4.25 meters (northeast to southwest) by 4 meters wide (see Figure 83). The west/southwestern wall of the enclosure extends perpendicular to the central portion of Feature 045 and has three walls (north wall, middle wall, and south wall) that extend and open to the east/southeast (see Figure 83). The interior of the enclosure is level and consists of grasses. With minimal signs of collapse and erosion, Feature 046 is in fair to poor condition. Although the function of Feature 046 was likely constructed during the Historic Period for livestock management purposes



Figure 84. Feature 046, enclosure with central wall and Feature 045 in the background, view to the northeast.



Figure 85. Feature 046, the northwestern edge portion of the enclosure, view to the east.

FEATURE 047

Feature 047 is a dry-stacked wall located in the north-central portion of Survey Area 1, approximately 7.5 meters west of Feature 046, and adjacent (west) of an existing dirt road (see Figure 1). It is situated in open pasture/field land where the surrounding ground surface slopes gently to the southwest. The wall has been constructed perpendicular to the slope thereby retaining soil on the upslope (north) side. Large-sized basalt cobbles and small to large-sized basalt boulders that have been dry stacked between one to three courses high (Figure 86). The wall measures 7 meters long (northwest to southeast) with varying widths and heights between 0.1 to 0.4 meters and 30 to 74 centimeters tall respectively (Figure 87). A tree has fallen on the feature causing collapse at the northwestern end (see Figure 86). Feature 047 is in fair to poor condition. Feature 047 was likely constructed during the during Historic Period. It may have been constructed along the bottom of a former fence to prevent livestock from going under.



Figure 86. Feature 047, view to the north.

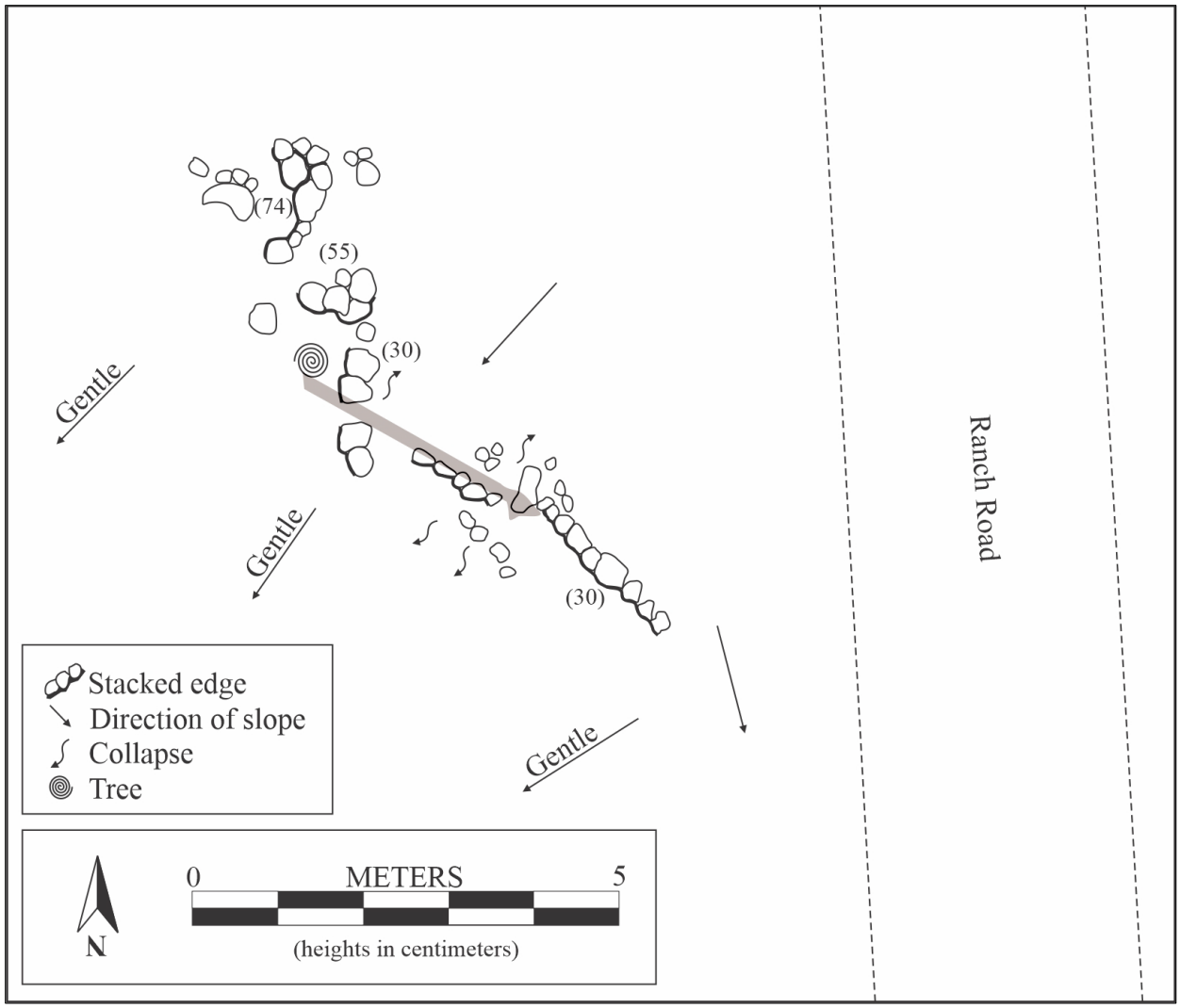


Figure 87. Plan view of Feature 047.

FEATURE 048

Feature 048 is a rock mound located in the north-central portion of Survey Area 1, approximately 48.74 meters northeast of Feature 045, and approximately 34.7 meters east of an existing dirt road (see Figure 1). This feature is situated in open pasture/field land where the surrounding ground surface slopes moderately to the north and northwest. It is constructed with small to large-sized basalt cobbles and medium-sized basalt boulders that have been stacked between one to two courses high (Figure 88). It measures 7.02 meters long (east to west) by 6.15 meters wide (north to south) with varying heights between 26 to 86 centimeters tall (Figure 90). The west/southwestern portion of the mound exhibits collapse (Figure 89). Given its proximity to the existing dirt road, it is possible that this mound may be the product of bulldozing activities. Due to significant collapse and erosion, Feature 048 is in poor condition. The function of Feature 048 is unknown.



Figure 88. Feature 048, view to the southwest.



Figure 89. Feature 048, view to the northeast.

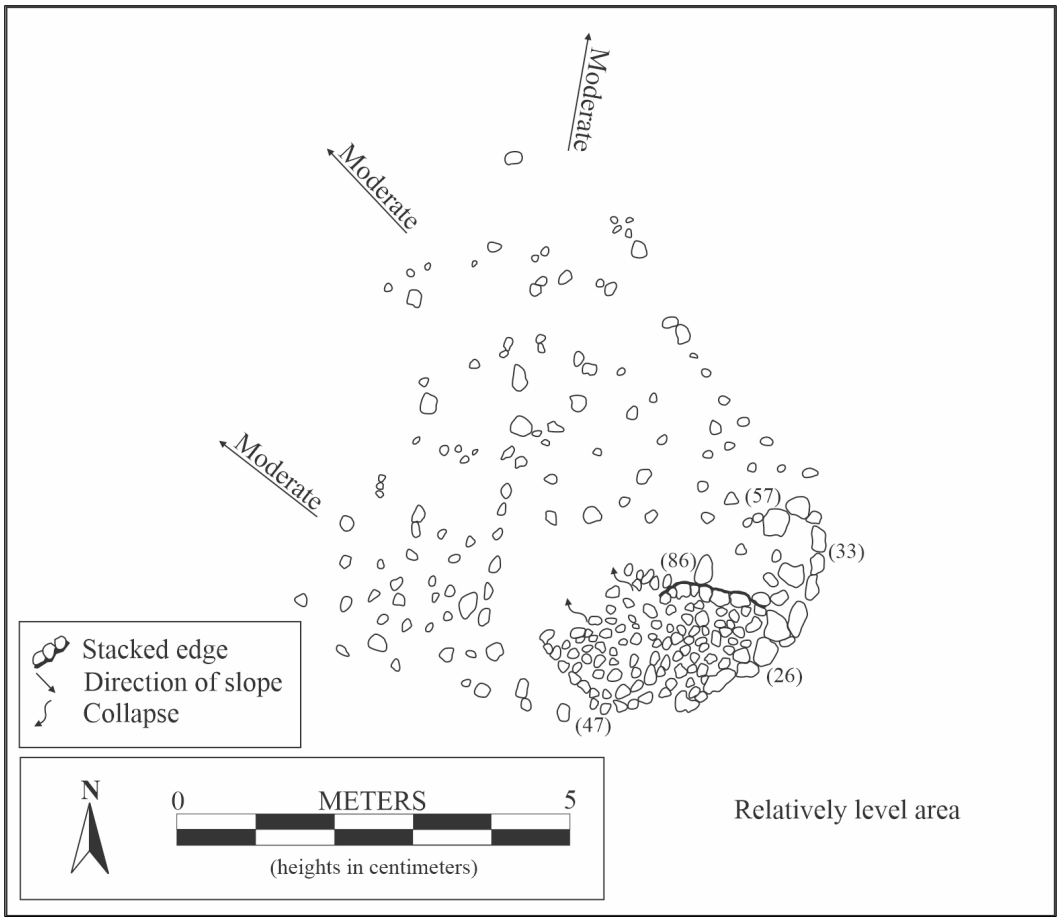


Figure 90. Plan view of Feature 048.

FEATURE 049

Feature 049 is a rock pile located in the north-central portion of Survey Area 1, approximately 76.9 meters west of Feature 048, and approximately 38.2 meters west of an existing dirt road (see Figure 1). This feature is situated in open pasture/field land where the surrounding ground surface slopes moderately to the north and northwest. It is constructed of small to medium-sized basalt cobbles that have been roughly piled on top of and around a single bedrock boulder (Figure 91). It measures 2.5 meters (northwest to southeast) by 2 meters wide with varying heights between 15 to 60 centimeters tall (Figure 92). Due to some collapse and erosion, Feature 049 is in fair to poor condition. The function of Feature 049 is unknown



Figure 91. Feature 049, view to the southeast.

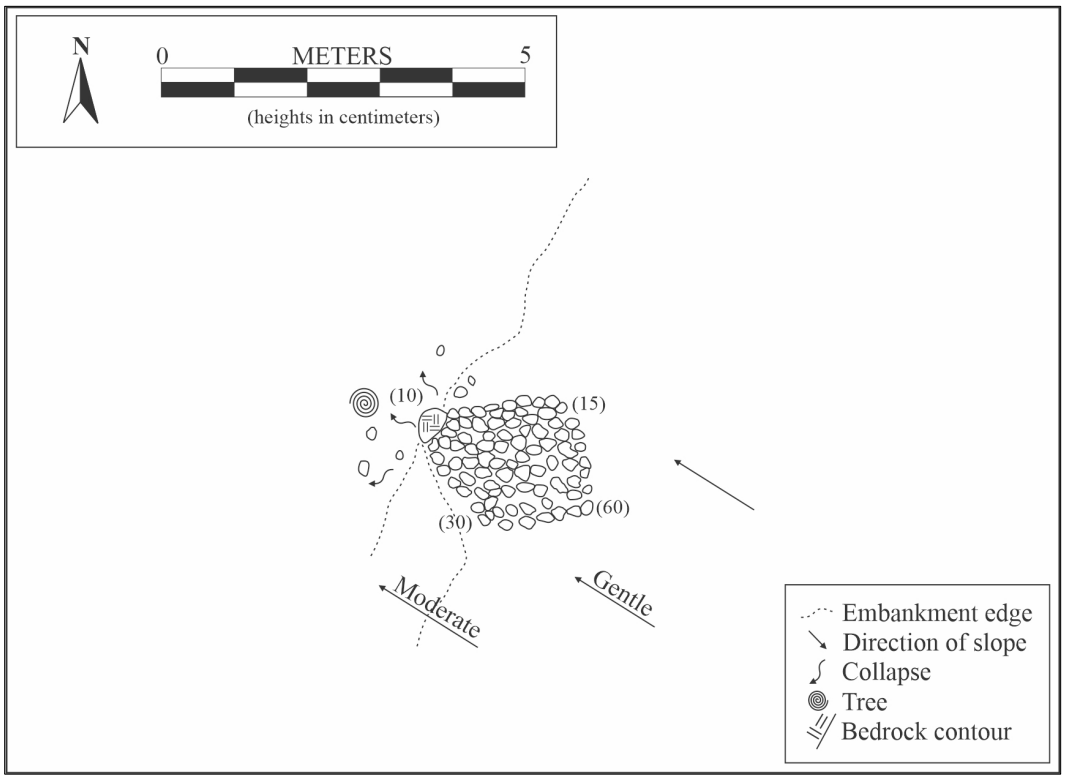


Figure 92. Plan view of Feature 049.

FEATURE 050

Feature 050 is a rock and mortar foundation located in the west corner of Survey Area 1, approximately 103.3 meters south of Feature 051, and approximately 85.6 meters of Kekaulike Avenue (see Figure 1). It is situated in open pasture/field land and east of a drainage. The foundation is constructed of small to large-sized basalt cobbles that have been mortared with concrete (Figure 93). It measures 1 meter long by 0.5 meters wide and stands 50 centimeters tall. Two oxidized metal bolts are affixed to the top and there is a half-pipe depression extending across, possibly to support a water pipe. The eastern end of the foundation is partially buried in soil and grass. Feature 050 is in fair to poor condition. Based on its construction methods and feature morphology, as well as its location, Feature 050 is most likely a part of the Kula water pipeline infrastructure.



Figure 93. Feature 050, view to southeast.

FEATURE 051

Feature 051 is a rock and mortar foundation located in the west corner of Survey Area 1, approximately 103.3 meters north of Feature 050, and approximately 50.14 meters of Kekaulike Avenue (see Figure 1). It is situated in open pasture/field land and east of a drainage. The foundation is constructed with small to large-sized basalt cobbles that have been mortared with concrete (Figure 94). It measures 0.65 meters long by 0.6 meters wide and stands 65 centimeters tall. Two oxidized metal bolts are affixed to the top and there is a half-pipe depression extending across, possibly to support a water pipe. The east/southeast end of the stanchion is partially buried in soil and grass. Feature 051 is in fair condition. Based on its construction methods and feature morphology, as well as its location, Feature 051 is most likely a part of the Kula water pipeline infrastructure.



Figure 94. Feature 051, view to the northwest.

FEATURE 052

Feature 052 is a rock pile located in the northeast quadrant of Survey Area 1, approximately 144.2 meters southwest of Feature 035, and approximately 180.4 meters southeast of Feature 061 (see Figure 1). It is situated at a slight high point along the west/northwestern edge of a wooded area and the north edge of a shallow drainage channel. The surrounding ground surface slopes moderately to the west. Approximately 10-20 small to large-sized basalt cobbles have been piled on top an exposed bedrock outcrop (Figure 95). These cobbles may have once been stacked one on top of the other, but have since collapsed, resulting in the feature's poor condition. The function of Feature 052 is unknown.



Figure 95. Feature 052, view to the southwest.

FEATURE 053

Feature 053 is a wooden trough located in the northwest quadrant of Survey Area 1 and approximately15.5 meters west/southwest of the Erehwon Dairy Barn (see Figure 1). It is constructed with redwood planks and there is a water pipe attached to the south-face of the trough (Figure 96). It measures approximately 5.8 meters long by 0.9 meters wide and has a maximum height of 60 centimeters. Overall, Feature 053 is in fair to good condition. This trough served as a drinking water source for livestock (cattle) associated with the dairy and/or ranching activities during the Historic Period.



Figure 96. Feature 053, view to the northwest.

FEATURE 054

Feature 054 is rock pile located in the northwest quadrant of Survey Area 1, approximately 54.9 meters west of Feature 062, and approximately 56.7 meters northeast of Feature 055 (see Figure 1). It is situated in an open pasture/field land along the north edge of a drainage. It is constructed with small to large-sized cobbles and one large-sized boulder and appears that is a dozer push pile (Figure 97). No measurements were documented. Given its haphazardly construction, it is in poor condition. The function of Feature 054 is unknown.



Figure 97. Feature 054, view to the southwest.

FEATURE 055

Feature 055 is a circular-shaped depression located in the northwest quadrant of Survey Area 1 and situated in an open pasture/field land (see Figure 1). This depression is constructed with basalt cobbles and the inner walls is reinforced with concrete (Figure 98). It measures between 2.7 meters long by 2.7 meters wide with varying depths between 30 to 38 centimeters below the existing ground surface (Figure 99). During the time of fieldwork, the interior consisted of soil, grasses and weeds. With minimal signs of collapse, Feature 055 is in fair condition. Based on construction methods and feature morphology, Feature 055 likely served as a well/watering hole purposes associated with ranching activities during the Historic Period.



Figure 98. Feature 055, view to the north.

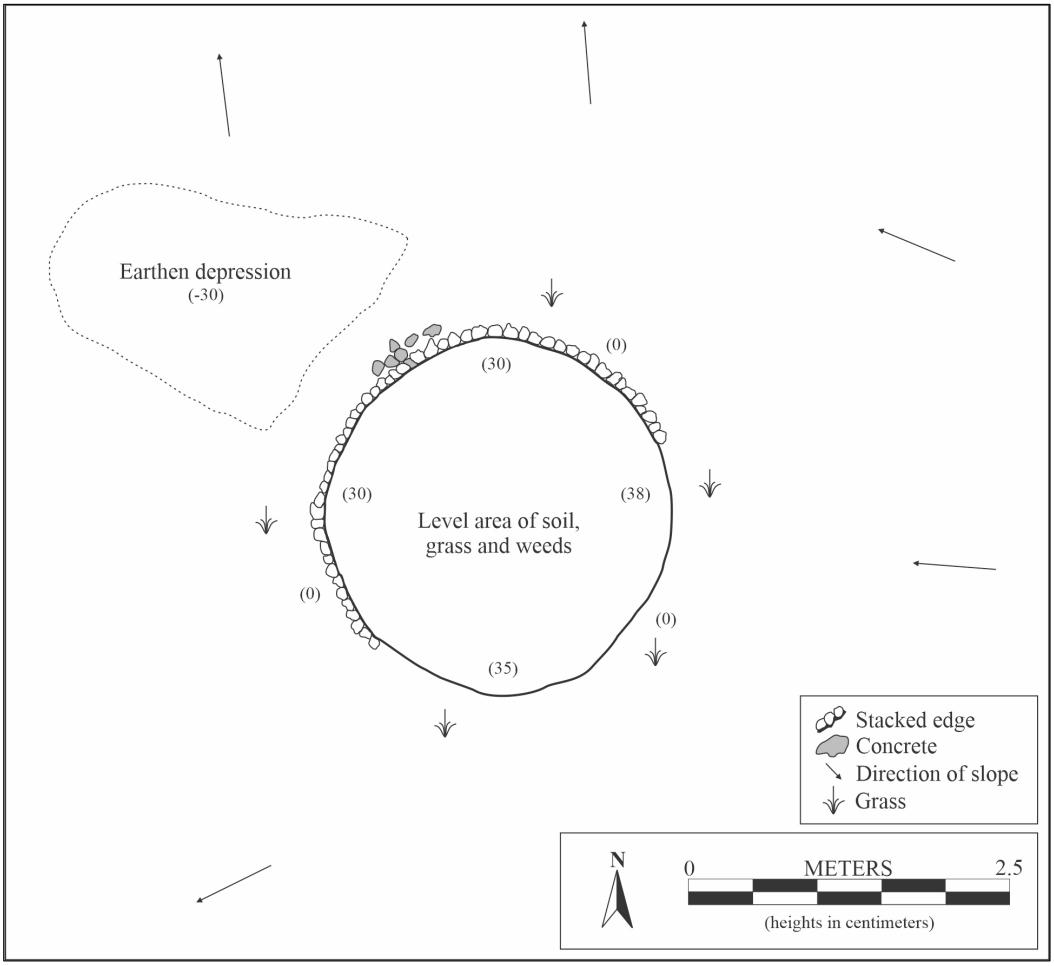


Figure 99. Plan view of Feature 055.

FEATURE 056

Feature 056 is a rock pile located in the south-central portion of Survey Area 1, approximately 39.1 meters west of Feature 066, and approximately 49.2 meters northwest of Feature 009 (see Figure 1). It is situated on a slight westerly slope in an open pasture/field land adjacent to the (north) edge of a drainage (Figure 100). It is constructed with medium and large-sized cobbles and medium and large-sized boulders that have been loosely piled between 14 to 50 centimeters tall. It measures 1.8 meters long by 1.8 meters wide. With minimal collapse and erosion, Feature 056 is in fair condition. The function of Feature 056 is unknown.



Figure 100. Feature 056 situated along the northern edge of a drainage, view to the southeast.

FEATURE 057

Feature 057 is a dry-stacked wall located in the southwest corner of Survey Area 1, approximately 12.6 meters west of Feature 014, and approximately 26 meters east of Feature 065 (see Figure 1). It is situated along the southwest edge of a drainage in an open pasture/field land. It is constructed with medium and large-sized basalt cobbles that have been stacked on top bedrock and measures 8.9 meters long by 0.4 meters wide with a height of 58 centimeters tall (Figure 101). With signs of collapse, Feature 057 is in poor condition. Feature 057 was likely constructed during the Historic Period to prevent livestock from going under a fence line.



Figure 101. Feature 057, view to the southwest.

FEATURE 058

Feature 058 is a dry-stacked wall located in the northwestern portion of Survey Area 1, approximately 10.3 meters north of Feature 064, and approximately 70.5 meters east of Feature 014 (see Figure 1). It extends parallel to the northern edge of a drainage (Figure 102). The wall is constructed with small to large-sized boulders that have been roughly stacked one to five courses high. It measures an overall length of approximately 84.1 meters long by 0.3 meters wide (width of alignment) and varies in height between 48 and 130 centimeters (Figures 103 and 104). With signs of collapse, Feature 058 is in poor condition. Feature 058 was likely constructed along a former fence line during the Historic Period to prevent livestock from going under.



Figure 102. Feature 058, view to the southeast.



Figure 103. Feature 058, view to the east.



Figure 104. Feature 058, view to the east.

FEATURE 059

Feature 059 is a terrace/berm located in the southwestern portion of Survey Area 1 and situated in open pasture/field land (see Figure 1). It is constructed with soil and a few sporadic small-sized boulders (Figure 105). It measures approximately 305.6 meters long (northeast to southwest) by 3 meters wide with varying heights between 0 to 30 (upslope) and 20 to 70 centimeters (downslope) (Figure 106). Based on construction methods and feature morphology, Feature 059 was likely constructed during the Historic Period for potato cultivation



Figure 105. Feature 059, view to the southeast.



Figure 106. Feature 059, view to the northeast.

FEATURE 060

Feature 060 is a dry-stacked wall located in the northeast portion of Survey Area 1. It is situated in open pasture/field land and adjacent (southwest) of a drainage (see Figure 1). The wall is constructed with medium and large-sized basalt cobbles and small-sized basalt boulders that have been stacked two courses high (Figures 107 and 108). It measures 3.7 meters long (north to south) by 0.3 meters wide and stands at 55 centimeters tall. Portions of the wall exhibit collapse. Feature 060 is in poor condition. Based on construction methods and feature morphology, Feature 060 was likely constructed along a former fence line during the Historic Period to prevent livestock from going under.



Figure 107. Feature 060, view to the southeast.



Figure 108. Feature 060, view to the north.

FEATURE 061

Feature 061 is a dry-stacked wall located in the northeast portion of Survey Area 1, approximately 16.1 meters east of Feature 060. It is situated in open pasture/field land and adjacent (southwest) of a drainage (see Figure 1). The wall is constructed with medium and large-sized basalt cobbles and small-sized basalt boulders that have been stacked two courses high (Figures 109). It measures 3.44 meters long (north to south) by 0.3 meters wide and stands 55 centimeters tall. Portions of the wall exhibit collapse. Feature 061 is in poor condition. Based on construction methods and feature morphology, Feature 061 was likely constructed along a former fence line during the Historic Period to prevent livestock from going under.



Figure 109. Feature 061, view to the north.

FEATURE 062

Feature 062 is an alignment located in the northwest quadrant of Survey Area 1, approximately 71.3 meters west/northwest of Feature 019 (see Figure 1). It situated in an open pasture/field land and along the south edge of a drainage. The alignment consists of medium and large-sized boulders arranged in a linear pattern and measures 4.6 meters long by 0.82 meters wide with a height of 55 centimeters tall (Figure 110). The area *mauka* (east) of the feature is level and appears to have been bulldozed in the past. Feature 062 in poor condition. Based on construction methods and feature morphology, Feature 062 was likely constructed along a former fence line during the Historic Period to prevent livestock from going under.



Figure 110. Feature 062, view to the southeast.

FEATURE 063

Feature 063 is a dry-stacked wall located in the northeast portion of Survey Area 1, approximately 32.4 meters west of Feature 060. It is situated in open pasture/field land and is south of a drainage (see Figure 1). This alignment is constructed with medium and large-sized basalt cobbles and small-sized basalt boulders that have been stacked two courses high (Figure 111). It measures 3.9 meters long (east to west) by 0.3 meters wide and has varying heights between 20 to 60 centimeters tall. Feature 063 is in poor condition. Based on construction methods and feature morphology, Feature 063 was likely constructed along a former fence line during the Historic Period to prevent livestock from going under.



Figure 111. Feature 063, view to the northeast.

FEATURE 064

Feature 064 is a dry-stacked wall located in the northwestern portion of Survey Area 1, approximately 10.3 meters south of Feature 058, and approximately 37.2 meters northwest of Feature 055 (see Figure 1). Feature 064 is situated along the southern edge of a drainage and appears to have possibly marked the route of a former fence line. This alignment runs roughly in an east to west orientation and exhibits a0.56 meters wide gap. It is constructed with medium and large-sized cobbles and small and medium-sized boulders that have been stacked between one to three course high. The eastern segment extends for 7.7 meters long by 0.3 meters wide with varying heights between 40 to 100 centimeters tall (Figure 112). The western segment extends for 12.1 meters long by 0.25 meters wide with varying heights between 25 to 50 centimeters tall (Figure 113). It is possible that this alignment may have been used to prohibit cattle from falling into the adjacent drainage. With significant signs of collapse and erosion, Feature 064 is in poor condition. Based on construction methods and feature morphology, Feature 064 was likely constructed along a former fence line during the Historic Period to prevent livestock from going under.



Figure 112. Feature 064, view to the southwest.



Figure 113. Feature 064, view to the southwest.

FEATURE 065

Feature 065 is a dry-stacked wall located in the southwest corner of Survey Area 1, approximately 47.9 meters west of Feature 014, and approximately 24.6 meters north of an existing dirt road (see Figure 1). It is situated along the southwest edge of a drainage in an open pasture/field land. It is constructed with medium and large-sized basalt cobbles that have been stacked against the natural, eroding bedrock ridge of the drainage. It measures 2.4 meters long by 0.45 meters wide and has a height of 83 centimeters tall (Figure 114). With significant signs of collapse and erosion, Feature 065 is in poor condition. Based on construction methods and feature morphology, Feature was likely constructed along a former fence line during the Historic Period to prevent livestock from going under.



Figure 114. Feature 065, view to the southwest.

FEATURE 066

Feature 066 is an earthen terrace/berm located in the south-central quadrant of Survey Area 1, approximately 7.22 meters upslope (east) of Feature 069 (see Figure 1). It is situated in open pasture/field land. The terrace/berm is constructed with soil and possibly stone, however, due to the overgrowth of grass at the time of the fieldwork, stones were not visible. It measures approximately 559.4 meters long (north to south) (Figure 115). It was difficult to determine the width and height of this feature, as well as its condition due to the overgrowth of the grass. Overall, Feature 066 is in poor condition. Based on construction methods and feature morphology, Feature 066 was likely constructed for potato cultivation during the Historic Period.



Figure 115. Feature 066, view to the southeast.

FEATURE 067

Feature 067 is a dry-stacked wall located in the south-central quadrant of Survey Area 1 and approximately 3 meters downslope (west) of Feature 066 (see Figure 1). It is situated in open pasture/field land and on the northern edge of a drainage. It is constructed with one large-sized cobble, one medium-sized boulder, and three large-sized basalt boulders that have been stacked at least two courses high (Figure 116). It measures approximately 2.3 meters long (north to south) by 0.23 meters wide and has a height of 84 centimeters tall. This retaining wall sits at the *makai* edge of Feature 066, retaining the terrace/berm edge. Feature 067 in poor condition due to areas of collapse. Based on construction methods and feature morphology, Feature 067 may have served as a retaining wall utilized during potato cultivation in the Historic Period.



Figure 116. Feature 067 situated at the *makai* edge of Feature 066 to retain edge, view to the northeast.

FEATURE 068

Feature 068 is an alignment located in the south-central quadrant of Survey Area 1, approximately 4.22 meters downslope of Feature 066, and approximately 6.33 meters northwest of Feature (see Figure 1). It is situated in an open pasture/field land and along the north edge of a drainage. This alignment is curvilinear in shape and is constructed with medium-sized cobbles and small-sized boulders. It measures approximately 5.87 meters long with varying widths and heights between 0.33 to one meter wide and 10 to 50 centimeters tall respectively (Figure 117). It extends to the southwest from the *makai* edge of Feature 066 to possibly divert water south. Feature 068 is in poor condition due to areas of collapse. Feature 068 may have served as a retaining wall utilized during potato cultivation in the Historic Period.



Figure 117. Feature 068, view to the southwest.

FEATURE 069

Feature 069 is an earthen terrace/berm located in the south-central quadrant of Survey Area 1, approximately 7.22 meters downslope (west) of Feature 069. It is situated in open pasture/field land (see Figure 1). The terrace/berm is constructed with soil and possibly stone, however, due to the overgrowth of grass at the time of the fieldwork, stones were not visible (Figure 118), although, at least two large-sized cobbles were visible defining a section of the *makai* edge (Figure 119). The overall length of the earthen terrace/berm measures 36.1 meters long. As previously mentioned, due to the overgrowth of the grasses, it was difficult to determine the width and height of this feature. Overall, due to significant collapse and erosion, Feature 069 is poor condition. Based on construction methods and feature morphology, Feature 069 was likely utilized for potato cultivation during the Historic Period.



Figure 118. Feature 069, view to the south.



Figure 119. Feature 069, two large cobbles forming alignment, view to the southeast.

FEATURE 070

Feature 070 is a rock pile located in the south-central quadrant of Survey Area 1, approximately 16.6 meters downslope of Feature 068, and approximately 20.8 meters downslope of Feature 067 (see Figure 1). It is situated in an open pasture/field land and near the north edge of a drainage. The rock pile is constructed with medium and large-sized cobbles that have been roughly stacked one to two courses high (Figure 120). It measures approximately 2.2 meters long by 0.4 meters wide and 33 centimeters tall. Feature 070 is in fair condition and its function is unknown.



Figure 120. Feature 070, view to the east.

FEATURE 071

Feature 071 is a core-filled rock wall located in the west-central portion of Survey Area 1, within Keāhuaiwi Gulch, approximately 129.5 meters north of Feature 059, and approximately 156.2 meters southwest of Feature 055 (see Figure 1). It is constructed with small to large-sized cobbles and small to large-sized boulders that have been loosely piled at least five courses high and haphazardly core-filled with small and medium-sized cobbles (Figures 121 and 122). It measures seven meters long with varying widths between 0.3 to 0.95 meters wide and varying heights between 0.59 to 125 (exterior heights) and five to 113 (interior heights) centimeters tall. Modern trash, metal barbed wires, growing pots, and mortar concrete fragments were present throughout the feature. Overall, Feature 071 is in poor condition. Feature 071 was likely constructed during the Historic Period for water management purposes.



Figure 121. Feature 071, view to the west.



Figure 122. Feature 071, view to the southeast.

FEATURE 072

Feature 072 is a CRM wall located in the central portion of Survey Area 1, directly (west) of Feature 007, and directly east of Feature 073 (see Figure 1). The wall extends across a portion of Keāhuaiwi Gulch for 4.5 meters long (northeast to southwest) and measures approximately 0.5 meters wide with varying heights between 30 to 45 centimeters (Figure 123). It is constructed with small to large-sized basalt cobbles and small to large-sized basalt boulders that have been haphazardly stacked and mortared to approximately three to four courses high. During the time of fieldwork, a pool of stagnant water was present in between Features 072 and 073 (Figure 124). The wall has been built perpendicular to and across the gulch and is one of three in succession extending downstream (Features 007, 072, and 073). With minimal signs of weathering and collapse, Feature 072 is in good condition. Based on construction methods and feature morphology, Feature 072 was constructed during the Historic Period for water management within Keāhuaiwi Gulch.

FEATURE 073

Feature 073 is CRM wall located in the central portion of Survey Area 1, directly west of Feature 072, and approximately 15 meters west of Feature 007 (see Figures (see Figure 1 and 123). It extends 12.8 meters (northeast to southwest) across a portion of Keāhuaiwi Gulch and measures approximately 0.5 meters wide with varying heights between five to 45 centimeters tall. It is constructed with small to large-sized basalt cobbles and small to large-sized basalt boulders that have been haphazardly stacked and mortared to approximately three to four courses high. During the time of fieldwork, a pool of stagnant water was present in between Features 072 and 073 (see Figure 124). The wall has been built perpendicular to and across the gulch and is one of three in succession extending downstream (Features 007, 072, and 073). Feature 073 is in fair to poor condition due to its collapsed nature. Based on construction methods and feature morphology, Feature 073 was constructed during the Historic Period for water management within Keāhuaiwi Gulch.



Figure 123. Feature 072, with Features 007 (top of frame), 072 (center of frame), and 073 (bottom of frame), view to the east.



Figure 124. Feature 072, a pool of stagnant water in between Features 073 (right) and 072 (left) view to the south.

FEATURE 074

Feature 074 is cattle squeeze located in the northwestern quadrant of Survey Area 1, within the northwestern corner of Feature 022, and situated within a designated cattle management area of Erehwon Ranch (see Figure 1). This cattle cage is constructed with metal bars, plates, and chains (Figures 125 and 126). A manufacturer's plaque is present on the top portion of the north-face side of the feature. On the plaque is a trademark registered cartoon picture of a cow and reads: "PORTABLE / CATTLE / SQUEEZE / AND / DEHORNING GATE / PATENT NO. …90…3 / TECO PRODUCT / MANUFACTURED BY / THOMPSON & GILL, INC. / … CALIFORNIA / MODEL SERIAL NO. / 68R SERIAL NO. 12209 (Figure 127). Overall, Feature 074 is in good condition. Feature 074 served as a cattle squeeze and dehorning cage associated with ranching activities during the Historic Period.



Figure 125. Feature 074, view to the southwest.



Figure 126. Feature 074, view to the south.



Figure 127. Feature 074, close-up of manufacturer's plaque.

FEATURE 075

Feature 075 is a rock pile located in the northwestern quadrant of Survey Area 1, approximately 12 meters south of the north boundary of the current project area, and approximately 21 meters northeast of Feature 076 (see Figure 1). It is situated along the southern edge of a drainage in an open pasture/field land. It is constructed with medium and large-sized basalt cobbles that have been stacked on top bedrock and measures 1.2 meters long by 0.67 meters wide with a height of 90 centimeters tall (Figure 128). With signs of collapse, Feature 075 is in poor condition. Based on construction methods, feature morphology, Feature 075 may have marked a route of a former fence line associated with ranching and/or agricultural purposes during Historic Period.



Figure 128. Feature 075, view to the south.

FEATURE 076

Feature 076 is rock pile located in the northwest quadrant of Survey Area 1, approximately 16.8 meters southwest of the northern boundary of the current project area, and approximately 21 meters west of Feature 076 (see Figure 1). It is situated along the southern edge of a drainage in an open pasture/field land. It is constructed with small to large-sized basalt cobbles and small-sized basalt boulders that have been roughly stacked between one to four courses high on top bedrock (Figure 129). It measures 2.6 meters long by 2.2 meters wide with a height of 106 centimeters tall. With minimal signs of collapse, Feature 075 is in fair condition and its function is unknown.



Figure 129. Feature 076, view to the south.

FEATURE 077

Feature 077 is a dry-stacked wall located in the southwestern quadrant of Survey Area 1, approximately 20 meters northwest of Feature 050, and approximately 78.9 meters northeast of Feature 078 (see Figure 1). It is situated in an open pasture/field land on a moderate westerly slope. It is constructed with small to large-sized basalt cobbles and small-sized boulders (Figure 130). The wall runs 40 degrees northeast and measures 2.6 meters long by 0.45 meters wide with a height of 50 centimeters tall. The feature is partially covered by grass and is roughly 4 meters northeast of a fence line. With some signs of collapse, this retaining wall is in fair to poor condition. Based on construction methods and feature morphology, Feature 077 may have marked a route of a former fence line associated with ranching and/or agricultural purposes during Historic Period.



Figure 130. Feature 077, view to the southeast.

FEATURE 078

Feature 078 is a dry-stacked wall located in the southwestern quadrant of Survey Area 1, approximately 78.9 meters southwest of Feature 077, and approximately 56.5 west of Feature 079 (see Figure 1). It is situated in an open pasture/field land on a moderate westerly slope. It is constructed with small to large-sized basalt cobbles and small-sized boulders (Figure 131). The wall runs 32 degrees northeast and measures 1.8 meters long by 0.35 meters wide with a height of 38 centimeters tall. The feature is partially covered by grass. With some signs of collapse, Feature 078 is in poor condition. Based on construction methods and feature morphology, Feature 078 may have marked a route of a former fence line associated with ranching and/or agricultural purposes during the Historic Period.



Figure 131. Feature 078, view to the east.

FEATURE 079

Feature 079 is a dry-stacked wall located in the southwestern quadrant of Survey Area 1, approximately 57.7 meters southeast of Feature 077, and approximately 100.1 meters south of Feature 050 (see Figure 1). It is situated in an open pasture/field land on a steep westerly slope. It is constructed with small to large-sized basalt cobbles and small-sized boulders (Figure 132). The wall runs 40 degrees northeast and measures 1.7 meters long by 0.3 meters wide with a height of 33 centimeters tall. The feature is partially covered by grass. Signs of collapse were observed, and the feature is in poor condition. Based on construction methods and feature morphology, Feature 079 may have marked a route of a former fence line associated with ranching and/or agricultural purposes during the Historic Period.



Figure 132. Feature 079, view to the south.

FEATURE 080

Feature 080 consists of four pyramidal-shaped rock and mortar foundations located in the northwestern corner of Survey Area 1, approximately 24.6 meters southeast of Feature 075, and approximately 53.8 meters northwest of Feature 057 (see Figure 1). The foundations are situated in in a drainage area and adjacent (east) to a modern water line that is still in use (Figure 133). They are constructed from stacked basalt cobbles of varying sizes, ranging from small to large that have been mortared together. Each foundation tapers towards the top and is wider at the base, with a maximum width of 0.5 meters and heights ranging from 50 to 90 centimeters. At the top of each foundation are two oxidized metal bolts used to secure a pipe in place (see Figure 133 and Figure 134). These foundations are similar, if not identical, to Features 050 and 051, which are located approximately 441 to 545 meters southwest of Feature 080. With minimal deterioration, Feature 080 is overall in fair condition. Based on its construction methods and feature morphology, as well as its location, Feature 080 most likely served as water management associated with the Kula water pipeline infrastructure.



Figure 133. Feature 080, view to the south.



Figure 134. Feature 080, view to the north.

FEATURE 081

Feature 081 consists of three wooden structures located along the western boundary of Survey Area 1 (see Figure 1). They are all built on a concrete slab foundation, rectangular-shaped, and A-framed with vertical wooden planks. The northwestern most structure has a corrugated tin roof (Figure 135), while the other two have roofs constructed with plywood (Figures 136 and 137). During the time of the fieldwork, the southernmost structure was fenced off with t-posts and hog-wire fencing materials. With some deterioration and collapse, Feature 081 is in overall fair to poor condition. Based on its construction methods and feature morphology, as well as its location, the wooden structures of Feature 081 most likely served as water pump sheds associated with the Kula water pipeline infrastructure.



Figure 135. Feature 081 northwesternmost water pump shed, view to the south.



Figure 136. Feature 081 water pump shed east of substation, view to the west.



Figure 137. Feature 081 southernmost water pump shed, view to the north.

FEATURE 082

Feature 082 is a CRM wall remnant located in the southeastern quadrant of Survey Area 1 (see Figure 1). It extends across Keāhuaiwi Gulch. This wall is constructed with small to large-sized basalt cobbles and small-sized basalt boulders (Figure 138 and 139) that have been mortared together. It measures 3.7 meters long by 0.55 meters and 27 centimeters tall. With signs of weathering due to water damage, Feature 082 is in poor condition. Based on its construction methods and feature morphology, Feature 082 was constructed during the Historic Period for water management purposes within Keāhuaiwi Gulch.



Figure 138. Feature 082 in the foreground with Feature 005 in the background, view to the east.



Figure 139. Feature 082 low-lying retaining wall, view to the west.

APPENDIX G. DIVISION OF FORESTRY AND WILDLIFE MANAGEMENT GUIDELINES CLASSIFICATION

Forest Products Management – LNR 172		
Management of sustainable forest product opportunities.		
Class Name	Class Definition	Management Strategies
F-1: Large Scale Commercial	• Forest products are a primary objective, and large scale sustainable commercial timber harvesting or salvage is allowed; • Permits, licenses and environmental compliance are required; • Harvesting of non-timber forest products is allowed.	• Produce a sustainable timber supply in balance with other resource management objectives; • Activities may include site preparation, tree-planting, thinning operations, forest stand improvement and large-scale timber harvest; • Timber management plans are required to mitigate non-timber resource impacts, and assure sustainable yield and positive impact forestry.
F-2: Small Scale Commercial	• Areas where limited commercial timber harvesting or salvage is allowed in balance with other land uses; • Required permits, licenses and environmental compliance depend on scope and scale of operations; • Harvesting of non-timber forest products may be allowed.	• To produce a sustainable supply of forest products while minimizing other resource impacts; • Activities may include site preparation, tree-planting, thinning operations, forest stand improvement and small-scale timber harvest; • Impacts of harvesting distributed over the resource area through controlled seasons and harvest; • Timber management plans are required to mitigate non-timber resource impacts, and assure sustainable yield and positive impact forestry; • Forest management activities performed in coordination with other resource management activities.
F-3: Personal Use	• Areas where selective non-commercial timber harvesting and targeted commercial timber salvage is allowed in balance with other land use objectives; • Permits for harvest of non-timber products issued on a case by case basis. •	• Limited timber harvest performed as appropriate to bring materials to local market, and produce other positive resource outcomes; • Minimize human impacts to native species and native ecosystems; • Accommodate harvest of forest products for sustainable personal use.
F-4: Restricted	• Harvesting of timber only considered if activity improves other priority resource outcomes; • Permits for harvest of non-timber forest products will be considered on a case by case basis for research and education, improving forest science and health, watershed protection, traditional and customary practices, and conservation efforts.	• Resource protection is the top priority; • Prioritize protection of native species and native ecosystems; • Permitted activities in these areas are minimally disruptive, and focused on improving forest and watershed health, native ecosystems, and other conservation efforts.

Conservation Resources - Native Species Habitat, Water Resources – LNR 402/407		
Class Name	Class Definition: May have one, all, or a combination of conservation values	Management Strategy
C-1: High Conservation Resources	• High level of native biological resources, native ecosystem intactness, and/or recovery potential; • Essential to the conservation and/or recovery of native species; • Important restoration areas, such as rare ecosystem remnants, native wildlife habitat, wetlands, and offshore islands; • High degree of conservation related regulatory encumbrances - critical habitat, restricted watershed, conservation easements and/or zoning; • High watershed conservation value per CWRM, USGS, BWS, and/or DOFAW.	• Intensive management applied, as necessary, to protect watershed values, and native species and ecosystems, as resources permit; • Management may include animal exclusion fencing, predator control, vegetation/weed control; • Work may include out-planting of native vegetation and reintroduction of native wildlife, as needed.
C-2: Medium Conservation Resources	• Moderate level of native biological diversity and/or native ecosystem intactness; • Contributes to the conservation and/or recovery of native species (i.e. T&E / native species habitat, water resources); • Medium degree of conservation related regulatory encumbrances; • Medium watershed conservation value.	• Management activities to control priority threats and improve watershed, native species or ecosystem outcomes; • Work may include out-planting of native vegetation and reintroduction of native wildlife, as needed. • Other uses may include forest products gathering, hiking, and liberal hunting.
C-3: Low Conservation Resources	• Low level of native biological diversity and/or native ecosystem intactness; • Low conservation and/or recovery of native species but may contribute to conservation (i.e. individual or small clusters of rare plants; genetic collection); • Low degree of conservation related regulatory encumbrances; • May have low watershed conservation value.	• Native species management occurs mostly in remnant patches and fenced units; • Mixed use area with forest products gathering, hunting and non-hunting recreation, as appropriate.
C-4: Little to No Conservation Resources	• Little to no native biological diversity and/or native ecosystems highly degraded or absent; • Little to no contribution to the conservation and/or recovery of native species; • Very little or no conservation related regulatory encumbrances; • May have low watershed conservation value.	• Area managed for a variety of uses not appropriate for more pristine environments, including timber harvest, regulated hunting and more intensive non-hunting recreation (hiking, equestrian and/or off-road vehicles).

Hunting Management – LNR 804		
Management for public recreation, subsistence hunting and animal damage control.		
Class Name	Class Definition	Management Strategy
H-1: Active Hunting Management:	• Public hunting is a high priority land use; • Area is suitable for a high degree of active management for public hunting; • Management of the area is designed to provide maximum sustained yield of game animals.	• Hunting regulations for the area are designed to provide maximum sustained yield while minimizing environmental impacts; • High degree of management to maintain or improve hunting program infrastructure; • Habitat is managed to maintain or increase game animal carrying capacity, while maintaining healthy vegetative cover for proper range management and erosion control.
H-2: Moderate Hunting Management:	• Area is suitable for a moderate degree of active management for animal enhancement and habitat management to increase animal productivity for public hunting; • Public hunting opportunities may be improved or maximized; • Public hunting is balanced with other objectives.	• Hunting regulations established to manage animal harvest; • Moderate degree of infrastructure for animal management; • Habitat modification for game animal production as appropriate for the area; • Balance animal impacts with other resources.
H-3: Low Intensity Hunting Management:	• Area not suitable for game enhancement and habitat management to increase animal densities - hunters play an important role in limiting animal impacts; • Minimal public hunting restrictions provide maximum public hunting opportunity; • Public hunting management includes maintaining access and monitoring hunter effort and success.	• Hunting seasons, bag limits and other hunting regulations liberalized to maximize hunting opportunity; • Hunting opportunities may include permitted hunts if needed to improve access; • No habitat modification for production and/or enhancement of game animals.
H-4: No Hunting Management:	• Area is not suitable for open public hunting due to environmental sensitivity, access, or safety; • No active management for public hunting; public hunting may be used for animal damage control on a permit basis; • Public hunting is not a primary land management objective.	• Area not open to regular public hunting seasons for either management, access or safety reasons; • Animal control to be conducted by staff, permitted and/or guided hunters, and other cooperators as appropriate.

Recreation Management – LNR 804		
Class Name	Class Definition	Management Strategy
R-1: High Recreation Management:	• Areas where outdoor recreation is a primary objective; • High level of visitor use is received and accommodated; • May include recreation, transit and/or urban elements; • Approximate average daily use: 100 - 1000+ users.	• Area can sustain heavy recreational use; recreation plays a major role in use of the area; • Trails maintained to sustain heavy use which may include hiking, mountain bike riding, equestrian and/or off-road vehicle use; • Improvements commensurate with use.
R-2: Medium Recreation Management:	• Areas where outdoor recreation is of moderate intensity, and may be integrated with other uses; • Includes a wide range of trails and roads requiring a moderate level of management and maintenance to meet user needs and balance other land use objectives; • Approximate average daily use: 0 – 500 (+/-) users.	• Area can sustain moderate recreational use; recreation integrated with other management programs; • Roads and trails maintained to sustain moderate use which may include hiking, mountain bike riding, equestrian, and/or off-road vehicle improvements; • Improvements commensurate with use.
R-3: Low Recreation Management:	• Areas where outdoor recreation is of low intensity, and is integrated with other uses; • Trails and roads that receive limited use, or whose character and terrain require little maintenance relative to the usage; • Approximate average daily use: 0 – 100 (+/-).	• Areas may be inaccessible or remote; facilities and improvements are limited, in keeping with the level of use; • Areas may be managed for multiple uses including forest protection, conservation, hunting, and hiking, or protected and managed to preserve natural conditions; activities may include hiking, biking, equestrian and/or off-road vehicles; • To protect both the trail environment and experience, improvements are typically minimal, and designed to fit the setting and need.
R-4: Recreation Management (Restricted access):	• Areas where outdoor recreation is restricted or controlled; • Areas sensitive to human disturbance due to natural, cultural or archaeological features; • Access primarily for management purposes, and/or limited or programmatic recreational or educational uses.	• Areas may be classified “restricted” due to hazardous conditions, watershed protection, sensitive wildlife, fragile ecosystems, cultural resources, limited accessibility, or management practices incompatible with recreational activities; • Managed to limit impacts from human activities; • Facilities and improvements are very limited and generally associated resource management; • Trails will not feature extensive recreational amenities and will generally incorporate only facilities necessary to protect and manage the resource; • Access may be controlled via permits, group number limitations, or other restrictions as appropriate for the area.

APPENDIX H. INVASIVE PLANT SPECIES PROFILES

Cabinet-level direction on invasive species issues

Hawaii Invasive Species Council

BLACK WATTLE (ACACIA MEARNSII)





BLACK WATTLE (ACACIA MEARNSII)

Hawaii Pacific Weed Risk Assessment: 15 High Risk

Regulatory Status: Hawaii Noxious Weed List

Prevention and Control Category: N/A

REPORT INVASIVE SPECIES
643-PEST
643pest.org
CALL OR CLICK TO PROTECT HAWAII

Description

- Fast growing tree. All parts finely hairy. Hairs of new growth is golden in color. Leaves are dark olive-green and also finely hairy, bipinnate; leaflets short (1.5 – 4mm) and crowded. Raised glands occur at and between the junctions of pinnae pairs. Flowers form in large globular clusters and are pale yellow or cream colored. Fruits are dark brown pods.

Impacts

- It threatens native habitats by competing with indigenous vegetation, replacing grass communities, and reducing native biodiversity
- Increases water loss from riparian zones due to high transpiration rates
- Long lived seeds readily germinate after fire

Distribution

- Distribution in Hawaii is currently unknown

For more information, see

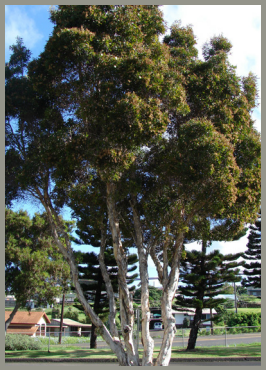
- Acacia mearnsii Datasheet from CABI
- Acacia mearnsii information from USDA
- Acacia mearnsii information from ISSG

COAST BANKSIA
Banksia integrifolia











Don't confuse with paperbark (left), which has white flowers and papery bark or button mangrove (above), with button-like fruit.

All images Forest & Kim Starr (UH)

TREE

COAST BANKSIA
Banksia integrifolia

FAMILY: Proteaceae

General Description: Coast banksia is an evergreen tall shrub / short tree in the Protea family that can grow 20-52' tall. Plants have rough grey bark and dark green leaves that are white and woolly underneath and grow in a whorled arrangement. Its leaves are long and narrow (2-8" long by .4-1" wide). Its flowers are pale yellow and grow in a dense spike (4-5" long) nested within the leaves. Older flowers fall away to reveal a "cone" that starts green and fuzzy and fades into grey with age. Each cavity in the cone contains 1 or 2 winged seeds.

Impacts: Coast banksia does well in coastal areas and in poor soil environments, making it a potential invader in coastal strand communities and lava fields.

Dispersal Mechanism: Coast banksia reproduces via winged seeds that are carried by the wind and can travel well beyond the parent plant.

Origin, Distribution, and Habitat: Coast banksia is native to eastern Australia. It has started to naturalize and become weedy in western Australia and New Zealand. In Hawaii, it can be found on Kaua'i, Maui, and the Big Island. This tree is spreading in upcountry areas of Maui that border Haleakalā National Park. As the common name implies, this tree can live in coastal areas, where it is resistant to salt and wind exposure.

Cultivation: Coast banksia has been planted in botanical gardens in Hawaii. It has been classified as "High Risk" by the Hawaii-Pacific Weed Risk Assessment and should not be cultivated.

Don't confuse with:

Paperbark (*Melaleuca quinquenervia*) can be distinguished by its white bottle-brush-like flowers and paper-like peeling bark. THIS PLANT IS ALSO INVASIVE.

Button mangrove (*Conocarpus erectus*) also grows in coastal areas and has a similar leaf shape. Look for button-like fruits to make a distinction. THIS PLANT IS ALSO INVASIVE.

! Hawaii State Noxious Weed

BOCCONIA
Bocconia frutescens











All images Forest & Kim Starr (UH)

SHRUB

BOCCONIA
Bocconia frutescens

FAMILY: Papaveraceae

Hawaii State Noxious Weed

General Description: Bocconia (tree poppy) is the largest member of the poppy family growing to the stature of a small tree (20'). It has large lobed leaves (4-23.5" long by 1.5-8" wide) that are clustered at the branch tips. It produces branched clusters of small beige-yellow flowers that develop into fleshy red fruits (~.2") enclosed in a grey capsule.

Impacts: Bocconia is an aggressive invader of dry forests that can crowd out native plants. One mature plant can produce more than 300,000 seeds per annual fruiting season. It can colonize pastures, degrading grazing quality, and open lava flows, displacing native species. On the Big Island, one cultivated planting in Ka'ū infested 3,500 acres of abandoned agricultural fields.

Dispersal Mechanism: Bocconia plants produce thousands of seeds, which are attractive to birds that can spread them long distances. It is difficult to manage and can resprout after chemical treatments from its prolific seed bank or small root fragments.

Origin, Distribution, and Habitat: Bocconia is native to Central and South America. In Hawaii, it has been introduced on O'ahu, Maui and the Big Island and is a serious pest on Maui and the Big Island. It thrives in leeward dry areas on 'a'ā lava, but is also spreading in the wetter areas of upcountry Maui. Bocconia is widespread in areas of Kula and Kāhikinui that border Haleakalā National Park. It grows in diverse habitats, including dry forest and cloud forest.

Cultivation: Bocconia is grown in gardens. It was first recorded on Maui in 1920. It is a Hawaii state noxious weed and is illegal to plant or transport across the state. It has been classified as "High Risk" by the Hawaii-Pacific Weed Risk Assessment.

Cabinet-level direction on invasive species issues

Hawaii Invasive Species Council

SMOKE BUSH



SMOKE BUSH (*BUDDLEJA MADAGASCARIENSIS*)

Hawaii Pacific Weed Risk Assessment: 7 High Risk

Regulatory Status: None

Prevention and Control Category: BIISC Target Species.

REPORT INVASIVE SPECIES
643-PEST
643pest.org
CALL OR CLICK TO PROTECT HAWAII

Description:

- Viney shrub with dense, sprawling habit
- Clusters of small, orange, attractive, fragrant flowers
- Gray-green leaves 3-5″ long
- Seeds born in pulpy fruits on terminal clusters
- Native to Madagascar, introduced to Hawaii as an ornamental plant

Harm



- Aggressive invader of disturbed areas at mid to low elevations, including open range, stream beds, and gulches
- Forms dense stands that crowd out and compete with native plants
- Plant produces numerous fruit that are attractive to birds, which disperse the seeds.
- Mechanical and chemical control of this species is difficult.

Distribution



- Kauai: Spreading in Kokee, encroaching on native ecosystems. On Kauai Landscaping Industry Council's "Don't Sell" list as part of the Landscapers' Voluntary Codes of Conduct.
- Oahu: Present, but only in few locations, including East Range, Mililani Mauka, on Army property. Monitored and targeted by Oahu Invasive Species Committee (OISC). Please report all sightings by calling 286-4616.
- Maui: Serious invader in mid-elevation sites, especially Kula, and lowland moist to wet sites, such as near Puaa Kaa Wayside on the road to Hana
- Molokai: None known
- Lanai: None known
- Kahoolawe: None known
- Big Island: Infestations in Volcano. Targeted for control by the Big Island Invasive Species Committee (BIISC)

For more information, see

- Buddleja madagascariensis Datasheet from CABI
- Buddleja madagascariensis information from HEAR
- Buddleja madagascariensis information from PIER

NIGHT CESTRUM
Cestrum nocturnum



All images unless noted Forest & Kim Starr (UH)



Penarc



Don't confuse with other nonnative cestrum, which have non-white flowers.



Gary Bess

SHRUB

NIGHT CESTRUM
Cestrum nocturnum

FAMILY: Solanaceae

General Description: Night cestrum (night blooming jasmine) is a sprawling evergreen shrub with pale white bark that turns green with age. It grows to 20' tall and has smooth hairless leaves that grow in an alternate arrangement (3-6" long) and are foul smelling when crushed. The predominantly white tubular flowers (1" long), which open at night, are strongly fragrant, and form in clusters. Glossy berries start green and mature white (.2-.5" diameter).

Impacts: Night cestrum can form dense impenetrable thickets that exclude all other plants. All parts of this plant are toxic to humans and animals, including livestock. Its strong scent can cause hay fever-like respiratory symptoms in sensitive and asthmatic people. Once naturalized, night cestrum can be hard to control.

Dispersal Mechanism: Night cestrum seeds are moved by birds, flooding, soil movement, and garden waste dumping. Its seeds persist for long periods of time and it can reproduce vegetatively from stem or root fragments.

Origin, Distribution, and Habitat: Native to tropical America and Cuba, night cestrum has been introduced to the southern United States, China, India, Australia, New Zealand, and much of Oceania. In Hawaii, night cestrum has escaped cultivation on all of the main islands except Moloka'i, Ni'ihau, and Kaho'olawe. On the Big Island, this plant is widely cultivated and common in communities surrounding Hawai'i Volcanoes National Park. It naturalizes in moist to wet forests, and along roads, trails, and streams.

Cultivation: Night cestrum is a popular ornamental plant due to its strong-smelling flowers. The Hawaii Department of Land and Natural Resources considers night cestrum one of Hawaii's most invasive horticultural plants. It has been classified as "High Risk" by the Hawaii-Pacific Weed Risk Assessment and should not be cultivated.

Don't confuse with:

Other cestrum plants, such as green cestrum (*Cestrum parqui*), red cestrum (*C. fasciculatum*), purple cestrum (*C. elegans*), and orange cestrum (*C. aurantiacum*) are found in many Hawaiian gardens. Only night cestrum has predominantly white flowers. THESE PLANTS ARE ALSO INVASIVE.

Cabinet-level direction on invasive species issues
Hawaii Invasive Species Council

1:15

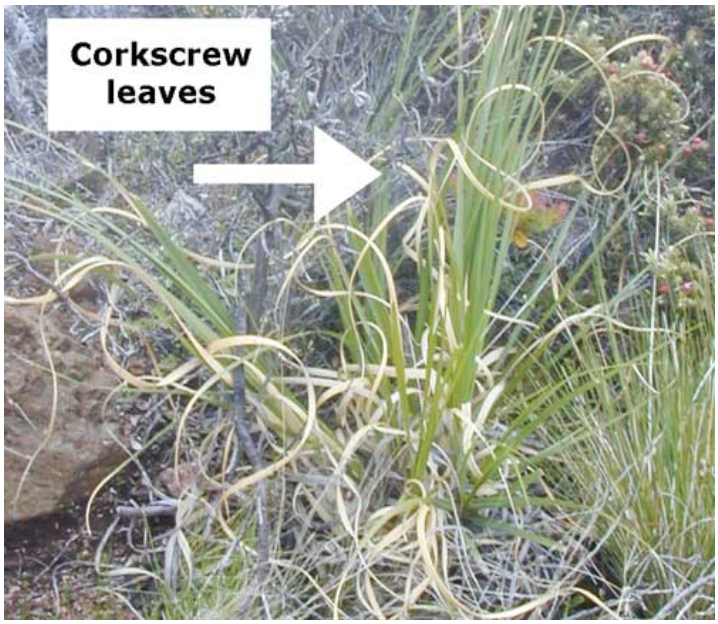
PAMPAS GRASS

PAMPAS GRASS (*CORTADERIA JUBATA, CORTADERIA SELLOANA*)

Hawai'i-Pacific Weed Risk Assessment Score: *C. jubata* – 26 High Risk. *C. selloana* – 24 High Risk. Visit Plant Pono for more information.

Regulatory Status: Hawaii Noxious Weed (HAR 68)

Prevention and Control Category: KISC Target Species. OISC Target Species. MISC Target Species. BIISC Target Species



REPORT INVASIVE SPECIES
643-PEST
643pest.org
CALL OR CLICK TO PROTECT HAWAII

Description

Pampas grass is an erect giant bunch grass with long, slender, bright green, saw-toothed leaves. At its base are dried, corkscrew-shaped leaves. It has large showy flower plumes that extend 2-3′ beyond the foliage. Two species of pampas grass are found in Hawaii, Cortaderia selloana and C. jubata, which are difficult to tell apart. Both reach heights of 9-10′ and have loosely clumped pinkish-white seed heads. They flower from July through November. Spent flower stalks are sometimes persistent for several years

Impacts

Pampas grass grows rapidly, produces thousands of seeds per flower plume, and can accumulate large amounts of fire prone biomass. Seeds are viable for 4-6 months, but field evidence from

Hawaii suggests viability could be greater. It can crowd out native species, impede access, degrade grazing lands, and create fire hazards.

Distribution

Native to South America, pampas grass was introduced to Hawaii as an ornamental. On Maui, this plant has escaped cultivation and spread into pristine, upland native forests. It is found in pastures, gulches, yards, along road cuts. Cortaderia are found in residential and remote areas of Maui and O‘ahu.



1:15

What you can do

It is important NOT to pull and move the plant, as proper removal and disposal are essential to prevent spreading seeds and re-sprouting.

Look-alike Species

Sugarcane (*Saccharum officinarum*): is a Polynesian introduced plant that has a similar seed plume as pampas but the plume is not as dense and sugarcane does not have corkscrew leaves.

Native Hawaiian sedges (*Cyperaceae sp.*): These can be confused with young pampas grass. They do not produce corkscrew leaves, tall flowering stalks, or large showy seed plumes. Most Hawaiian sedge leaves are not as sharp.

For more information, see:

- ***Cortaderia selloana* Datasheet** from CABI
- ***Cortaderia jubata Datasheet*** from CABI
- ***Cortaderia jubata* information** from HEAR
- ***Cortaderia selloana* information** from HEAR
- ***Cortaderia jubata* information** from ISSG
- ***Cortaderia selloana* information** from ISSG
- **Pampas grass information** from UC WRIC
- The Hawai‘i Invasive Species Council, https://dlnr.hawaii.gov/hisc/info/species/pampas-grass/
- Maui Invasive Species Committee, mauiinvasive.org/2013/02/24/pampas-grass/
- O‘ahu Invasive Species Committee:www.oahuisc.org/pampas-grass/
- Kaua‘i Invasive Species Committee,www.kauaiisc.org/pampas-grass/

- Big Island Invasive Species Committee, https://www.biisc.org/wp-content/uploads/Pampas-grass_final.pdf
- CTAHR Weed's of Hawaii's Pastures and Natural Areas: https://www.ctahr.hawaii.edu/invweed/WeedsHI/W_Cortaderia_jubata.pdf

1:15

Cabinet-level direction on invasive species issues
Hawaii Invasive Species Council

COTONEASTER (COTONEASTER PANNOSUS)

COTONEASTER *(COTONEASTER PANNOSUS)*

Hawaii Pacific Weed Risk Assessment: 11 High Risk

Regulatory Status: Hawaii Noxious Weed List

Prevention and Control Category: N/A



REPORT INVASIVE SPECIES
643-PEST
643pest.org
CALL OR CLICK TO PROTECT HAWAII

Description

- Multi-stemmed shrub with arching branches. Can grow up to 15′ tall. Flowers are white or pink with five petals. Oblong leaves are 0.5 in – 1 in long and are a green-grey color with fuzzy bottoms. Fruit are a dull red when ripe and contain 1-3 seeds.

Impacts

- Invades pasture lands and native rain forests. Highly adaptable and germinates readily in shade.

Distribution

- Big Island and Maui: Cotoneaster is currently known to be found on Hawai'i Island and Maui.



What you can do

If you see this species, call 643-PEST and/or visit 643pest.org.

Look-alike Species:

Firethorn (Pyracantha angustifolia)- This shrub species is also invasive. It has similar flowers and fruits, but is covered in thorns.



For more information, see

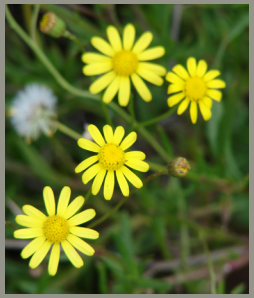
- Cotoneaster pannosus information from USDA
- Haleakala National Park Invasive Plant Field Guide

CANARY ISLANDS ST. JOHN'S WORT
Hypericum canariense











Don't confuse with invasive fireweed (left), which has a 13-petaled flower or invasive St. John's wort (above), which has petals with black glands.



GRASS/ HERB

CANARY ISLANDS ST. JOHN'S WORT
Hypericum canariense

FAMILY: Hypericaceae

General Description: Canary Islands St. John's wort is a multi-stemmed shrubby plant that grows 3-12' tall. Its lance-shaped leaves (2-2.7" long) grow in an opposite arrangement along the stem with 2-3 leaves at each node. It produces yellow flowers with 5 petals and many yellow whiskery stamens in the center. The fruits are leathery capsules that open and release seeds.

Impacts: Canary Islands St. John's wort readily escapes cultivation and can form dense thickets that crowd out other vegetation. In California, this plant outcompetes both native plants and nonnative weeds, such as pampas grass (*Cortaderia* sp.), resulting in nearly 100% single species stands. In favorable conditions, infestations can spread 150-300' a year. It may be poisonous to livestock, like other related hypericum plants.

Dispersal Mechanism: Canary Islands St. John's wort seeds are wind dispersed and can readily propagate.

Origin, Distribution, and Habitat: Canary Islands St. John's wort is native to the volcanic Canary Islands and Madeira. In Hawaii, it is known from one site on Maui, in Kula (175 acres), where it naturalized and spread from the initial infestation. It can grow in mid-range to high elevation grasslands, shrublands, and mesic to dry forests.

Cultivation: Canary Islands St. John's wort is grown as an ornamental in private gardens as well as in arboreta. The Hawaii Chapter of the American Society of Landscape Architects categorizes Canary Islands St. John's wort as a "do not plant" species. It has been classified as "High Risk" by the Hawaii-Pacific Weed Risk Assessment and should not be cultivated. It should not be confused with the St. John's wort that is used for medicinal purposes.

Don't confuse with:

Fireweed (*Senecio madagascariensis*) is a common weed in the upcountry area of Maui. It has 13-petaled flowers. Fireweed is not established in Haleakalā National Park. THIS PLANT IS ALSO INVASIVE.

St. John's wort (*Hypericum perferatum*) is a closely related weed which has black glands along the edge of its flower petals. THIS PLANT IS ALSO INVASIVE.

Lonicera japonica

Japanese honeysuckle

Lonicera japonica Thunb.

Family: Caprifoliaceae



Description: A popular ornamental. Sprawling and climbing perennial, smothers shrubs. Young stems hairy. Leaves opposite, ovate, lower leaves sometimes lobed, 3 inches long by 1.5 inches wide. Flowers in pairs at the axils, white, maturing to yellow. Fruits rarely except in Mānoa Valley; fruit roundish, blue-black. Genus named in honor of 16th century German botanist Adam Lonitzer[70]; *japonica*, of Japan[19].

Distribution: Native to Asia. A serious weed on two million acres of U.S. mainland forests[38]. First collected on Hawai‘i in 1951[70]. Occurs in mesic to wet areas such as Kōke‘e on Kaua‘i and Volcano on Hawai‘i, from sea level to at least 4000 ft.

Environmental impact: Smothers plants in mesic to wet forests.

Management: Sensitive to hormone-type herbicides and to metsulfuron and glyphosate[38].

This is an excerpt from *Weeds of Hawai‘i’s Pastures and Natural Areas; An Identification and Management Guide* by P. Motooka et al.
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Cabinet-level direction on invasive species issues
Hawaii Invasive Species Council

FIRE TREE

FIRE TREE, FIRETREE, FAYA BUSH (*MORELLA FAYA*)



Hawaii Pacific Weed Risk Assessment: 17 High Risk

Regulatory Status: Hawaii Noxious Weed List (HAR 68)

Prevention and Control Category: None

REPORT INVASIVE SPECIES
643-PEST
643pest.org
CALL OR CLICK TO PROTECT HAWAII

Description:

- Evergreen shrub or small tree up to 8 m tall (26 ft)
- Fruit are pink to red or blackish when mature, and appear bumpy
- Native to the Azores, Madeira and Canary Islands, introduced to Hawaii as an ornamental and backyard food crop (berry wine) by Portuguese laborers in the 1800's and spread as a reforestation tree in the 1920's.

Harm:

- Out-competes native plant species and capable of forming dense, single-species stands, devoid of other plant life
- Modifies forest habitat by significantly increasing nitrogen levels in the soil, which makes the area inhospitable to native plants, but more suitable for other invasive species
- Seeds spread by animals.
- Able to colonize a wide range of habitats due to its ability to alter soil chemistry

In Hawaii:

- Kauai: Present in Waimea Canyon and Kokee State Park. Landowners are encouraged to control where possible.

- Oahu: Established in the southern Waianae mountains where Oahu Army Natural Resources Program controls populations. There are no known trees in the Koolau mountains.
- Maui: Present in large numbers on the slopes of Haleakala. Not considered eradicable by MISC. Landowners are encouraged to control where possible. The only known plants on West Maui have been controlled.
- Molokai: Presence/absence unknown.
- Lanai: Presence/absence unknown.
- Kahoolawe: None known.
- Big Island: Widespread on the Big Island where hundreds of acres are already infested. Not considered eradicable by BIISC. However, landowners are encouraged to control wherever possible.

For more information, see:

- ***Morrella faya* Datasheet** from CABI
- Morella faya information from HEAR
- Morella faya information from PIER
- Morella faya information from ISSG

Cabinet-level direction on invasive species issues
Hawaii Invasive Species Council

BANANA POKA (PASSIFLORA MOLLISIMA)

BANANA POKA (PASSIFLORA TARMINIANA) SYNONYM: *P. MOLLISSIMA*

Hawaii Pacific Weed Risk Assessment: 24 High Risk

Regulatory Status: Hawaii Noxious Weed List

Prevention and Control Category: none



REPORT INVASIVE SPECIES
643-PEST
643pest.org
CALL OR CLICK TO PROTECT HAWAII

Description

- Fast growing climbing vine. Large showy pink flowers. Produces many elongated fruit that are yellow in color when ripe. Fruit contain an orange pulp with hundreds of seeds. leaves are dark green and have three distinct lobes.

Impacts

- Found in disturbed areas, open fields and around fresh water habitats. *P. tarminiana* will readily climb and smother trees. Fruit provides a food source for non-native animals. Seeds are dispersed by birds and feral pigs. Dense curtains of the vine can extend to the ground from canopy branches, sometimes causing branches to break and toppling trees during storms. Where the canopy has been opened, dense mats of vines also cover the understory trees and shrubs and inhibit regeneration of the native trees (Mueller-Dombois et al. 1980).

Distribution

- Kauai: Widespread in the Koke'e area

- Maui: Currently restricted to the Kula area
- Big Island: Widespread



For more information, see

- Passiflora tarminiana Datasheet from CABI
- Passiflora tarminiana information from USDA
- Passiflora tarminiana information from ISSG
- https://www.hear.org/starr/hiplants/reports/pdf/passiflora_mollissima.pdf

PINE TREES
Pinus spp.











Don't confuse with native young pūkiawe plants, which have smaller sharp leaves.



TREE

PINE TREES
Pinus spp.

FAMILY: Pinaceae

General Description: Pines are evergreen trees with characteristic needle leaves and cone fruits. Most pine bark is thick, scaly, and resin-producing. They can reach heights exceeding 100'.

Impacts: Three species - Monterey pine (*Pinus radiata*), Mexican weeping pine (*Pinus patula*) and maritime pine (*Pinus pinaster*) - are particularly invasive. Pines can grow up to 1' a year and can reproduce in 6-8 years. Trees produce large amounts of seeds that can remain viable for many years. Pine needles decay slowly, resulting in the accumulation of litter, which can suppress the growth of other plants and may ultimately result in reduced diversity.

Dispersal Mechanism: Pine seeds are dispersed in the wind.

Origin, Distribution, and Habitat: Pines were introduced in the early 1900s to Maui for forestry purposes. Hosmer's Grove, one of the earliest forestry plantings in the state, and surrounding areas contain Monterey, Mexican, and maritime pine. Pines pose a particular threat to the subalpine shrubland and crater areas of Haleakalā where they readily establish from neighboring populations. Thousands of seedlings are removed every year. No pines are native to Hawaii.

Cultivation: Pine trees were introduced to Hawaii for forestry and ornamental purposes. The Hawaii Department of Land and Natural Resources considers Mexican weeping pine one of Hawaii's most invasive horticultural plants. The Hawaii Chapter of the American Society of Landscape Architects categorizes Monterey pine as a "do not plant" species. Several pine trees have been classified as "High Risk" by the Hawaii-Pacific Weed Risk Assessment and should not be cultivated.

Don't confuse with:

Pūkiawe (*Leptecophylla tameiameiae*) is a native shrub that grows on Haleakalā from shore to summit, though predominantly at higher elevations. Young seedlings can resemble a pine tree. Pūkiawe leaves are shorter and have sharp tips.

! Hawaii State Noxious Weed

SWEET PITTOSPORUM
Pittosporum undulatum









TREE



Don't confuse with invasive cape pittosporum (left), which does not have wavy leaf margins or macadamia nut (right), which also looks similar but has pipe cleaner-like flower spikes and rounded leaf tips.



SWEET PITTOSPORUM
Pittosporum undulatum

FAMILY: Pittosporaceae

Hawaii State Noxious Weed

General Description: Sweet pittosporum (Victorian box) is a fast-growing evergreen tree often cultivated in gardens for its aromatic white flowers. It can grow from 15-45' tall and has shiny green leaves that are 2-6'' long with distinctly undulating edges. The leaves are arranged alternately along the stem. Its white 5-petaled flowers (.7-1'' long) are found clustered at the ends of young branches and smell strongly of citrus. Orange fruit capsules are formed in the fall (.6'' long) and contain shiny black seeds.

Impacts: Sweet pittosporum is a popular landscaping tree that has escaped cultivation in Hawaii, Jamaica, South Africa, New Zealand and other Pacific and Atlantic islands. This tree is considered the most threatening invasive plant in the Blue & John Crow Mountains of Jamaica, where it outcompetes native plants in tropical montane forests. A single tree can produce more than 37,500 seeds.

Dispersal Mechanism: Sweet pittosporum is spread by humans who use the plant in landscaping. It readily escapes cultivation and the seeds are eaten and dispersed long distances by fruit-eating birds.

Origin, Distribution, and Habitat: Sweet pittosporum is native to Australia. On the Big Island, it has naturalized in disturbed mesic forests in Waimea and Pa'auilo where it covers large acreage.

Cultivation: Sweet pittosporum is widely cultivated throughout the world as an ornamental plant.

Don't confuse with:

Cape pittosporum (*Pittosporum viridiflorum*) is native to South Africa and cultivated in Hawaii for garden plantings. It has fragrant flowers and orange seed pods, but lacks the undulating leaf margins. This tree is also a target pest as it readily naturalizes. THIS PLANT IS ALSO INVASIVE.

Macadamia nut (*Macadamia integrifolia*) is a nonnative crop plant that also has the undulating leaf margins characteristic of sweet pittosporum, but it has drooping flower spikes that resemble a pipe cleaner and fruits that turn from green to brown.

Pyracantha angustifolia

Firethorn

Pyracantha angustifolia (Franch.) C.K. Schneid.

Family: Rosaceae



Description: Semiwoody shrub to 12 ft tall, stems rigid, branched, thorns leafy. Leaves 2 inches long by 0.6 inches wide, upper surface hairy when young, smooth when mature. Lower surface of leaf is hairy, gray[70], as is the case with Kōkeʻe specimens, but the leaves of the plants at Volcano are smooth. Flowers in clusters, white. Fruit small, 0.3 inches diameter, numerous, bright red or orange. The generic name is derived from *pyr*, fire; and *acanthos*, thorn, in reference to the thorns and brightly colored berries; *angustifolia*, narrow leaves[5, 70].

Distribution: Native to China. Infests high-elevation areas in South Africa[22]. In Hawaiʻi, occurs in higher-elevation (3000–4000 ft) mesic to wet pastures and forests: Kōkeʻe on Kauaʻi and Volcano on Hawaiʻi. First collected on Kauaʻi in 1986[70].

Environmental impact: Grows along forest edges and in pastures and waste lands. Thorns impede passage.

Management: Somewhat tolerant of triclopyr. May require crop oil as adjuvant or carrier to enhance herbicide uptake. Katie Cassel (Kōkeʻe Museum) reports that cut-stump treatments with glyphosate or triclopyr are effective. Application of triclopyr to frills or basal bark caused slow and erratic results. Application of glyphosate (undiluted product) to frill was somewhat more effective than triclopyr. HAVO staff reported control with foliar applications of triclopyr amine at 2% product in water (Chris Zimmer, HAVO).

This is an excerpt from *Weeds of Hawai'i's Pastures and Natural Areas; An Identification and Management Guide* by P. Motooka et al.
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APPENDIX I. HAWAIIAN ISLANDS CLIMATE VULNERABILITY AND ADAPTATION SYNTHESIS

Hawaiian Islands Climate Vulnerability and Adaptation Synthesis

Excerpt pages 49-65

2018



www.EcoAdapt.org

Citation
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For more information on this report and other products, please contact Rachel@EcoAdapt.org and visit http://bit.ly/HawaiiClimate.

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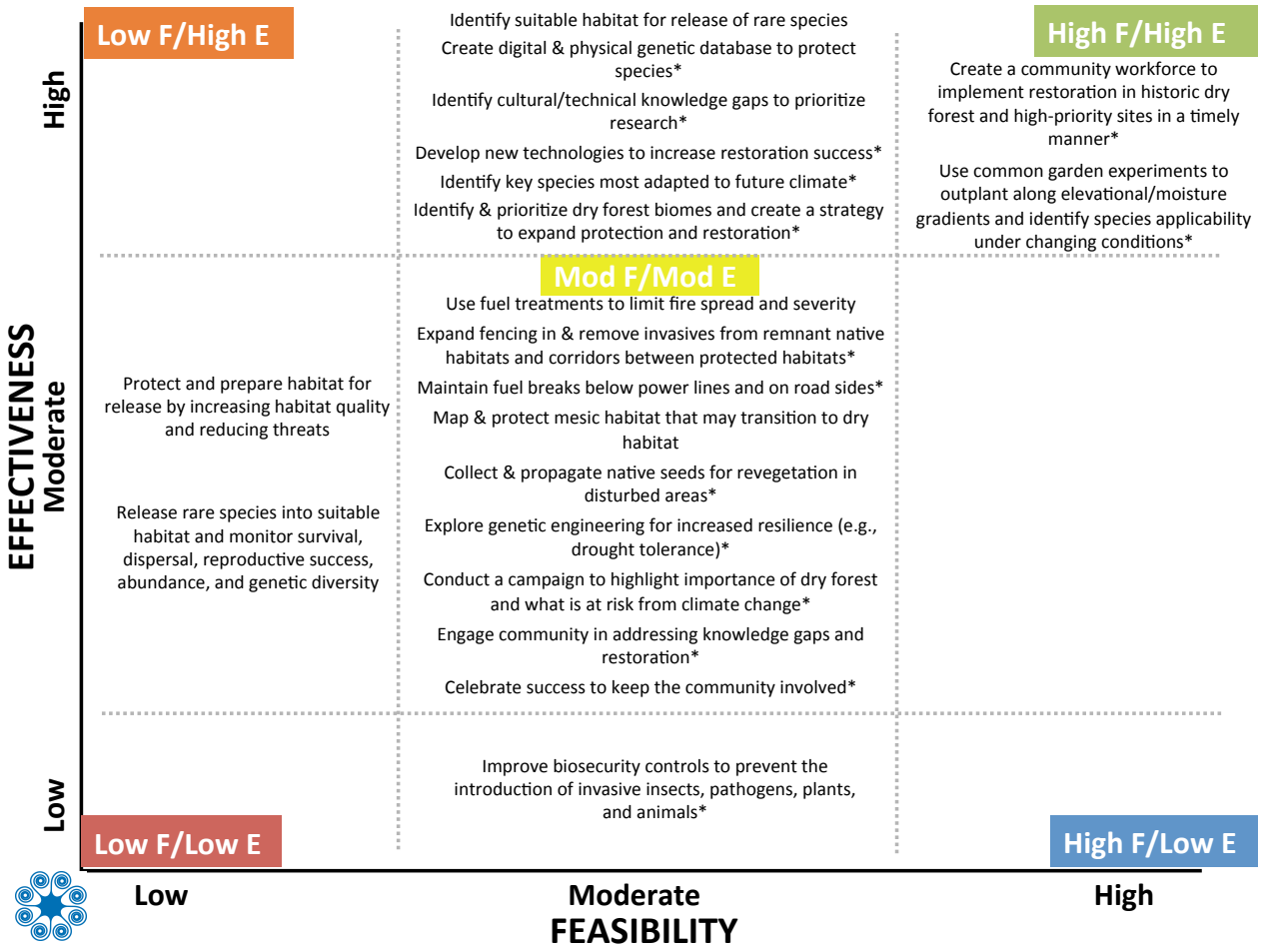


Figure 11. Maui Nui dry forest habitat adaptation actions plotted according to implementation feasibility and effectiveness. Those actions having high feasibility (action capable of being implemented) and effectiveness (action reduces vulnerability) appear in the upper right corner and those actions having low feasibility and effectiveness appear in the bottom left corner. An asterisk (*) denotes adaptation actions evaluated for feasibility and effectiveness by workshop participants. All other adaptation action evaluations are based on expert opinion.

Mesic and Wet Forest

Mesic and wet forest habitats are typically found on windward lowland areas and montane slopes up to elevations of 2,194 m (7,200 ft). These mesic/wet bands are created in areas that lie at or below the mean height of the TWI, and receive up to 7,620 mm (300 in) of rainfall per year. Mesic and wet forest habitat types range from mesic forests to tropical montane cloud forests, and are typically dominated by ʻōhiʻa and koa trees with dense understories comprised of shrubs, ferns, and sedges. Mesic and wet forest habitats can be found on east Maui from Makawao clockwise to Kipahulu and Kahikinui, and on the upland, windward slopes of west Maui. On Lānaʻi, mesic forest habitats are distributed on the windward slopes and extend down to the ocean. Kahoʻolawe lies in the rain shadow of Maui and does not contain mesic or wet forest habitat.

Vulnerability Assessment Results

Mesic and wet forest habitats were evaluated as having *moderate* vulnerability to climate change due to *moderate-high* sensitivity to climate and non-climate stressors, *moderate-high* exposure to projected future climate changes, and *moderate* adaptive capacity. Mesic and wet forests are sensitive to factors that alter moisture gradients, such as drought, precipitation amount and timing, storms, and air

temperature. Disturbance events, such as disease, wind, and insect outbreaks can damage large habitat areas, potentially allowing invasive plants to become established. Invasive ungulates, mammalian predators, trees/shrubs, flammable grasses, and pathogens/parasites are the primary non-climate stressors for mesic and wet forest types, and have led to the rapid decline of many native and endemic species over the past several hundred years. High-elevation wet forests remain relatively intact, but lowland areas and mesic forests experience development pressure and conversion to agriculture, ranching, or other uses. Forest species diversity and endemism is very high, and many species are able to recover rapidly from wildfire and other disturbances. Management and restoration efforts are likely to be relatively successful at alleviating the impacts of climate change, though public value and societal support for mesic and wet forest habitats is low.

Adaptation Planning Results

Table 12 presents a summary of possible adaptation strategies and actions for Maui Nui mesic and wet forest habitats, and consists of stakeholder input during an adaptation workshop as well as additional options from the literature or other similar efforts. Stakeholders identified ways in which current management actions could be modified to reduce habitat vulnerabilities as well as future management actions that are not currently implemented but could be considered for future implementation. Figure 12 plots adaptation actions according to implementation feasibility (action is capable of being implemented) and effectiveness (action reduces vulnerability).

Table 12. Summary of possible adaptation strategies and actions for Maui Nui mesic/wet forest habitat.

Adaptation Approach	Adaptation Strategy	Specific Adaptation Actions
Resistance *Near-term approach*	Manage invasive species	•! Expand fencing to lower elevations, focusing on incipient sites or most vulnerable areas throughout the forest •! Increase upfront investment in ungulate and mammalian predator removal through hunting/shooting and snares •! Remove invasive plants through biological, chemical, or mechanical treatments •! Prevent introduction of new insects and diseases by increasing biosecurity controls (e.g., quarantines, intra-island policies, optional vs. mandatory restrictions)
	Improve fire prevention and response	•! Prevent off-road vehicle and pedestrian activity in high recharge areas, sensitive watersheds, and core native habitats through education and access limits
Resilience *Near- to mid-term approach*	Maintain intact, native-dominated ecosystems	•! Outplant native species to create habitat and facilitate biome shifts •! Augment native habitat through outplanting and seeding of temperature- and drought-tolerant species in post-disturbance sites and buffer zones
	Maintain and restore water quality and quantity by controlling erosion and sedimentation	•! Plant species that control erosion (e.g., vetiver) •! Create and maintain check dams and retention basins to mechanically control erosion
Response	Facilitate transition of	•! Create test plots to determine where habitat may shift

Adaptation Approach	Adaptation Strategy	Specific Adaptation Actions
Long-term approach	species into new areas as climate regimes shift	along ecotone boundaries and identify potential unintended consequences •! Prioritize the planting of native species that thrive in a wide variety of conditions (e.g., generalists, resilient native/endemic species)
	Manage invasive species	•! Erect fences across biome and habitat borders to allow for potential habitat and species range shifts
Knowledge *Near- to long-term approach*	Develop more efficient technologies/tools for habitat restoration and invasive species control	•! Increase technical capacity and decrease regulations of invasive species removal (e.g., herbicide delivery) •! Develop biocontrol methods for invasive species •! Improve methods for native species propagation (all taxa) in high-quality core habitat
	Increase education and outreach to instill a community conservation ethic	•! Increase awareness of biocultural and ecosystem services
	Collect data on existing non-climate stressors	•! Monitor abundance of native and invasive forest species as temperature rises and precipitation changes
Collaboration *Near- to long-term approach*	Increase direct community restoration	•! Conduct place-based community education, organizing, management, and action focused on habitat restoration, cultural practices, and climate change impacts
	Create new/improve partnerships to increase capacity	•! Collaborate with universities to conduct research on invasive species management •! Improve data sharing within and between agencies

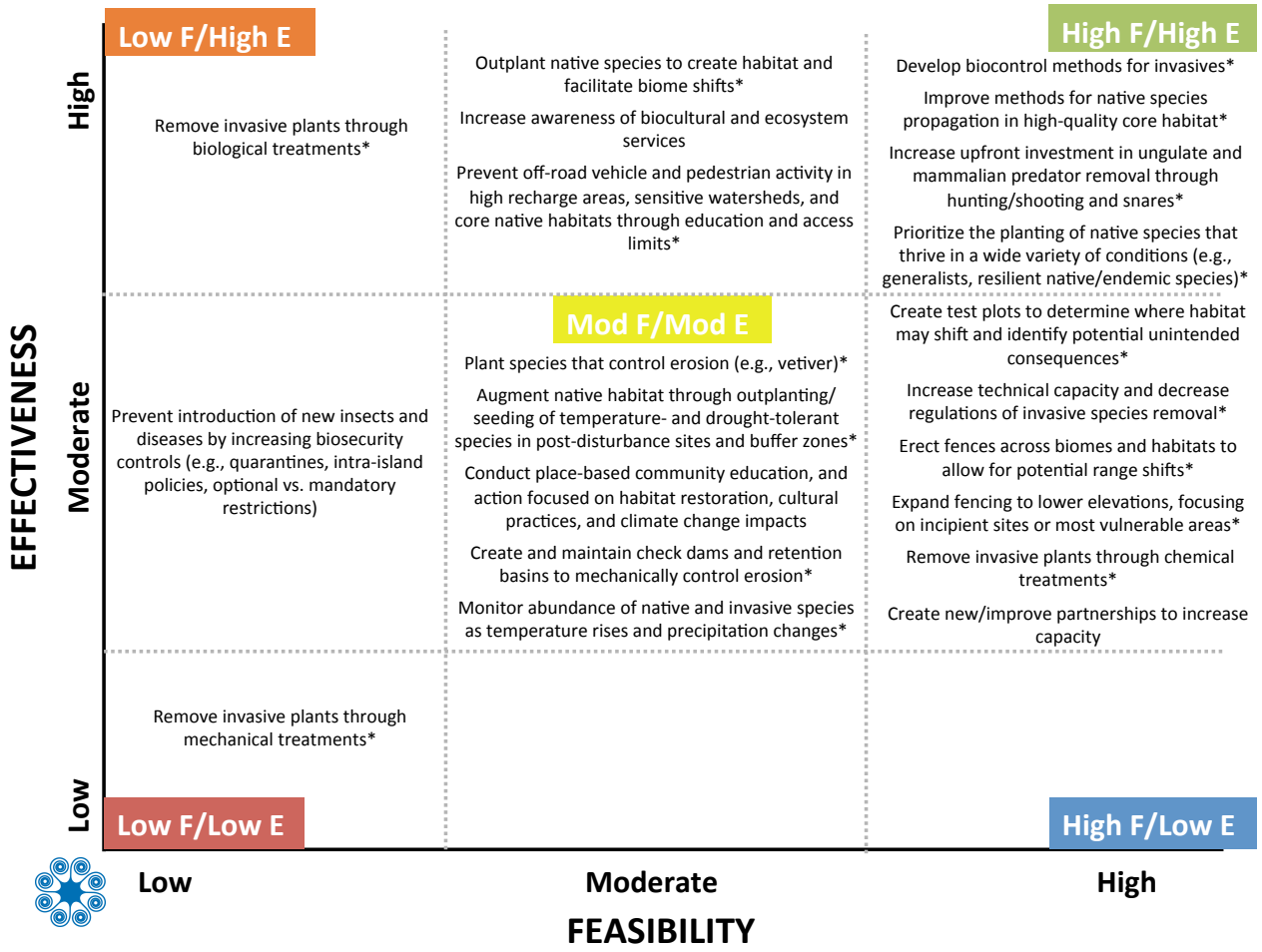


Figure 12. Maui Nui mesic and wet forest habitat adaptation actions plotted according to implementation feasibility and effectiveness. Those actions having high feasibility (action capable of being implemented) and effectiveness (action reduces vulnerability) appear in the upper right corner and those actions having low feasibility and effectiveness appear in the bottom left corner. An asterisk (*) denotes adaptation actions evaluated for feasibility and effectiveness by workshop participants. All other adaptation action evaluations are based on expert opinion.

Alpine/Subalpine

Alpine and subalpine habitats are found in high-elevation areas of Haleakalā on Maui. These habitats mostly lie above the mean height of the TWI, and are arid with very little precipitation or fog. Unlike many areas of the world, high-elevation vegetation is most likely limited by moisture rather than by temperature. Alpine communities are found above the tree line up to the summit of Haleakalā at 3,055 m (10,023 ft). Alpine habitats are dry and semi-barren, with sparse, highly specialized vegetation including the Haleakalā silversword. Subalpine communities lie between 2,000 and 3,000 m (6,560 to 10,000 ft) in elevation, and may consist of forests, shrublands, and grasslands. Dominant vegetation includes māmane, naio, and ʻōhiʻa trees; ʻōhelo, pūkiawe, and pilo shrubs; bracken fern; and alpine hairgrass. These communities are primarily found on windward east Maui, where subalpine shrublands transition into wet forest, and on leeward east Maui, where subalpine forests transition into remnant dry and mesic forest and and non-native habitats dominated by introduced forest and grassland species.

Vulnerability Assessment Results

Alpine and subalpine habitats in Maui were evaluated as having *moderate* vulnerability to climate change due to *moderate* sensitivity to climate and non-climate stressors, *moderate-high* exposure to projected future climate changes, and *low-moderate* adaptive capacity. Alpine and subalpine habitats are sensitive to factors that contribute to water stress, including changes in the amount and timing of precipitation, drought, air temperature, soil moisture, and changes in the frequency of the TWI. Disturbance events, such as wildfire, may allow invasive plants to become established, as native vegetation is slow to recover. Although non-climate stressors have a low impact on these habitats, invasive/problematic species and recreation can degrade habitats and alter native species composition. These habitat types are protected but very limited in extent, with little ability to shift upslope into higher-elevation areas. Although these habitats are highly valued, increasing water stress and the eventual loss of refugia may make it difficult for many endemic and highly specialized species to survive.

Adaptation Planning Results

Table 13 presents a summary of possible adaptation strategies and actions for Maui alpine and subalpine habitats, and consists of stakeholder input during an adaptation workshop as well as additional options from the literature or other similar efforts. Stakeholders identified ways in which current management actions could be modified to reduce habitat vulnerabilities as well as future management actions that are not currently implemented but could be considered for future implementation. Figure 13 plots adaptation actions according to implementation feasibility (action is capable of being implemented) and effectiveness (action reduces vulnerability).

Table 13. Summary of possible adaptation strategies and actions for Maui alpine/subalpine habitats.

Adaptation Approach	Adaptation Strategy	Specific Adaptation Actions
Resistance *Near-term approach*	Manage invasive species	•! Remove small mammals inside fences, as well as within a buffer around the fence •! Erect fencing to protect subalpine areas from feral ungulates •! Remove feral ungulates through aerial eradication, ground hunting, or snares •! Improve biosecurity controls to prevent the introduction of invasive insects, pathogens, plants, and animals
	Build fire-resilient native communities	•! Stabilize soils following wildfires to prevent post-burn erosion •! Increase fuel reduction efforts in common ignition sites and areas of high conservation value
Resilience *Near- to mid-term approach*	Manage invasive species	•! Prioritize invasive plant removal, focusing on areas with high diversity or rare species
	Maintain and augment native species populations	•! Identify a good existing seed bank and allow for natural regeneration •! Actively restore high-priority sites inside the fence, considering surrogate species that may be tolerant of future climate conditions
Response	Use assisted colonization to	•! Identify and prioritize suitable habitat for release of

Adaptation Approach	Adaptation Strategy	Specific Adaptation Actions
Long-term approach	restore rare species (e.g., birds)	rare species •! Protect and prepare habitat for rare species introduction by increasing habitat quality and reducing threats (e.g., predators, invasive species, human disturbance) •! Release rare species into suitable habitat and monitor survival, dispersal, reproductive success, abundance, and genetic diversity
	Facilitate transition of species into new areas as climate regimes shift	•! Create assessment/test plots to determine where habitat will be and whether there may be unintended consequences
Knowledge *Near- to long-term approach*	Improve silvicultural practices for priority species	•! Improve seed storage capacity •! Improve methodology for seed propagation •! Improve silvicultural planting methods (i.e. seed collection, composition, spacing)
	Conduct research to support adaptive policies and technology that increase landscape-level protection and restoration	•! Research and develop new/improved methods of small predator control •! Research and develop new/improved methods of weed control
Collaboration *Near- to long-term approach*	Increase direct community restoration	•! Conduct place-based community education, organizing, management, and action focused on habitat restoration, cultural practices, and climate change impacts

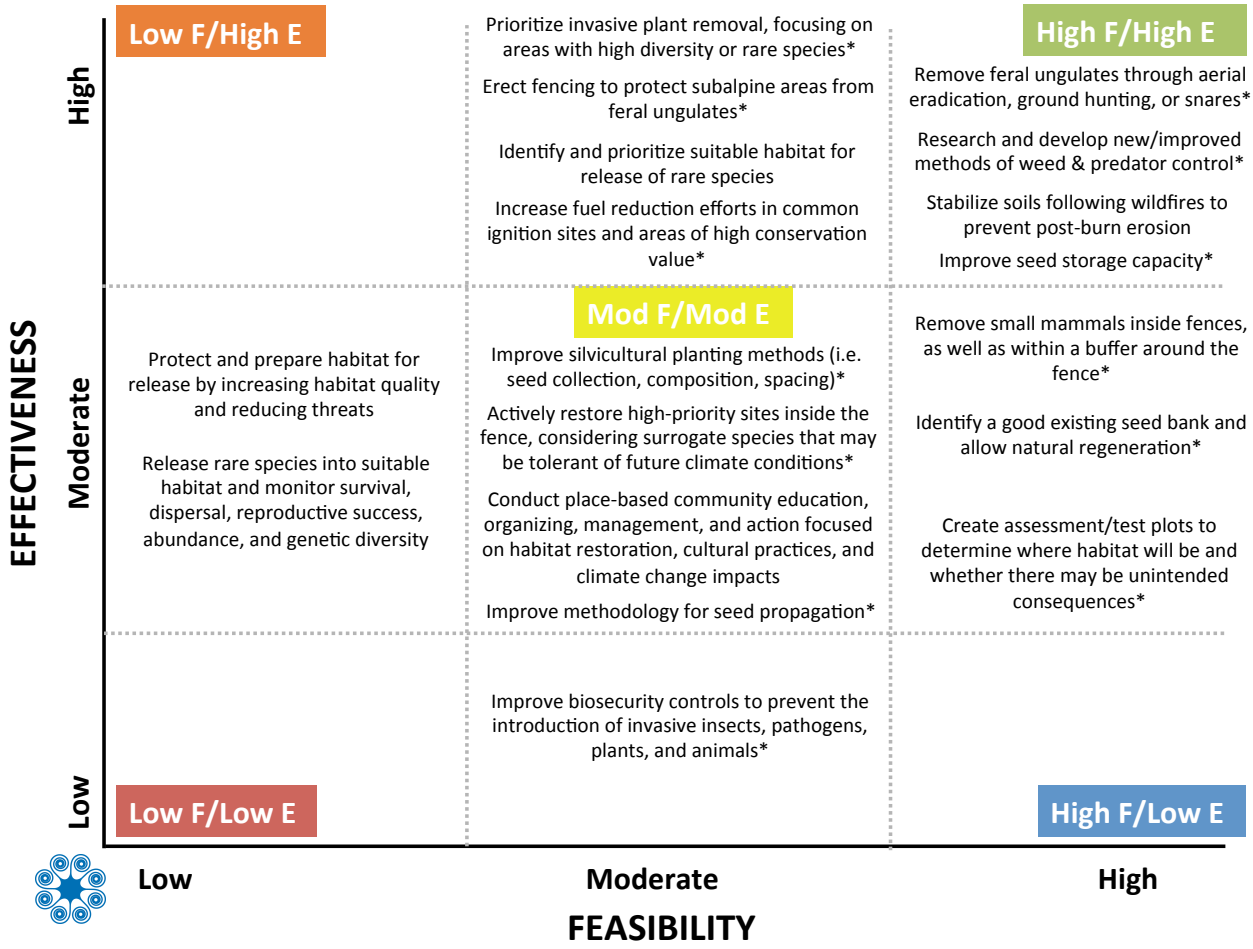


Figure 13. Maui Nui alpine and subalpine habitat adaptation actions plotted according to implementation feasibility and effectiveness. Those actions having high feasibility (action capable of being implemented) and effectiveness (action reduces vulnerability) appear in the upper right corner and those actions having low feasibility and effectiveness appear in the bottom left corner. An asterisk (*) denotes adaptation actions evaluated for feasibility and effectiveness by workshop participants, although in some cases the ranking was shifted based on expert opinion. All other adaptation action evaluations are based on expert opinion.

Cultural Knowledge and Heritage Values

Natural resources and Native Hawaiian culture are closely interwoven. Cultural knowledge is closely tied to the provisioning of food, clothing, and shelter, crop cultivation, plant propagation, and general stewardship of natural resources. Cultural heritage incorporates past legacies that relate to ecosystems and a sense of place, and includes many aspects of identity and spirituality. Many cultural practices are dependent on natural ecosystems, such as the gathering of native plant and animal species for food, medicine, carving, tools, weaving, jewelry, hula or traditional dance, and ceremonial practices.

Vulnerability Assessment Results

Cultural knowledge and heritage values on Maui Nui were evaluated as having *high* vulnerability to climate change due to *high* sensitivity to climate and non-climate stressors, *high* exposure to projected future climate changes, and *low* adaptive capacity. This ecosystem service is vulnerable to climate changes that impact the health and integrity of ecosystems and/or native species, and changes that damage or destroy valued cultural assets and heritage sites; these include changes in precipitation and drought, air and water temperatures, sea level rise, coastal erosion, and disturbance events such as

wildfire, flooding, insects, and disease. Disturbance events can affect large areas and cause extensive damage or loss of living things and landscapes of cultural importance, and they can also limit access to traditional gathering areas or the ability to carry out traditional practices. Many non-climate stressors are linked to increasing human populations and associated impacts of changes in land use and the overuse of natural resources (e.g., residential and commercial development, pollution and poisons, water diversions, recreation, etc.), which have fragmented and degraded natural habitats, exacerbating the negative effects of climate change. The introduction and establishment of invasive species, including plants, wildlife, insects, fish, and pathogens/parasites, have had an especially large impact on cultural knowledge and heritage by altering ecosystem functions and driving the loss of native species and habitats.

Native Hawaiian knowledge and heritage is still affected by colonialism, and these values receive relatively little public and societal recognition and support. However, the importance of cultural knowledge, as well as the benefits it offers to ecosystems and other ecosystem services, is starting to be incorporated into natural resource management and decision-making processes to a greater degree.

Adaptation Planning Results

Table 14 presents a summary of possible adaptation strategies and actions for Maui Nui cultural knowledge and heritage values, and consists of stakeholder input during an adaptation workshop as well as additional options from the literature or other similar efforts. Stakeholders identified ways in which current management actions could be modified to reduce habitat vulnerabilities as well as future management actions that are not currently implemented but could be considered for future implementation. Figure 14 plots adaptation actions according to implementation feasibility (action is capable of being implemented) and effectiveness (action reduces vulnerability).

Table 14. Summary of possible adaptation strategies and actions for Maui Nui cultural knowledge and heritage values.

Adaptation Category	Adaptation Strategy	Specific Adaptation Actions
Resistance *Near-term approach*	Protect cultural practices (e.g., fishing, gathering, farming, fiber collection and processing)	•! Protect/create dedicated spaces for cultural practices •! Protect water rights and public access to the shoreline and forest
Resilience *Near- to mid-term approach*	Prioritize and pair habitat restoration with cultural resource management	•! Restore culturally significant habitats from mauka to makai (e.g., loʻi, forests, beaches) •! Implement ahupuaʻa practices to encourage geographically based restoration and a sustainability mindset •! Articulate the value of culturally significant habitats (especially for cultural resource improvement)
	Increase biocultural landscape-based planning and management	•! Create policies that maintain public access to coastal, forest, and wetland areas •! Enforce existing conservation zoning laws (e.g., Haleakalā) •! Revise planning documents (e.g., Maui Island Plan) based on climate change data •! Revise the coastal erosion formula and setback

Adaptation Category	Adaptation Strategy	Specific Adaptation Actions
		requirements in Special Management Areas to account for projected sea level rise
Response *Long-term approach*	Anticipate and facilitate habitat migration	•! Acquire land for mauka migration in anticipation of sea level rise, increasing temperatures, and precipitation changes
Knowledge *Near- to long-term approach*	Increase understanding of cultural resources in need of protection	•! Collect data from the community in order to better protect cultural resources
	Ensure community-wide intergenerational transmission of knowledge	•! Facilitate mentorship and knowledge exchange among and between practitioners
Collaboration *Near- to long-term approach*	Increase direct community restoration	•! Conduct place-based community education, organizing, management, and action focused on habitat restoration, cultural practices, and climate change impacts
	Create healthy communities	•! Increase cultural community input on water use decisions •! Create/build relationships within the community, non-profit, and government sectors •! Break plantation mentality and strengthen ancestral connections

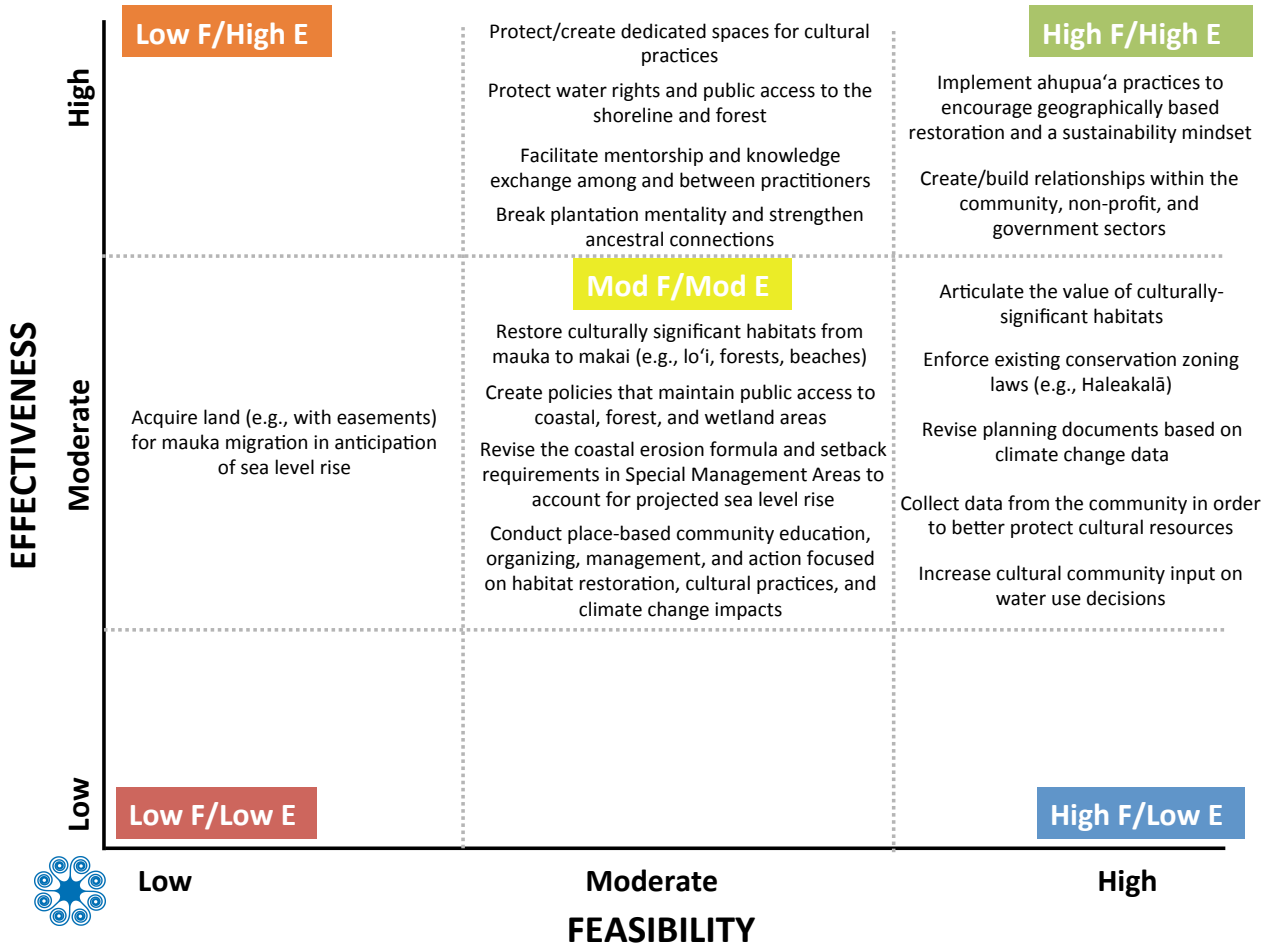


Figure 14. Maui Nui cultural knowledge and heritage values adaptation actions plotted according to implementation feasibility (action capable of being implemented) and effectiveness (action reduces vulnerability). Those actions having high feasibility and effectiveness appear in the upper right corner and those actions having low feasibility and effectiveness appear in the bottom left corner. An asterisk (*) denotes adaptation actions evaluated for feasibility and effectiveness by workshop participants, although in some cases the ranking was shifted based on expert opinion. All other adaptation action evaluations are based on expert opinion.

Flood and Erosion Control

Native terrestrial and aquatic ecosystems help regulate flooding and erosion by regulating surface and subsurface flow, storing and reducing rates of water discharge to water bodies, and anchoring and retaining sediment. For example, wetlands help slow floodwater velocity and attenuate sediment, and native forest landscapes intercept rain, slow runoff, and anchor sediment.

Vulnerability Assessment Results

The flood and erosion control ecosystem service on Maui Nui was evaluated as having *high* vulnerability to climate change due to *high* sensitivity to climate and non-climate stressors, *high* exposure to projected future climate changes, and *moderate* adaptive capacity. Climatic changes such as extreme precipitation and flash flood events can overwhelm this service, while drought and wildfire impair or alter native ecosystems, affecting their ability to provide flood and erosion control. Non-climate stressors such as residential and commercial development, roads, highways, trails, recreation, and water diversions increase sheet flow and alter surface runoff patterns, typically increasing streamflow volumes and velocity. These stressors, along with agricultural land use and invasive species (e.g., grasses, ungulates, trees), also increase bare ground and reduce native vegetative cover, increasing erosion potential. Workshop participants indicated that best management practices in urban, agricultural, and

natural landscapes may help maintain flood and erosion control into the future, but also indicated that political will and public support for enhanced management will be needed.

Adaptation Planning Results

Table 15 presents a summary of possible adaptation strategies and actions for Maui Nui flood and erosion control, and consists of stakeholder input during an adaptation workshop as well as additional options from the literature or other similar efforts. Stakeholders identified ways in which current management actions could be modified to reduce habitat vulnerabilities as well as future management actions that are not currently implemented but could be considered for future implementation. Figure 15 plots adaptation actions according to implementation feasibility (action is capable of being implemented) and effectiveness (action reduces vulnerability).

Table 15. Summary of possible adaptation strategies and actions for Maui Nui flood and erosion control.

Adaptation Approach	Adaptation Strategy	Specific Adaptation Actions
Resistance *Near-term approach*	Manage invasive species	•! Use fencing in critical watersheds to exclude ungulates from upland forested areas •! Remove invasive plants (e.g., Miconia)
	Increase education and outreach to increase public engagement and stewardship in conservation	•! Increase education and outreach on invasive species risks and specific actions the public can take to reduce introduction and spread (e.g., sterilize recreation equipment)
	Improve fire prevention and response	•! Use managed grazing and fuel treatments to limit potential fire spread and severity •! Maintain fuel breaks below power lines and on road sides
	Decrease erosion and sediment delivery to improve water quality and protect municipal water supplies	•! Design and construct roads to minimize erosion and sediment production •! Increase and/or relocate road cross drains to decrease hydrologic connectivity between roads and streams
	Reduce non-climate stressors that affect water quality	•! Reduce pollutant and sediment runoff (e.g., revegetate slopes with native plants, reduce acreage of fallow agricultural land)
Resilience *Near- to mid-term approach*	Protect forests to increase recharge and water retention	•! Support healthy native forests through land acquisition and plant restoration
	Build fire-resilient native communities	•! Stabilize soils following wildfires to prevent post-burn erosion
	Maintain and restore water quality and quantity by controlling erosion and sedimentation	•! Plant species that control erosion (e.g., vetiver) •! Create and maintain check dams and retention basins to mechanically control erosion
Response *Long-term approach*	Facilitate transition of species into new areas as climate regimes shift	•! Prioritize the planting of native species that thrive in a wide variety of conditions (e.g., generalists, resilient native/endemic species)

Adaptation Approach	Adaptation Strategy	Specific Adaptation Actions
	Provide sustainable recreation opportunities in response to changing supply and demand	•! Adjust the timing of actions (e.g. open/close dates, road or trail closures, food storage orders, special use permits) to accommodate changing climate conditions
Knowledge *Near- to long-term approach*	Anticipate and facilitate habitat migration	•! Conduct a cost-benefit analysis for a range of management alternatives based on climate change vulnerability assessments and prioritization processes
Collaboration *Near- to long-term approach*	Increase collaborative efforts to conserve streams and watersheds	•! Expand watershed conservation to lower elevations by enhancing watershed partnerships and seeking legislative changes at the state and local levels

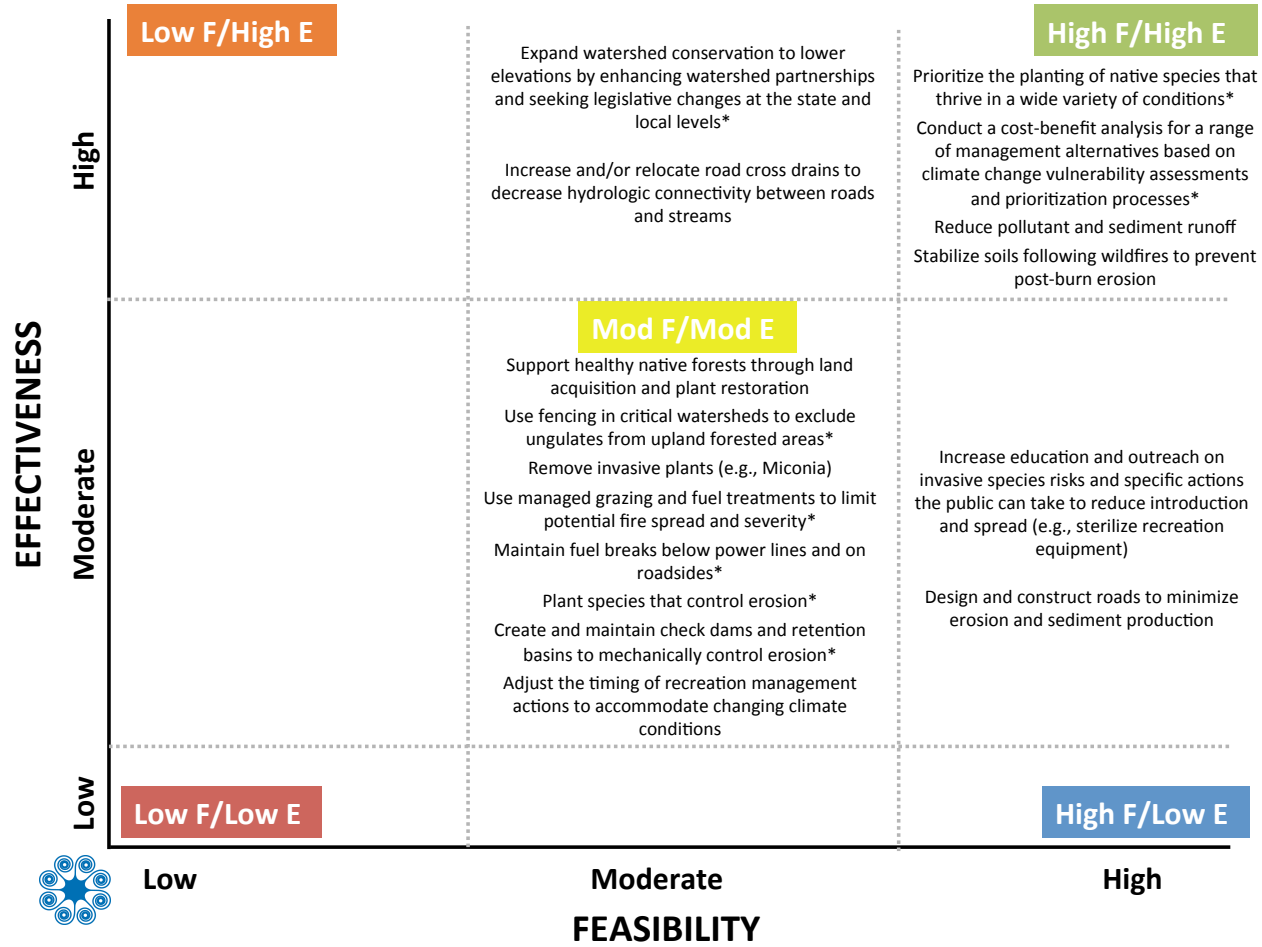


Figure 15. Maui Nui flood and erosion control adaptation actions plotted according to implementation feasibility and effectiveness. Those actions having high feasibility (action capable of being implemented) and effectiveness (action reduces vulnerability) appear in the upper right corner and those actions having low feasibility and effectiveness appear in the bottom left corner. An asterisk (*) denotes adaptation actions evaluated for feasibility and effectiveness by workshop participants, although in some cases the ranking was shifted based on expert opinion. All other adaptation action evaluations are based on expert opinion.

Fresh Water

Fresh water is classified as a provisioning ecosystem service because it supplies both consumptive (e.g., drinking water, agricultural and industrial use) and non-consumptive human uses (e.g., power generation). Fresh water also supports other natural systems and processes that provide additional ecosystem services. For example, it supports aquatic habitats, which in turn provide ecosystem services such as food production, flood control, aesthetic values, and tourism and recreation. Native forests, wetlands, and other habitats help maintain fresh water supply by intercepting, slowing, and storing water. Native habitats also enhance water quality by anchoring and filtering sediment and filtering pollutants. Groundwater, surface water, and rainwater catchments represent the primary sources of fresh water on the Hawaiian Islands, including Maui Nui. On Maui, groundwater is the primary fresh water source for public supply (e.g., drinking water), while surface water has historically been predominantly used for irrigation. Overall, Maui had the highest fresh water use of all Hawaiian Islands from 1980–2010, largely due to irrigation.

Vulnerability Assessment Results

Fresh water was evaluated as having *high* vulnerability to climate change due to *high* sensitivity to climate and non-climate stressors, *high* exposure to projected future climate changes, and *moderate-high* adaptive capacity. Climatic changes such as increasing drought frequency and severity, increasing precipitation variability, and warmer air temperatures are likely to reduce fresh water supply, and sea level rise may impair water quality. Shifting wind patterns may exacerbate changes in precipitation by altering orographic precipitation regimes, and changes in atmospheric circulation will likely increase TWI frequency, resulting in decreased rainfall. Other disturbance regimes such as wildfire and disease may reduce or alter native vegetation cover, impairing water capture and filtration. Non-climate stressors — including residential and commercial development, agriculture, energy development, water diversions, and groundwater development — alter water use and delivery, potentially exacerbating future climate-driven reductions in water availability. At a minimum, these stressors increase competition among water uses, which may become more problematic under drier climate conditions. Human land uses (e.g., roads, urban areas) and activities (e.g., recreation) can also impair water quality by introducing contaminants and alter water capture by increasing runoff and introducing invasive species. These invasive species — including invasive parasites/pathogens (e.g., ʻōʻhia rust), trees (e.g., strawberry guava, miconia, and kiawe), and ungulates (e.g., feral pigs, deer, goats, and cattle) — undermine watershed health and integrity, reducing water storage and degrading water quality.

The diverse uses of fresh water increase management challenges, particularly in the face of drier climate conditions. However, workshop participants indicated that fresh water is highly valued, which may support ecosystem service stewardship. Additionally, native landscape protection and restoration may help sustain fresh water quality and supply under variable climate conditions, although changes in societal water management, politics, and economics will also influence management opportunities.

Adaptation Planning Results

Table 16 presents a summary of possible adaptation strategies and actions for Maui Nui fresh water, and consists of stakeholder input during an adaptation workshop as well as additional options from the literature or other similar efforts. Stakeholders identified ways in which current management actions could be modified to reduce habitat vulnerabilities as well as future management actions that are not currently implemented but could be considered for future implementation. Figure 16 plots adaptation

actions according to implementation feasibility (action is capable of being implemented) and effectiveness (action reduces vulnerability).

Table 16. Summary of possible adaptation strategies and actions for Maui Nui fresh water.

Adaptation Approach	Adaptation Strategy	Specific Adaptation Actions
Resistance *Near-term approach*	Improve water conservation efforts	•! Develop a water budget to account for all water sources, connectivity, uses/withdrawals, and disposal/discharge •! Increase agricultural water conservation (i.e. promote soil moisture management, capture rain water) •! Increase public and private water system conservation (i.e. alter rate structure, use low-flow fixtures, detect and fix leaks)
	Manage invasive species	•! Practice strategic watershed fence placement from mauka to makai to best enhance water quality •! Prevent introduction of new diseases and pathogens by increasing biosecurity controls (e.g., quarantines, intraisland policies, optional vs. mandatory restrictions)
	Maintain/improve water quantity and quality	•! Alter well drill depths and practice optimal well placement to minimize vulnerability to saltwater intrusion •! Investigate and reduce non-point source pollution
	Reduce non-climate stressors	•! Increase public education to minimize disturbance and/or degradation of vulnerable habitats or species
Resilience *Near- to mid-term approach*	Protect forests to increase recharge and water retention	•! Support healthy native forests through land acquisition and plant restoration
	Mandate acquisition of new technologies to maintain and enhance water quality	•! Extract sodium to increase fresh water supplies •! Install diversion gates
	Increase ecosystem resilience, connectivity, and integrity	•! Restore hydrologic function (i.e. reduce/remove diversions, convert ditches to pipes)
	Build fire-resilient native communities	•! Stabilize soils following wildfires to prevent post-burn erosion
Response *Long-term approach*	Increase ecosystem resilience, connectivity, and integrity	•! Acquire land for mauka migration in anticipation of sea level rise, increasing temperatures, and precipitation changes
	Maintain/improve water quantity and quality	•! Integrate climate projections into Water Commission planning efforts
Knowledge *Near- to long-term approach*	Monitor pollutants to protect water quality	•! Monitor and regulate salinity and other indicators of water quality in wells and groundwater •! Monitor point- and non-point source pollutants associated with agriculture and development (e.g.,

Adaptation Approach	Adaptation Strategy	Specific Adaptation Actions
		fertilizers, insecticides, agricultural byproducts)
Collaboration *Near- to long-term approach*	Increase collaborative efforts to conserve streams and watersheds	•! Expand watershed conservation to lower elevations by enhancing watershed partnerships and seeking legislative changes at the state and local levels

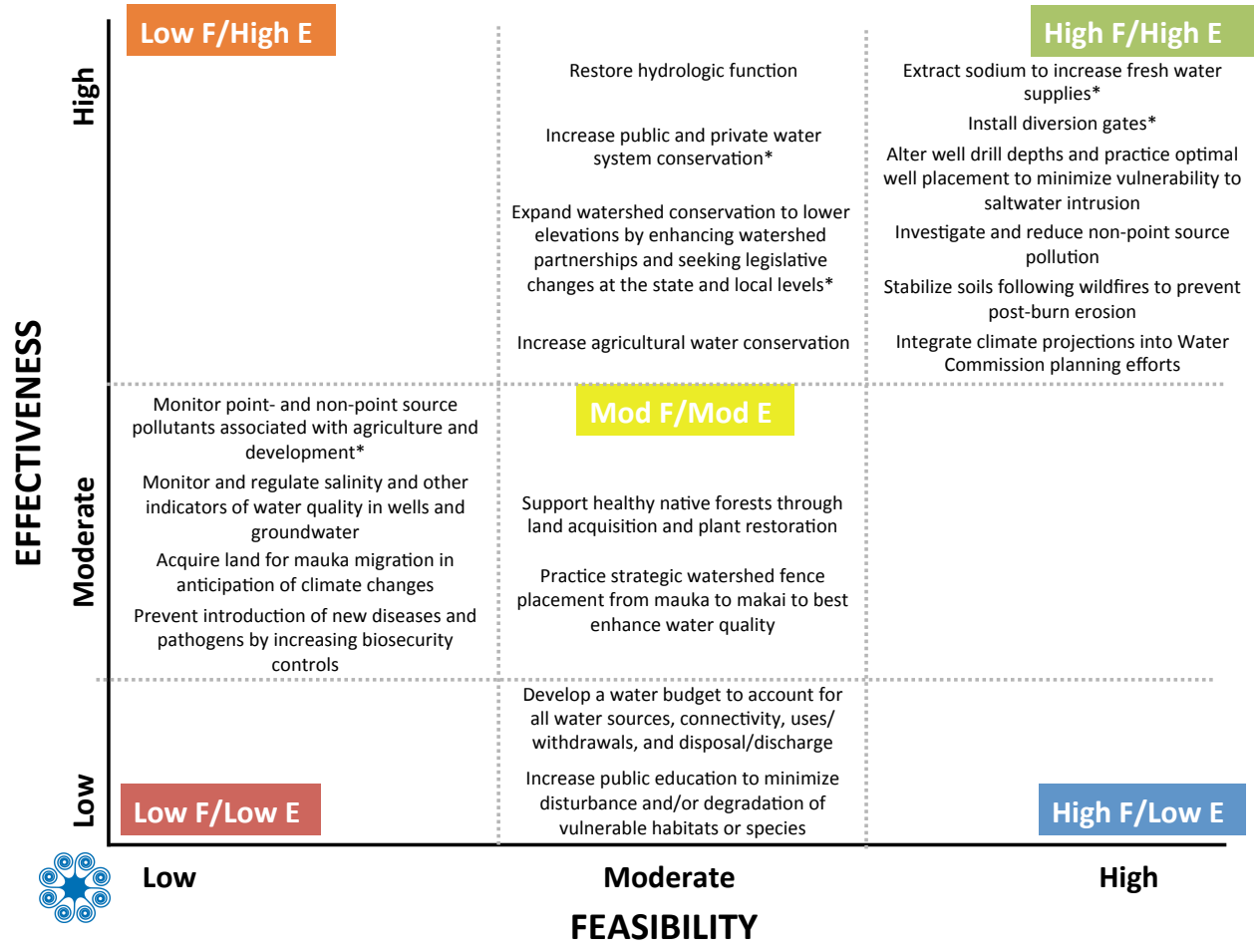


Figure 16. Maui Nui fresh water adaptation actions plotted according to implementation feasibility and effectiveness. Those actions having high feasibility (action capable of being implemented) and effectiveness (action reduces vulnerability) appear in the upper right corner and those actions having low feasibility and effectiveness appear in the bottom left corner. An asterisk (*) denotes adaptation actions evaluated for feasibility and effectiveness by workshop participants, although in some cases the ranking was shifted based on expert opinion. All other adaptation action evaluations are based on expert opinion.

Food and Fiber

Agriculture, aquaculture, hunting, fishing, and gathering are used to obtain food and fiber resources, and these include many traditional cultural practices such as pig hunting, taro cultivation, fishpond aquaculture, and forest, marine, and shoreline gathering. Native species historically and currently harvested for these purposes are critical links to bridge past and present Hawaiian culture. Many food and fiber products are derived from canoe plants, a group of species that were transported to the Hawaiian Islands by early Polynesian voyagers several thousand years ago, and then carefully

propagated and cultivated for use as food and fibers. Notable canoe plants used for fiber include the hala tree, wauke, olonā, and hau bush; canoe plants used for food include ʻolena (turmeric), niu (coconut palm), ko (sugarcane), and maiʻa (banana).

Native Hawaiians also historically constructed and utilized coastal fishponds (loko iʻa) for aquaculture, although fishpond use and distribution has declined over time (Maui has 44 remnant fishponds). Remnant loko iʻa in Hawaiʻi are used to raise and harvest the following traditional native species: ʻamaʻama (mullet), awa (milkfish), āholehole (Hawaiian flagtail), moi (threadfin), pāpio (jack), ʻōʻio (bonefish), awaʻaua (ladyfish), and limu (edible seaweeds). Additionally, fishponds are used to raise some harvestable non-native species, including ogo (seaweed), rainbow trout, tilapia, and ornamental carp.

Vulnerability Assessment Results

Overall, food and fiber ecosystem services were evaluated as having *moderate-high* vulnerability to climate change due to *moderate-high* sensitivity to climate and non-climate stressors, *high* exposure to projected future climate changes, and *moderate* adaptive capacity. Climatic changes such as water temperature, ocean acidification, and drought are likely to impact water supply and quality, increasing stress in cultivated and native species. These species may also be directly impacted by extreme events (e.g., storms) or disturbances (e.g., wildfire, insects, disease), which can impact water resources and damage infrastructure. Non-climate stressors introduce pollutants and diminish surface- and groundwater sources, degrading habitat quality and availability for harvestable species. Additionally, invasive plants and wildlife alter native ecosystems harboring species harvested for food, fiber, and other materials, in many cases out-competing native species for resources or leading to the damage or decline of cultivated and/or wild plants and animals. Although food and fiber ecosystem services are highly valued by the public, societal support for management is relatively low, and little funding is available to accomplish this. Food security in the Hawaiian Islands is low, but some efforts to restore fishponds and increase traditional taro cultivation have been successful.

Adaptation Planning Results

Table 17 presents a summary of possible adaptation strategies and actions for Maui Nui food and fiber, and consists of stakeholder input during an adaptation workshop as well as additional options from the literature or other similar efforts. Stakeholders identified ways in which current management actions could be modified to reduce habitat vulnerabilities as well as future management actions that are not currently implemented but could be considered for future implementation. Figure 17 plots adaptation actions according to implementation feasibility (action is capable of being implemented) and effectiveness (action reduces vulnerability).

Table 17. Summary of possible adaptation strategies and actions for Maui Nui food and fiber.

Adaptation Approach	Adaptation Strategy	Specific Adaptation Actions
Resistance *Near-term approach*	Manage invasive species	•! Provide erosion control by using fencing to exclude invasive species from upland habitats
	Increase food security to build resilient cultural communities	•! Preserve cultural foods
Resilience *Near- to mid-*	Protect cultural practices (e.g., fishing, gathering, farming, fiber	•! Create policies that maintain public access to coastal, forest, and wetland areas

Adaptation Approach	Adaptation Strategy	Specific Adaptation Actions
term approach	collection and processing)	•! Protect and restore culturally appropriate taro farming areas and fishponds
	Increase food security to build resilient cultural communities	•! Use community gardens as pilot sites to test resilient crops
	Preserve water supplies by increasing water use efficiency	•! Investigate alternative agricultural crops that have economic benefit and capture water •! Improve rainfall capture to decrease groundwater withdrawals
Response *Long-term approach*	Increase ecosystem resilience, connectivity, and integrity	•! Acquire land for mauka migration in anticipation of sea level rise, increasing temperatures, and precipitation changes
	Promote climate-adapted agricultural practices	•! Investigate alternative agricultural crop varieties and mixes with economic value
Knowledge *Near- to long-term approach*	Increase understanding of water quantity, quality, and allocations under changing climate conditions	•! Research options for water allocations under changing climate conditions •! Identify, map, and quantify groundwater and surface water conditions
Collaboration *Near- to long-term approach*	Increase direct community restoration	•! Conduct place-based community education, organizing, management, and action focused on native habitat restoration, cultural practices, and climate change impacts
	Create healthy communities	•! Increase cultural community input on water use decisions •! Create/build relationships within the community, non-profit, and government sectors

APPENDIX II. TRAFFIC STUDY FOR KAMEHAMENUI

February 28, 2023

Mr. Lance De Silva
Maui Branch Forestry Program Manager
Department of Land and Natural Resources
130 Mahalani St
Wailuku, HI 96793

Re: Kamehamenui Forest Reserve Traffic Assessment

Dear Mr. De Silva:

The Kamehamenui Forest Reserve is a 3,433-acre forest reserve located on the northwestern slopes of Haleakala in Kula on Maui between Haleakala National Park to the north and Kula Forest Reserve to the south as shown in Figure 1. Kamehamenui was acquired by the State of Hawaii Department of Land and Natural Resources (DLNR) in September 2020 and will be managed by the DLNR Division of Forestry and Wildlife (DOFAW). Kamehamenui Forest Reserve is planned to open in 2025.

Permitted uses at Kamehamenui will include hiking, biking, camping, bird watching, equestrian, archery, and hunting. Kamehamenui Forest Reserve is proposed to be accessed at three locations when it opens:

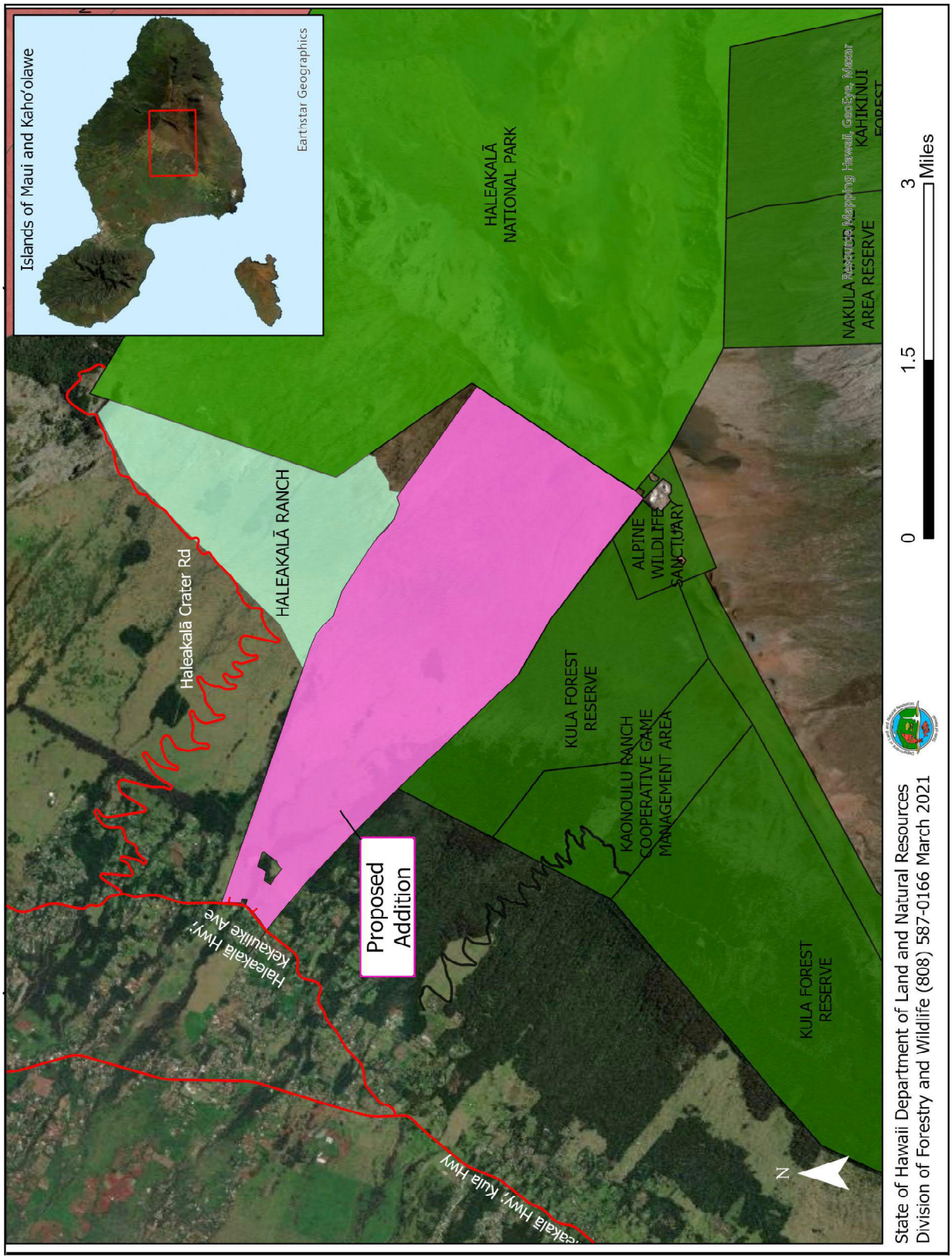
- Kekaulike Avenue (north) – This access will be located on Kekaulike Avenue around milepost (M.P.) 6.8, south of Kamehameiki Street. This driveway will lead approximately 0.5 miles up Haleakala to a 40-vehicle capacity parking lot which is screened from Kekaulike Avenue and residential land uses by eucalyptus trees.
- Kekaulike Avenue (south) – This access will be located on Kekaulike Avenue approximately 100' north of Ioio Place. This driveway will lead to a smaller 5-10 standard vehicle capacity parking lot along with 10 additional equestrian parking stalls.
- Kula Forest Reserve Access – the #5 access road gate will be left open, allowing for a direct connection between the Kula and Kamehamenui Forest Reserves.

A fourth access from Haleakala summit may be added in the future.

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wsp.com

Figure 1 Vicinity Map



Existing Conditions

Kamehamenui Forest Reserve's primary accesses will be to Kekaulike Avenue (Route 377). Route 377 is a major collector which provides north-south access and mobility in Upcountry Maui. Route 377 originates at its north intersection with Route 37 (Kula Highway) as Haleakala Highway. Haleakala Highway travels east before turning south around M.P. 2. It continues south, parallel to Kula Highway, before becoming Kekaulike Avenue at M.P. 5.972 at its intersection with Haleakala Crater Road. Kekaulike Avenue terminates at its south intersection with Kula Highway at M.P. 9.137. Kekaulike Avenue is a two-lane, undivided roadway in the vicinity of Kamehamenui Forest Reserve and the posted speed limit is 30 miles per hour (mph).

24-hour traffic data was obtained at Traffic Station 377073 located at M.P. 7.38 on Kekaulike Avenue in the vicinity of Wahelani Road, roughly 0.25 miles from the southern Kamehamenui property line. Historical Annual Average Daily Traffic (AADT) and peak hour traffic volumes were obtained for every day of the year between 2016 and 2020. December 2019 weekday AM, weekday PM, and Saturday peak hour volumes are shown in Table 1. Year 2019 traffic volumes were used as a proxy for existing 2022 traffic volumes because it was the last pre-pandemic year.

Table 1 Existing Peak Hour Traffic Volumes at Kekaulike Avenue at M.P. 7.38

	SB	NB
Weekday AM Hour	49	49
Weekday PM Hour	51	63
Saturday Peak Hour	60	57

Vehicles per hour

As shown in Table 1, existing through traffic on Kekaulike Avenue is on the order of approximately 1 vehicle in each direction per minute.

Future Conditions

In order to estimate future growth between 2022 and 2025, an annual growth rate was estimated based on historical AADTs obtained at Traffic Station 377073 shown in Table 2.

Table 2 Historical AADT at Kekaulike Avenue at M.P. 7.38

Year	AADT
2016	1109
2017	1067
2018	1101
2019	1065
2020	927

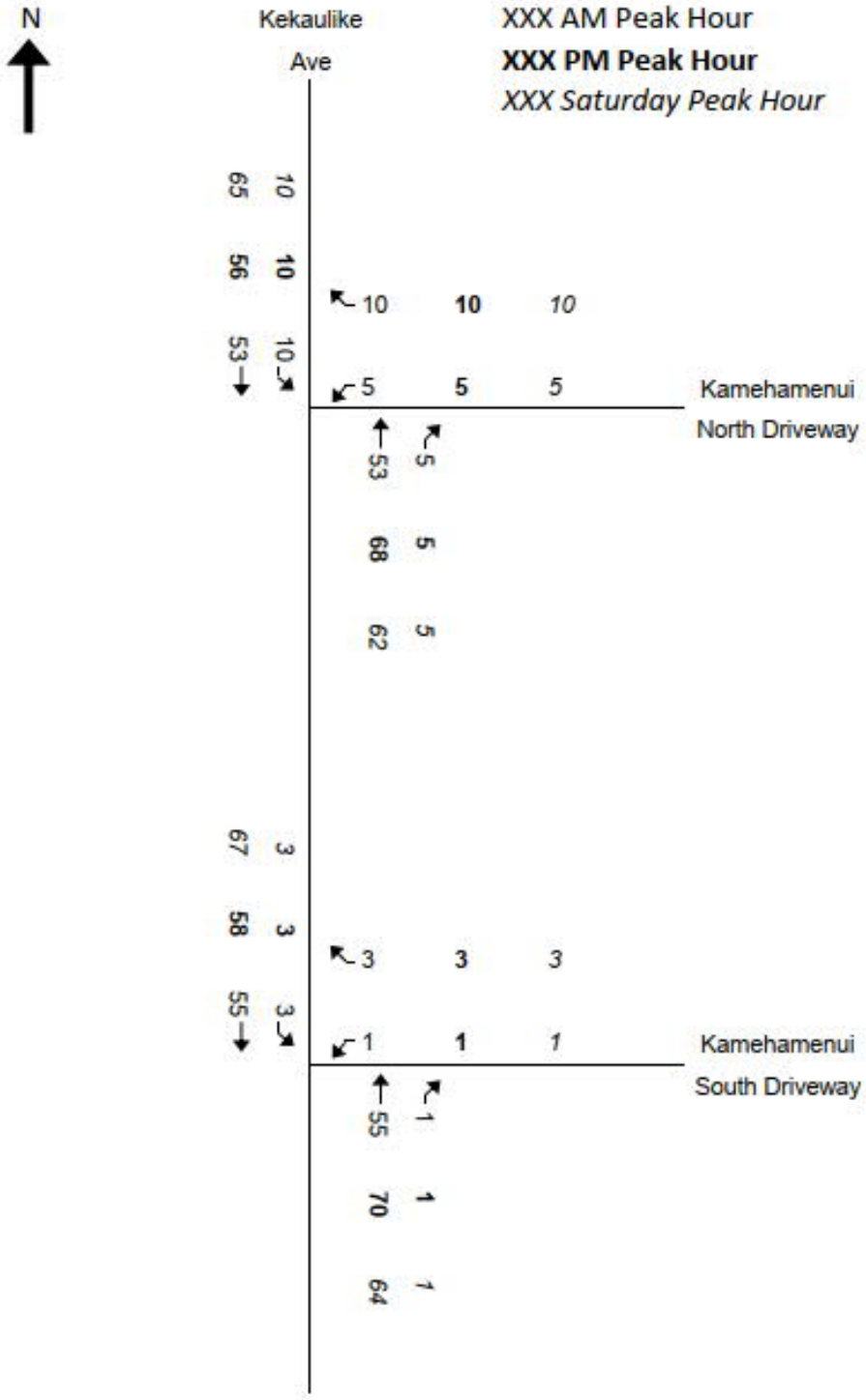
Vehicles per day

As shown in Table 2, there has been no recent growth on Kekaulike Avenue (discounting 2020 due to being a pandemic year). In order to be conservative, a 1% annual growth rate was assumed. The 1% annual growth rate was applied to the existing 2022 peak hour traffic volumes to obtain projected 2025 background traffic volumes.

Project-generated trips were estimated based on conversations with DOFAW and comparisons with Makawao Forest Reserve. Makawao Forest Reserve is Maui's most popular reserve, providing 2000 acres of hiking trails and allowing mountain bikes and equestrian uses. Two parking lots are provided, containing a total of 50 parking stalls. Users tend to stay 2-4 hours and the parking lots are generally 70% full throughout the day. Based on this data, 15 vehicles in and 15 vehicles out were assumed for the north access and 4 vehicles in and out were assumed for the south access.

The projected 2025 peak hour turning movement volumes are shown in Figure 2.

Figure 2 Projected 2025 Peak Hour Traffic Turning Movements with Project



The two Kamehamenui access points were analyzed in Synchro 11 using the methodologies for unsignalized intersections outlined in the Highway Capacity Manual 6th Edition (HCM6). Operating conditions at an intersection by approach are expressed as a qualitative measure known as Level of Service (LOS) ranging from A to F. LOS A represents free-flow operations with low delay, while LOS F represents congested conditions with relatively high delay. Table 3 shows the projected Year 2025 LOS with project.

Table 3 Projected 2025 Level of Service with Project

		Weekday AM		Weekday PM		Saturday	
		LOS	Delay	LOS	Delay	LOS	Delay
Kekaulike Avenue /Kamehamenui Driveway (north)	SB Kekaulike Left/Through	A	7.4	A	7.4	A	7.4
	WB Kamehamenui Left/Right	A	8.9	A	9.0	A	8.9
Kekaulike Avenue /Kamehamenui Driveway (south)	SB Kekaulike Left/Through	A	7.3	A	7.4	A	7.4
	WB Kamehamenui Left/Right	A	8.7	A	8.8	A	8.8

As shown, left and right turns out of the two Kamehamenui driveways are projected to operate at LOS A during all analysis periods. In addition, the southbound Kekaulike Avenue approaches are also projected to operate at LOS A during all analysis periods.

Conclusion

Based on the traffic analysis, it is concluded that Kamehamenui Forest Reserve will not significantly impact traffic operations on Kekaulike Avenue. DOFAW will seek to address potential parking issues along Kekaulike Avenue by designating shoulder of road section as 'No Parking' zone. DOFAW will also continue to look at other means to prevent and deter unwanted parking along Kekaulike Avenue to minimize the project's impact.

If you have any questions, please call me at 808-566-2256 or email phillip.matsunaga@wsp.com.

Very truly yours,

WSP USA



Phillip Matsunaga

Senior Transportation Engineer

Attachments

2019 Station 377073 Traffic Volumes

Year 2025 Synchro Analysis

2019 Station 377073 Traffic Volumes

STATION: 377073
STATION DESCRIPTION: 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui
YEAR: 2019 - 2019
LOC'N 20.750185 -156.312162

Maui
DIRECTION 01 (D1): To Kula Hwy, MOV 6
DIRECTION 02 (D2): To Jct W/ Kula Hwy & RTE 37, MOV 2

MONTH	MON	TUE	WED	THU	FRI	SAT	SUN	WEEKDAY AVERAGE	MONTHLY AVERAGE	AADT MON AVE	AADT AVE WKDY
January	1047	1029	1018	1064	1055	981	1004	1043	1028	1.03562	1.02145
February	1368	1112	1114	1049	1066	985	1101	1142	1113	0.95649	0.93287
March	1038	1086	1092	1075	1116	1019	998	1081	1061	1.00415	0.98492
April	1067	1112	1130	1111	1136	1055	1010	1111	1089	0.97828	0.95837
May	1023	1089	1103	1056	1126	1060	1042	1079	1071	0.99407	0.98668
June	976	995	1012	1010	1024	999	930	1003	992	1.07343	1.06169
July	985	1002	1039	1006	1014	1034	998	1009	1011	1.05326	1.05530
August	1041	1047	1100	1084	1087	1011	1013	1072	1055	1.00970	0.99361
September	1088	1120	1128	1050	1093	979	944	1096	1057	1.00739	0.97204
October	1106	1093	1088	1042	1112	1066	1012	1088	1074	0.99152	0.97869
November	1090	1126	1138	1129	1123	1097	1044	1121	1107	0.96241	0.94999
December	1096	1169	1171	1069	1145	1105	1096	1130	1122	0.94951	0.94243
AVERAGE	1077	1081	1094	1062	1091	1033	1016	AVERAGE 1081	D1+D2 AADT 1065		

K-FACTOR 12.02%
K-FACTOR PERIOD PM
D-FACTOR 53.91%

STATION: 377073
STATION DESCRIPTION: 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui
YEAR: 2019 - 2019
LOC'N 20.750185 -156.312162

Maui
DIRECTION 01 (D1): To Kula Hwy, MOV 6

MONTH	MON	TUE	WED	THU	FRI	SAT	SUN	WEEKDAY AVERAGE	MONTHLY AVERAGE	AADT MON AVE	AADT AVE WKDY
January	512	498	496	488	503	485	502	499	498	1.03410	1.03069
February	696	533	524	503	493	471	538	550	537	0.95884	0.93627
March	497	523	520	519	542	499	482	520	512	1.00617	0.98960
April	516	543	553	533	541	505	482	537	525	0.98102	0.95834
May	502	529	537	508	546	531	495	524	521	0.98804	0.98173
June	472	488	496	494	506	497	458	491	487	1.05626	1.04771
July	483	493	512	490	494	502	491	494	495	1.04013	1.04148
August	505	509	535	521	506	489	503	515	510	1.01014	0.99929
September	526	535	541	507	522	468	462	526	509	1.01195	0.97844
October	529	521	517	491	531	516	494	518	514	1.00109	0.99417
November	522	537	554	546	534	528	507	539	533	0.96655	0.95571
December	526	558	560	509	556	527	529	542	538	0.95703	0.95011
AVERAGE	524	522	529	509	523	501	495	AVERAGE 521	D1 AADT 515		

STATION: 377073
STATION DESCRIPTION: 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui
YEAR: 2019 - 2019
LOC'N 20.750185 -156.312162

Maui
DIRECTION 02 (D2): To Jct W/ Kula Hwy & RTE 37, MOV 2

MONTH	MON	TUE	WED	THU	FRI	SAT	SUN	WEEKDAY AVERAGE	MONTHLY AVERAGE	AADT MON AVE	AADT AVE WKDY
January	536	531	521	576	552	496	502	543	531	1.03705	1.01296
February	672	579	590	546	573	514	563	592	577	0.95431	0.92971
March	541	563	572	557	574	521	516	561	549	1.00227	0.98058
April	551	569	577	578	594	550	527	574	564	0.97572	0.95840
May	521	560	566	547	580	530	548	555	550	0.99979	0.99137
June	504	506	516	516	517	502	472	512	505	1.09000	1.07511
July	503	509	526	516	521	532	507	515	516	1.06585	1.06857
August	537	538	565	563	581	522	511	557	545	1.00929	0.98836
September	562	584	587	544	571	510	482	570	548	1.00315	0.96612
October	577	572	571	551	582	550	517	570	560	0.98273	0.96465
November	567	589	585	583	589	569	537	582	574	0.95857	0.94470
December	570	611	611	560	590	579	566	588	584	0.94258	0.93535
AVERAGE	553	559	566	553	569	531	521	AVERAGE 560	D2 AADT 550		

January, 2019

STATION NO 377073 STATION DESCRIPTION 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui

DIRECTION 01 To Kula Hwy, MOV 6

DIRECTION 02 To Jct W/ Kula Hwy & RTE 37, MOV 2

Maui

Date	Day of Week	H / WD	Unsuccessful Polling	24-HOUR TOTAL					A.M. TOTAL					P.M. TOTAL				
				%		Volume			00:00 - 12:00			PEAK HOUR		12:00-24:00			PEAK HOUR	
				D-01	D-02	D-01	D-02	1+2	D-01	D-02	1+2	D-01	D-02	D-01	D-02	1+2	D-01	D-02
1/1/2019	Tue	*		45.1	54.9	465	566	1031	193	179	372	34	49	272	387	659	23	86
1/2/2019	Wed			45.9	54.1	457	538	995	212	221	433	39	60	245	317	562	49	41
1/3/2019	Thu			42.5	57.5	470	637	1107	187	263	450	39	51	283	374	657	44	59
1/4/2019	Fri			47.2	52.8	507	568	1075	202	191	393	46	44	305	377	682	40	66
1/5/2019	Sat			50.4	49.6	501	493	994	209	174	383	36	43	292	319	611	45	51
1/6/2019	Sun			50.9	49.1	494	476	970	193	128	321	48	41	301	348	649	42	54
1/7/2019	Mon			49.0	51.0	505	526	1031	188	186	374	36	44	317	340	657	45	62
1/8/2019	Tue			49.7	50.3	509	515	1024	210	183	393	32	46	299	332	631	47	60
1/9/2019	Wed			49.6	50.4	491	498	989	199	205	404	40	43	292	293	585	46	41
1/10/2019	Thu			48.5	51.5	498	529	1027	197	203	400	46	40	301	326	627	47	51
1/11/2019	Fri			48.5	51.5	517	549	1066	195	220	415	39	49	322	329	651	54	56
1/12/2019	Sat			49.6	50.4	490	498	988	202	176	378	39	55	288	322	610	42	50
1/13/2019	Sun			49.0	51.0	468	487	955	194	161	355	52	37	274	326	600	39	52
1/14/2019	Mon			48.7	51.3	518	545	1063	205	221	426	44	56	313	324	637	44	57
1/15/2019	Tue			47.1	52.9	487	547	1034	193	184	377	40	35	294	363	657	57	56
1/16/2019	Wed			50.6	49.4	541	528	1069	210	201	411	39	41	331	327	658	36	60
1/17/2019	Thu			46.9	53.1	497	562	1059	191	197	388	47	40	306	365	671	46	63
1/18/2019	Fri			47.4	52.6	485	539	1024	196	213	409	35	50	289	326	615	49	60
1/19/2019	Sat			48.4	51.6	465	496	961	172	171	343	44	42	293	325	618	56	44
1/20/2019	Sun			50.0	50.0	544	544	1088	199	157	356	39	48	345	387	732	41	65
1/21/2019	Mon	*	3	42.4	57.6	538	732	1270	224	174	398	58	50	314	558	872	37	90
1/22/2019	Tue		3	40.6	59.4	495	725	1220	187	286	473	29	73	308	439	747	43	77
1/23/2019	Wed		3	46.3	53.7	539	626	1165	227	299	526	44	49	312	327	639	59	55
1/24/2019	Thu		3	43.8	56.3	497	639	1136	208	198	406	31	50	289	441	730	35	66
1/25/2019	Fri		3	48.7	51.3	543	571	1114	235	223	458	51	40	308	348	656	57	60
1/26/2019	Sat		3	59.3	40.7	522	358	880	198	117	315	39	26	324	241	565	20	159
1/27/2019	Sun		3	52.0	48.0	485	448	933	198	166	364	38	39	287	282	569	45	46
1/28/2019	Mon		3	46.4	53.6	506	584	1090	192	202	394	38	42	314	382	696	47	56
1/29/2019	Tue		3	40.2	59.8	480	715	1195	186	218	404	36	50	294	497	791	49	86
1/30/2019	Wed		3	40.6	59.4	508	742	1250	203	287	490	31	96	305	455	760	25	117
1/31/2019	Thu		3	23.3	76.7	480	1580	2060	208	385	593	1	172	272	1195	1467	31	611

1 - INCOMPLETE FILE
2 - DIRECTIONAL SPLIT
3 - USER DEFINED ERROR

February, 2019

STATION NO 377073 STATION DESCRIPTION 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui

DIRECTION 01 To Kula Hwy, MOV 6

DIRECTION 02 To Jct W/ Kula Hwy & RTE 37, MOV 2

Maui

Date	Day of Week	H / WD	Unsuccessful Polling	24-HOUR TOTAL					A.M. TOTAL					P.M. TOTAL				
				%		Volume			00:00 - 12:00			PEAK HOUR		12:00-24:00			PEAK HOUR	
				D-01	D-02	D-01	D-02	1+2	D-01	D-02	1+2	D-01	D-02	D-01	D-02	1+2	D-01	D-02
2/1/2019	Fri		3	38.5	61.5	510	815	1325	224	407	631	32	181	286	408	694	36	118
2/2/2019	Sat		3	38.6	61.4	378	602	980	183	219	402	50	36	195	383	578	27	103
2/3/2019	Sun		3	42.9	57.1	470	625	1095	208	204	412	37	69	262	421	683	41	64
2/4/2019	Mon		3	40.0	60.0	562	844	1406	202	451	653	46	62	360	393	753	63	59
2/5/2019	Tue		3	38.5	61.5	552	882	1434	218	338	556	52	58	334	544	878	53	64
2/6/2019	Wed		3	39.9	60.1	560	845	1405	222	483	705	2	152	338	362	700	59	55
2/7/2019	Thu			49.0	51.0	548	570	1118	213	218	431	45	51	335	352	687	55	65
2/8/2019	Fri			48.1	51.9	544	588	1132	217	227	444	53	42	327	361	688	41	55
2/9/2019	Sat			47.3	52.7	421	469	890	156	128	284	47	36	265	341	606	43	49
2/10/2019	Sun		3	46.3	53.7	550	637	1187	152	149	301	40	36	398	488	886	69	72
2/11/2019	Mon			51.8	48.2	801	745	1546	234	237	471	59	49	567	508	1075	107	96
2/12/2019	Tue			48.2	51.8	555	597	1152	207	214	421	47	41	348	383	731	54	67
2/13/2019	Wed			46.2	53.8	529	615	1144	207	196	403	43	38	322	419	741	45	71
2/14/2019	Thu			45.4	54.6	454	545	999	198	222	420	47	42	256	323	579	43	47
2/15/2019	Fri			43.2	56.8	452	595	1047	186	219	405	49	48	266	376	642	45	56
2/16/2019	Sat			47.9	52.1	502	546	1048	187	173	360	47	50	315	373	688	49	59
2/17/2019	Sun			48.8	51.2	529	555	1084	186	179	365	45	46	343	376	719	59	69
2/18/2019	Mon	*		49.1	50.9	581	603	1184	245	226	471	68	50	336	377	713	64	61
2/19/2019	Tue		3	47.5	52.5	369	408	777	152	170	322	30	41	217	238	455	32	37
2/20/2019	Wed			48.8	51.2	541	568	1109	216	221	437	33	48	325	347	672	48	56
2/21/2019	Thu			48.9	51.1	510	534	1044	195	207	402	36	47	315	327	642	49	45
2/22/2019	Fri			47.4	52.6	483	536	1019	205	215	420	38	49	278	321	599	36	50
2/23/2019	Sat			48.1	51.9	490	528	1018	195	193	388	54	55	295	335	630	44	44
2/24/2019	Sun			49.0	51.0	547	570	1117	217	192	409	48	47	330	378	708	48	63
2/25/2019	Mon			49.7	50.3	591	598	1189	224	235	459	45	47	367	363	730	65	49
2/26/2019	Tue			47.7	52.3	511	561	1072	221	242	463	35	59	290	319	609	49	53
2/27/2019	Wed			46.1	53.9	502	587	1089	189	215	404	33	49	313	372	685	45	60
2/28/2019	Thu			48.4	51.6	500	533	1033	204	207	411	37	45	296	326	622	57	51

1 - INCOMPLETE FILE
2 - DIRECTIONAL SPLIT
3 - USER DEFINED ERROR

March, 2019

STATION NO 377073 STATION DESCRIPTION 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui

DIRECTION 01 To Kula Hwy, MOV 6

DIRECTION 02 To Jct W/ Kula Hwy & RTE 37, MOV 2

Maui

Date	Day of Week	H / WD	Unsuccessful Polling	24-HOUR TOTAL					A.M. TOTAL					P.M. TOTAL				
				%		Volume			00:00 - 12:00			PEAK HOUR		12:00-24:00			PEAK HOUR	
				D-01	D-02	D-01	D-02	1+2	D-01	D-02	1+2	D-01	D-02	D-01	D-02	1+2	D-01	D-02
3/1/2019	Fri			48.8	51.2	529	554	1083	206	203	409	41	50	323	351	674	67	47
3/2/2019	Sat			50.1	49.9	506	504	1010	210	177	387	51	41	296	327	623	46	51
3/3/2019	Sun			47.9	52.1	469	510	979	206	176	382	61	48	263	334	597	41	48
3/4/2019	Mon			48.1	51.9	507	546	1053	217	214	431	40	51	290	332	622	57	50
3/5/2019	Tue			48.4	51.6	514	548	1062	219	207	426	41	44	295	341	636	53	49
3/6/2019	Wed			47.4	52.6	512	568	1080	185	203	388	39	42	327	365	692	55	59
3/7/2019	Thu			49.1	50.9	511	529	1040	205	208	413	44	45	306	321	627	43	51
3/8/2019	Fri			49.8	50.2	602	607	1209	252	247	499	48	54	350	360	710	52	56
3/9/2019	Sat			48.7	51.3	513	541	1054	217	201	418	52	50	296	340	636	50	52
3/10/2019	Sun			49.0	51.0	500	520	1020	215	182	397	53	53	285	338	623	58	46
3/11/2019	Mon			48.3	51.7	485	519	1004	195	209	404	45	43	290	310	600	53	46
3/12/2019	Tue			47.7	52.3	518	568	1086	204	227	431	41	52	314	341	655	41	62
3/13/2019	Wed			47.6	52.4	515	568	1083	225	233	458	49	44	290	335	625	47	55
3/14/2019	Thu			47.6	52.4	534	588	1122	212	230	442	47	37	322	358	680	52	59
3/15/2019	Fri			48.8	51.2	536	562	1098	224	205	429	50	32	312	357	669	49	58
3/16/2019	Sat			48.6	51.4	509	538	1047	210	160	370	44	40	299	378	677	45	56
3/17/2019	Sun			48.9	51.1	477	498	975	185	171	356	44	45	292	327	619	43	58
3/18/2019	Mon			46.7	53.3	502	573	1075	200	195	395	43	47	302	378	680	54	54
3/19/2019	Tue			48.5	51.5	538	572	1110	204	222	426	43	49	334	350	684	46	62
3/20/2019	Wed			46.8	53.2	519	590	1109	206	206	412	36	52	313	384	697	51	51
3/21/2019	Thu			48.2	51.8	523	563	1086	231	196	427	44	43	292	367	659	49	55
3/22/2019	Fri			48.2	51.8	504	542	1046	208	208	416	37	48	296	334	630	43	51
3/23/2019	Sat			50.0	50.0	475	475	950	176	164	340	43	43	299	311	610	46	49
3/24/2019	Sun			46.9	53.1	450	510	960	172	157	329	38	41	278	353	631	49	52
3/25/2019	Mon			48.3	51.7	492	527	1019	187	200	387	40	53	305	327	632	39	54
3/26/2019	Tue	*		49.8	50.2	539	543	1082	201	201	402	46	59	338	342	680	44	49
3/27/2019	Wed			48.9	51.1	535	560	1095	208	226	434	46	41	327	334	661	50	54
3/28/2019	Thu			48.1	51.9	507	546	1053	200	235	435	42	51	307	311	618	43	60
3/29/2019	Fri			47.2	52.8	539	603	1142	220	250	470	38	55	319	353	672	42	56
3/30/2019	Sat			47.3	52.7	490	546	1036	198	183	381	45	40	292	363	655	42	53
3/31/2019	Sun			48.5	51.5	513	544	1057	229	196	425	51	46	284	348	632	36	61

1 - INCOMPLETE FILE
2 - DIRECTIONAL SPLIT
3 - USER DEFINED ERROR

April, 2019

STATION NO 377073 STATION DESCRIPTION 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui

DIRECTION 01 To Kula Hwy, MOV 6

DIRECTION 02 To Jct W/ Kula Hwy & RTE 37, MOV 2

Maui

Date	Day of Week	H / WD	Unsuccessful Polling	24-HOUR TOTAL					A.M. TOTAL					P.M. TOTAL				
				%		Volume			00:00 - 12:00			PEAK HOUR		12:00-24:00			PEAK HOUR	
				D-01	D-02	D-01	D-02	1+2	D-01	D-02	1+2	D-01	D-02	D-01	D-02	1+2	D-01	D-02
4/1/2019	Mon			48.6	51.4	503	531	1034	186	196	382	51	40	317	335	652	48	58
4/2/2019	Tue			47.1	52.9	514	577	1091	212	233	445	51	43	302	344	646	48	47
4/3/2019	Wed			49.3	50.7	557	573	1130	229	240	469	46	54	328	333	661	44	55
4/4/2019	Thu			47.1	52.9	512	574	1086	214	212	426	47	48	298	362	660	51	55
4/5/2019	Fri			48.7	51.3	579	609	1188	232	237	469	57	55	347	372	719	54	58
4/6/2019	Sat			49.5	50.5	510	520	1030	228	182	410	48	44	282	338	620	47	52
4/7/2019	Sun			49.5	50.5	516	527	1043	222	173	395	51	44	294	354	648	43	61
4/8/2019	Mon			49.1	50.9	520	539	1059	201	204	405	45	45	319	335	654	52	60
4/9/2019	Tue			48.5	51.5	553	588	1141	223	218	441	53	47	330	370	700	48	67
4/10/2019	Wed			47.8	52.2	540	590	1130	231	229	460	47	47	309	361	670	41	57
4/11/2019	Thu			49.5	50.5	505	516	1021	205	194	399	36	47	300	322	622	41	49
4/12/2019	Fri			46.5	53.5	518	595	1113	216	222	438	46	45	302	373	675	41	56
4/13/2019	Sat			47.2	52.8	471	527	998	189	182	371	39	59	282	345	627	46	53
4/14/2019	Sun			46.2	53.8	479	557	1036	195	190	385	46	54	284	367	651	51	49
4/15/2019	Mon			47.7	52.3	515	565	1080	207	223	430	45	43	308	342	650	38	55
4/16/2019	Tue			49.7	50.3	547	553	1100	229	247	476	46	53	318	306	624	44	52
4/17/2019	Wed			47.6	52.4	550	606	1156	217	261	478	47	54	333	345	678	48	53
4/18/2019	Thu			47.8	52.2	578	630	1208	220	222	442	44	52	358	408	766	65	52
4/19/2019	Fri	*		48.0	52.0	552	599	1151	232	218	450	47	48	320	381	701	46	53
4/20/2019	Sat			47.3	52.7	542	605	1147	235	221	456	53	51	307	384	691	45	62
4/21/2019	Sun	*		48.9	51.1	511	533	1044	236	182	418	55	61	275	351	626	44	62
4/22/2019	Mon			47.6	52.4	552	608	1160	225	222	447	57	47	327	386	713	51	53
4/23/2019	Tue			49.8	50.2	547	552	1099	233	211	444	56	44	314	341	655	44	67
4/24/2019	Wed			51.1	48.9	564	540	1104	234	198	432	62	39	330	342	672	48	50
4/25/2019	Thu			47.5	52.5	537	593	1130	195	223	418	43	50	342	370	712	48	68
4/26/2019	Fri			47.6	52.4	527	579	1106	212	226	438	50	43	315	353	668	46	46
4/27/2019	Sat			47.7	52.3	497	546	1043	202	219	421	49	56	295	327	622	48	44
4/28/2019	Sun			47.6	52.4	452	498	950	194	170	364	54	46	258	328	586	41	60
4/29/2019	Mon			48.8	51.2	490	514	1004	209	209	418	42	52	281	305	586	36	55
4/30/2019	Tue			48.9	51.1	552	576	1128	210	219	429	40	51	342	357	699	50	57

1 - INCOMPLETE FILE
2 - DIRECTIONAL SPLIT
3 - USER DEFINED ERROR

May, 2019

STATION NO 377073 STATION DESCRIPTION 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui

DIRECTION 01 To Kula Hwy, MOV 6

DIRECTION 02 To Jct W/ Kula Hwy & RTE 37, MOV 2

Maui

Date	Day of Week	H / WD	Unsuccessful Polling	24-HOUR TOTAL					A.M. TOTAL					P.M. TOTAL				
				%		Volume			00:00 - 12:00			PEAK HOUR		12:00-24:00			PEAK HOUR	
				D-01	D-02	D-01	D-02	1+2	D-01	D-02	1+2	D-01	D-02	D-01	D-02	1+2	D-01	D-02
5/1/2019	Wed			47.1	52.9	518	582	1100	197	221	418	33	52	321	361	682	46	68
5/2/2019	Thu			46.9	53.1	469	531	1000	221	223	444	50	47	248	308	556	34	58
5/3/2019	Fri			48.6	51.4	521	550	1071	197	201	398	46	53	324	349	673	42	68
5/4/2019	Sat			51.5	48.5	479	452	931	203	192	395	51	47	276	260	536	75	41
5/5/2019	Sun			47.5	52.5	478	528	1006	176	154	330	46	49	302	374	676	62	50
5/6/2019	Mon			49.5	50.5	527	537	1064	228	209	437	47	47	299	328	627	50	53
5/7/2019	Tue			48.4	51.6	540	575	1115	207	211	418	35	44	333	364	697	52	57
5/8/2019	Wed			48.5	51.5	521	554	1075	222	227	449	57	50	299	327	626	52	59
5/9/2019	Thu			48.5	51.5	548	581	1129	234	209	443	53	38	314	372	686	53	64
5/10/2019	Fri			47.7	52.3	582	639	1221	229	235	464	45	50	353	404	757	55	59
5/11/2019	Sat			53.3	46.7	604	530	1134	211	195	406	48	54	393	335	728	76	70
5/12/2019	Sun			47.0	53.0	475	536	1011	222	213	435	57	71	253	323	576	62	51
5/13/2019	Mon			48.5	51.5	483	513	996	211	209	420	48	50	272	304	576	43	55
5/14/2019	Tue			49.5	50.5	545	556	1101	218	215	433	36	45	327	341	668	56	58
5/15/2019	Wed			48.7	51.3	566	597	1163	210	217	427	38	45	356	380	736	53	63
5/16/2019	Thu			47.7	52.3	457	501	958	188	203	391	36	46	269	298	567	33	59
5/17/2019	Fri			49.5	50.5	572	583	1155	214	218	432	42	46	358	365	723	52	51
5/18/2019	Sat			46.8	53.2	520	591	1111	188	203	391	41	47	332	388	720	53	55
5/19/2019	Sun			48.7	51.3	535	564	1099	218	176	394	50	41	317	388	705	65	58
5/20/2019	Mon			49.1	50.9	496	514	1010	192	207	399	44	38	304	307	611	43	58
5/21/2019	Tue			48.3	51.7	527	564	1091	213	211	424	41	43	314	353	667	51	61
5/22/2019	Wed			50.2	49.8	530	526	1056	209	188	397	41	35	321	338	659	46	52
5/23/2019	Thu			49.6	50.4	559	567	1126	195	203	398	45	36	364	364	728	53	65
5/24/2019	Fri			48.1	51.9	522	563	1085	215	207	422	53	35	307	356	663	57	53
5/25/2019	Sat			48.8	51.2	520	545	1065	220	172	392	53	34	300	373	673	52	43
5/26/2019	Sun			46.5	53.5	490	563	1053	208	193	401	59	32	282	370	652	45	71
5/27/2019	Mon	*		47.7	52.3	477	523	1000	209	172	381	49	50	268	351	619	40	61
5/28/2019	Tue			47.9	52.1	502	546	1048	189	209	398	37	40	313	337	650	49	62
5/29/2019	Wed			49.1	50.9	551	572	1123	217	199	416	49	34	334	373	707	45	58
5/30/2019	Thu			47.8	52.2	509	556	1065	208	193	401	37	38	301	363	664	41	59
5/31/2019	Fri			48.4	51.6	531	565	1096	214	208	422	42	39	317	357	674	45	50

1 - INCOMPLETE FILE
2 - DIRECTIONAL SPLIT
3 - USER DEFINED ERROR

June, 2019

STATION NO 377073 STATION DESCRIPTION 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui

DIRECTION 01 To Kula Hwy, MOV 6

DIRECTION 02 To Jct W/ Kula Hwy & RTE 37, MOV 2

Maui

Date	Day of Week	H / WD	Unsuccessful Polling	24-HOUR TOTAL					A.M. TOTAL					P.M. TOTAL				
				%		Volume			00:00 - 12:00			PEAK HOUR		12:00-24:00			PEAK HOUR	
				D-01	D-02	D-01	D-02	1+2	D-01	D-02	1+2	D-01	D-02	D-01	D-02	1+2	D-01	D-02
6/1/2019	Sat			48.3	51.7	487	521	1008	209	193	402	48	50	278	328	606	39	57
6/2/2019	Sun			50.4	49.6	457	450	907	201	153	354	41	40	256	297	553	39	53
6/3/2019	Mon			46.2	53.8	470	548	1018	202	193	395	42	50	268	355	623	41	66
6/4/2019	Tue			49.1	50.9	418	433	851	167	168	335	25	44	251	265	516	42	43
6/5/2019	Wed			49.3	50.7	485	498	983	214	170	384	46	34	271	328	599	44	59
6/6/2019	Thu			49.5	50.5	504	514	1018	197	158	355	37	36	307	356	663	42	64
6/7/2019	Fri			49.1	50.9	490	508	998	192	176	368	47	26	298	332	630	41	56
6/8/2019	Sat			49.6	50.4	500	508	1008	201	181	382	45	41	299	327	626	42	51
6/9/2019	Sun			49.4	50.6	458	470	928	189	157	346	34	41	269	313	582	53	46
6/10/2019	Mon			48.2	51.8	463	497	960	176	184	360	32	45	287	313	600	35	54
6/11/2019	Tue	*		46.8	53.2	483	550	1033	195	199	394	35	40	288	351	639	39	68
6/12/2019	Wed			49.1	50.9	512	530	1042	214	210	424	37	45	298	320	618	38	58
6/13/2019	Thu			48.5	51.5	498	528	1026	194	200	394	40	36	304	328	632	40	58
6/14/2019	Fri			50.0	50.0	506	506	1012	214	178	392	42	30	292	328	620	40	55
6/15/2019	Sat			49.8	50.2	486	490	976	202	170	372	43	55	284	320	604	46	49
6/16/2019	Sun			47.4	52.6	465	515	980	194	169	363	50	40	271	346	617	40	49
6/17/2019	Mon			49.8	50.2	480	484	964	205	180	385	43	36	275	304	579	48	42
6/18/2019	Tue			49.1	50.9	549	568	1117	228	209	437	43	40	321	359	680	47	65
6/19/2019	Wed			49.2	50.8	504	521	1025	196	165	361	31	35	308	356	664	44	58
6/20/2019	Thu			47.9	52.1	456	495	951	187	189	376	36	41	269	306	575	42	52
6/21/2019	Fri			49.1	50.9	484	501	985	203	169	372	35	36	281	332	613	47	45
6/22/2019	Sat			52.2	47.8	538	493	1031	215	154	369	72	36	323	339	662	54	51
6/23/2019	Sun			49.3	50.7	439	451	890	192	163	355	50	42	247	288	535	47	42
6/24/2019	Mon			49.4	50.6	475	487	962	184	179	363	33	38	291	308	599	49	40
6/25/2019	Tue			49.0	51.0	498	518	1016	196	187	383	41	38	302	331	633	43	67
6/26/2019	Wed			48.4	51.6	483	514	997	210	191	401	50	38	273	323	596	39	55
6/27/2019	Thu			49.7	50.3	518	525	1043	216	194	410	49	33	302	331	633	38	60
6/28/2019	Fri			49.6	50.4	545	554	1099	229	193	422	50	46	316	361	677	41	56
6/29/2019	Sat			48.7	51.3	473	499	972	194	193	387	44	53	279	306	585	48	49
6/30/2019	Sun			49.7	50.3	471	476	947	232	163	395	48	40	239	313	552	46	52

1 - INCOMPLETE FILE
2 - DIRECTIONAL SPLIT
3 - USER DEFINED ERROR

July, 2019

STATION NO 377073 STATION DESCRIPTION 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui

DIRECTION 01 To Kula Hwy, MOV 6

DIRECTION 02 To Jct W/ Kula Hwy & RTE 37, MOV 2

Maui

Date	Day of Week	H / WD	Unsuccessful Polling	24-HOUR TOTAL					A.M. TOTAL					P.M. TOTAL				
				%		Volume			00:00 - 12:00			PEAK HOUR		12:00-24:00			PEAK HOUR	
				D-01	D-02	D-01	D-02	1+2	D-01	D-02	1+2	D-01	D-02	D-01	D-02	1+2	D-01	D-02
7/1/2019	Mon			49.4	50.6	504	516	1020	182	179	361	31	42	322	337	659	37	60
7/2/2019	Tue			48.2	51.8	522	561	1083	212	218	430	41	40	310	343	653	46	61
7/3/2019	Wed			48.6	51.4	522	551	1073	191	199	390	32	47	331	352	683	57	40
7/4/2019	Thu	*		52.0	48.0	519	480	999	193	169	362	46	36	326	311	637	43	42
7/5/2019	Fri			50.1	49.9	528	526	1054	234	189	423	57	36	294	337	631	52	46
7/6/2019	Sat			47.2	52.8	505	564	1069	191	196	387	48	43	314	368	682	34	63
7/7/2019	Sun			49.6	50.4	476	484	960	195	167	362	56	41	281	317	598	42	50
7/8/2019	Mon			50.6	49.4	483	471	954	173	159	332	39	27	310	312	622	54	37
7/9/2019	Tue			50.1	49.9	456	455	911	181	170	351	34	39	275	285	560	35	48
7/10/2019	Wed			49.9	50.1	505	508	1013	209	168	377	41	32	296	340	636	41	60
7/11/2019	Thu			48.5	51.5	499	529	1028	206	184	390	38	38	293	345	638	41	66
7/12/2019	Fri			48.3	51.7	466	498	964	202	181	383	44	35	264	317	581	43	45
7/13/2019	Sat			48.3	51.7	484	518	1002	188	184	372	48	40	296	334	630	44	49
7/14/2019	Sun			49.4	50.6	477	489	966	209	158	367	48	44	268	331	599	42	47
7/15/2019	Mon			46.3	53.7	459	533	992	180	187	367	37	39	279	346	625	44	54
7/16/2019	Tue			48.7	51.3	492	519	1011	215	211	426	44	36	277	308	585	47	46
7/17/2019	Wed			50.8	49.2	540	523	1063	229	186	415	39	39	311	337	648	41	55
7/18/2019	Thu			48.2	51.8	498	536	1034	211	191	402	35	47	287	345	632	46	52
7/19/2019	Fri			49.1	50.9	496	515	1011	190	174	364	36	47	306	341	647	42	47
7/20/2019	Sat			50.9	49.1	528	509	1037	201	171	372	53	40	327	338	665	55	45
7/21/2019	Sun			47.7	52.3	484	531	1015	185	162	347	42	41	299	369	668	54	46
7/22/2019	Mon			49.3	50.7	471	485	956	209	194	403	41	50	262	291	553	35	42
7/23/2019	Tue			49.4	50.6	504	517	1021	207	203	410	41	35	297	314	611	41	57
7/24/2019	Wed			48.8	51.2	495	519	1014	196	188	384	37	41	299	331	630	50	60
7/25/2019	Thu			49.5	50.5	473	483	956	193	167	360	45	26	280	316	596	40	52
7/26/2019	Fri			47.1	52.9	484	543	1027	222	208	430	50	37	262	335	597	32	50
7/27/2019	Sat			47.7	52.3	491	538	1029	199	183	382	48	42	292	355	647	45	45
7/28/2019	Sun			50.2	49.8	527	523	1050	214	175	389	56	54	313	348	661	48	61
7/29/2019	Mon			49.4	50.6	496	509	1005	215	174	389	47	38	281	335	616	44	51
7/30/2019	Tue			49.9	50.1	491	492	983	204	177	381	40	34	287	315	602	35	51
7/31/2019	Wed			48.4	51.6	499	531	1030	200	188	388	45	36	299	343	642	49	45

1 - INCOMPLETE FILE
2 - DIRECTIONAL SPLIT
3 - USER DEFINED ERROR

August, 2019

STATION NO 377073 STATION DESCRIPTION 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui

DIRECTION 01 To Kula Hwy, MOV 6

DIRECTION 02 To Jct W/ Kula Hwy & RTE 37, MOV 2

Maui

Date	Day of Week	H / WD	Unsuccessful Polling	24-HOUR TOTAL					A.M. TOTAL					P.M. TOTAL				
				%		Volume			00:00 - 12:00			PEAK HOUR		12:00-24:00			PEAK HOUR	
				D-01	D-02	D-01	D-02	1+2	D-01	D-02	1+2	D-01	D-02	D-01	D-02	1+2	D-01	D-02
8/1/2019	Thu			47.3	52.7	526	585	1111	230	206	436	44	39	296	379	675	39	61
8/2/2019	Fri		3	47.0	53.0	379	428	807	148	168	316	25	36	231	260	491	39	29
8/3/2019	Sat			49.6	50.4	471	478	949	199	184	383	39	46	272	294	566	46	46
8/4/2019	Sun			51.2	48.8	505	482	987	206	166	372	45	52	299	316	615	108	55
8/5/2019	Mon			49.8	50.2	507	512	1019	203	212	415	49	34	304	300	604	52	45
8/6/2019	Tue			48.5	51.5	467	495	962	181	197	378	31	44	286	298	584	42	41
8/7/2019	Wed			50.0	50.0	555	556	1111	227	211	438	49	43	328	345	673	46	55
8/8/2019	Thu			48.6	51.4	539	570	1109	212	217	429	36	47	327	353	680	43	60
8/9/2019	Fri			45.3	54.7	491	593	1084	188	249	437	38	48	303	344	647	49	46
8/10/2019	Sat			49.0	51.0	469	489	958	189	173	362	58	47	280	316	596	43	43
8/11/2019	Sun			49.0	51.0	513	534	1047	205	172	377	48	48	308	362	670	43	62
8/12/2019	Mon			47.5	52.5	483	533	1016	178	189	367	41	40	305	344	649	40	55
8/13/2019	Tue			47.6	52.4	499	549	1048	205	208	413	37	48	294	341	635	44	51
8/14/2019	Wed			47.4	52.6	508	563	1071	219	226	445	46	49	289	337	626	53	45
8/15/2019	Thu			48.0	52.0	493	534	1027	203	212	415	40	46	290	322	612	43	64
8/16/2019	Fri	*		46.1	53.9	496	580	1076	183	205	388	37	34	313	375	688	54	51
8/17/2019	Sat			48.8	51.2	492	517	1009	198	160	358	50	43	294	357	651	34	56
8/18/2019	Sun			49.2	50.8	509	525	1034	218	175	393	66	43	291	350	641	50	54
8/19/2019	Mon			46.8	53.2	505	574	1079	190	221	411	45	55	315	353	668	47	59
8/20/2019	Tue			49.8	50.2	541	546	1087	230	222	452	47	43	311	324	635	59	50
8/21/2019	Wed			49.0	51.0	553	576	1129	237	219	456	56	35	316	357	673	42	64
8/22/2019	Thu			47.0	53.0	517	582	1099	207	228	435	45	51	310	354	664	50	62
8/23/2019	Fri			46.4	53.6	481	555	1036	190	227	417	44	48	291	328	619	42	55
8/24/2019	Sat			47.4	52.6	527	585	1112	208	183	391	43	52	319	402	721	38	59
8/25/2019	Sun			49.0	51.0	483	502	985	203	166	369	44	43	280	336	616	40	57
8/26/2019	Mon			49.8	50.2	523	528	1051	213	181	394	48	43	310	347	657	50	47
8/27/2019	Tue			48.4	51.6	528	562	1090	205	196	401	51	45	323	366	689	53	63
8/28/2019	Wed			48.2	51.8	525	565	1090	208	212	420	48	52	317	353	670	61	43
8/29/2019	Thu			49.3	50.7	529	544	1073	213	200	413	48	50	316	344	660	42	61
8/30/2019	Fri			47.9	52.1	547	594	1141	210	222	432	49	49	337	372	709	43	64
8/31/2019	Sat			47.4	52.6	486	540	1026	198	197	395	46	61	288	343	631	43	53

1 - INCOMPLETE FILE
2 - DIRECTIONAL SPLIT
3 - USER DEFINED ERROR

September, 2019

STATION NO 377073 STATION DESCRIPTION 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui

DIRECTION 01 To Kula Hwy, MOV 6

DIRECTION 02 To Jct W/ Kula Hwy & RTE 37, MOV 2

Maui

Date	Day of Week	H / WD	Unsuccessful Polling	24-HOUR TOTAL					A.M. TOTAL					P.M. TOTAL				
				%		Volume			00:00 - 12:00			PEAK HOUR		12:00-24:00			PEAK HOUR	
				D-01	D-02	D-01	D-02	1+2	D-01	D-02	1+2	D-01	D-02	D-01	D-02	1+2	D-01	D-02
9/1/2019	Sun			49.2	50.8	477	492	969	206	165	371	41	42	271	327	598	37	55
9/2/2019	Mon	*		48.7	51.3	477	503	980	201	199	400	46	71	276	304	580	51	47
9/3/2019	Tue			48.0	52.0	537	581	1118	220	212	432	53	47	317	369	686	41	64
9/4/2019	Wed			47.4	52.6	518	574	1092	217	222	439	47	50	301	352	653	47	55
9/5/2019	Thu			50.3	49.7	589	583	1172	235	207	442	43	51	354	376	730	55	57
9/6/2019	Fri			45.9	54.1	509	599	1108	208	232	440	46	59	301	367	668	41	52
9/7/2019	Sat			46.0	54.0	440	516	956	165	187	352	37	36	275	329	604	44	62
9/8/2019	Sun			48.6	51.4	476	503	979	203	168	371	53	45	273	335	608	46	61
9/9/2019	Mon			47.0	53.0	492	555	1047	204	211	415	44	45	288	344	632	45	62
9/10/2019	Tue			47.4	52.6	536	595	1131	221	234	455	44	57	315	361	676	47	65
9/11/2019	Wed			48.6	51.4	550	582	1132	229	221	450	55	60	321	361	682	40	57
9/12/2019	Thu			47.3	52.7	488	544	1032	196	215	411	44	49	292	329	621	45	56
9/13/2019	Fri			48.5	51.5	537	570	1107	228	217	445	58	49	309	353	662	44	43
9/14/2019	Sat			48.1	51.9	472	509	981	204	196	400	39	46	268	313	581	46	56
9/15/2019	Sun			48.2	51.8	439	471	910	187	161	348	44	37	252	310	562	38	53
9/16/2019	Mon			48.2	51.8	574	617	1191	236	224	460	49	59	338	393	731	51	68
9/17/2019	Tue			47.6	52.4	530	584	1114	205	225	430	50	50	325	359	684	46	63
9/18/2019	Wed			47.7	52.3	551	603	1154	217	227	444	57	57	334	376	710	46	63
9/19/2019	Thu			47.1	52.9	466	523	989	185	185	370	43	38	281	338	619	45	52
9/20/2019	Fri			48.2	51.8	518	557	1075	216	213	429	43	54	302	344	646	46	61
9/21/2019	Sat			47.3	52.7	505	563	1068	213	174	387	41	51	292	389	681	51	56
9/22/2019	Sun			50.3	49.7	454	448	902	202	145	347	57	41	252	303	555	44	57
9/23/2019	Mon			50.0	50.0	522	522	1044	218	190	408	45	48	304	332	636	47	49
9/24/2019	Tue			48.3	51.7	538	577	1115	225	204	429	41	50	313	373	686	49	69
9/25/2019	Wed			48.1	51.9	544	588	1132	242	220	462	53	54	302	368	670	52	71
9/26/2019	Thu			48.0	52.0	484	524	1008	209	219	428	44	42	275	305	580	40	52
9/27/2019	Fri			48.3	51.7	522	559	1081	209	199	408	40	42	313	360	673	43	55
9/28/2019	Sat			50.2	49.8	456	453	909	163	165	328	34	43	293	288	581	40	54
9/29/2019	Sun			48.4	51.6	464	494	958	212	184	396	36	58	252	310	562	34	61
9/30/2019	Mon			48.3	51.7	517	553	1070	214	194	408	53	37	303	359	662	54	61

1 - INCOMPLETE FILE
2 - DIRECTIONAL SPLIT
3 - USER DEFINED ERROR

October, 2019

STATION NO 377073 STATION DESCRIPTION 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui

DIRECTION 01 To Kula Hwy, MOV 6

DIRECTION 02 To Jct W/ Kula Hwy & RTE 37, MOV 2

Maui

Date	Day of Week	H / WD	Unsuccessful Polling	24-HOUR TOTAL					A.M. TOTAL					P.M. TOTAL				
				%		Volume			00:00 - 12:00			PEAK HOUR		12:00-24:00			PEAK HOUR	
				D-01	D-02	D-01	D-02	1+2	D-01	D-02	1+2	D-01	D-02	D-01	D-02	1+2	D-01	D-02
10/1/2019	Tue			47.5	52.5	512	566	1078	194	215	409	50	46	318	351	669	49	56
10/2/2019	Wed			48.5	51.5	481	510	991	196	202	398	45	43	285	308	593	48	53
10/3/2019	Thu			46.0	54.0	443	521	964	177	203	380	43	43	266	318	584	34	66
10/4/2019	Fri			48.9	51.1	521	545	1066	200	201	401	42	49	321	344	665	50	56
10/5/2019	Sat			49.5	50.5	461	470	931	201	175	376	45	43	260	295	555	46	38
10/6/2019	Sun			50.8	49.2	478	463	941	194	161	355	41	31	284	302	586	42	52
10/7/2019	Mon			47.4	52.6	499	554	1053	185	206	391	33	50	314	348	662	44	53
10/8/2019	Tue			48.0	52.0	504	545	1049	206	203	409	42	41	298	342	640	48	49
10/9/2019	Wed			47.4	52.6	529	587	1116	210	224	434	46	41	319	363	682	37	63
10/10/2019	Thu			46.7	53.3	471	538	1009	199	197	396	38	46	272	341	613	45	66
10/11/2019	Fri			46.6	53.4	485	555	1040	198	198	396	39	37	287	357	644	44	55
10/12/2019	Sat			47.9	52.1	543	590	1133	237	205	442	58	47	306	385	691	55	58
10/13/2019	Sun			48.2	51.8	474	510	984	213	172	385	53	50	261	338	599	45	59
10/14/2019	Mon			49.9	50.1	558	561	1119	220	201	421	46	44	338	360	698	62	69
10/15/2019	Tue			48.3	51.7	524	562	1086	202	218	420	41	50	322	344	666	43	68
10/16/2019	Wed			46.7	53.3	536	611	1147	217	235	452	41	46	319	376	695	50	60
10/17/2019	Thu			48.3	51.7	520	557	1077	213	240	453	42	53	307	317	624	51	57
10/18/2019	Fri			48.3	51.7	567	608	1175	223	248	471	41	53	344	360	704	55	63
10/19/2019	Sat			47.0	53.0	499	563	1062	218	216	434	53	51	281	347	628	42	55
10/20/2019	Sun			48.3	51.7	515	551	1066	206	209	415	53	54	309	342	651	47	63
10/21/2019	Mon			45.9	54.1	520	613	1133	217	244	461	43	50	303	369	672	47	79
10/22/2019	Tue			47.3	52.7	559	624	1183	209	237	446	45	57	350	387	737	54	65
10/23/2019	Wed			48.2	51.8	546	587	1133	233	251	484	43	64	313	336	649	52	43
10/24/2019	Thu			47.4	52.6	529	586	1115	209	213	422	41	48	320	373	693	48	69
10/25/2019	Fri			47.1	52.9	550	618	1168	219	229	448	54	50	331	389	720	53	62
10/26/2019	Sat			49.3	50.7	562	577	1139	242	219	461	48	60	320	358	678	48	58
10/27/2019	Sun			48.3	51.7	510	545	1055	223	199	422	51	61	287	346	633	50	70
10/28/2019	Mon			48.2	51.8	538	579	1117	238	235	473	50	56	300	344	644	50	54
10/29/2019	Tue			47.5	52.5	507	561	1068	210	227	437	41	43	297	334	631	42	61
10/30/2019	Wed			46.7	53.3	493	562	1055	214	229	443	40	46	279	333	612	47	52
10/31/2019	Thu			47.2	52.8	493	551	1044	199	245	444	37	49	294	306	600	49	48

1 - INCOMPLETE FILE
2 - DIRECTIONAL SPLIT
3 - USER DEFINED ERROR

November, 2019

STATION NO 377073 STATION DESCRIPTION 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui

DIRECTION 01 To Kula Hwy, MOV 6

DIRECTION 02 To Jct W/ Kula Hwy & RTE 37, MOV 2

Maui

Date	Day of Week	H / WD	Unsuccessful Polling	24-HOUR TOTAL					A.M. TOTAL					P.M. TOTAL				
				%		Volume			00:00 - 12:00			PEAK HOUR		12:00-24:00			PEAK HOUR	
				D-01	D-02	D-01	D-02	1+2	D-01	D-02	1+2	D-01	D-02	D-01	D-02	1+2	D-01	D-02
11/1/2019	Fri			46.4	53.6	479	553	1032	193	217	410	33	43	286	336	622	35	64
11/2/2019	Sat			49.9	50.1	547	549	1096	189	220	409	47	50	358	329	687	105	48
11/3/2019	Sun			49.6	50.4	515	523	1038	210	182	392	50	49	305	341	646	54	55
11/4/2019	Mon			48.0	52.0	519	562	1081	211	232	443	51	56	308	330	638	53	55
11/5/2019	Tue			48.3	51.7	554	594	1148	224	220	444	48	52	330	374	704	51	64
11/6/2019	Wed			48.6	51.4	530	561	1091	233	217	450	54	43	297	344	641	44	58
11/7/2019	Thu			48.9	51.1	567	593	1160	245	233	478	43	49	322	360	682	44	70
11/8/2019	Fri			48.7	51.3	583	613	1196	239	233	472	56	46	344	380	724	49	74
11/9/2019	Sat			47.3	52.7	533	594	1127	226	217	443	55	51	307	377	684	45	56
11/10/2019	Sun			47.4	52.6	499	553	1052	217	215	432	53	57	282	338	620	45	48
11/11/2019	Mon	*		50.0	50.0	538	539	1077	217	202	419	45	49	321	337	658	50	62
11/12/2019	Tue			48.1	51.9	556	599	1155	219	228	447	47	41	337	371	708	55	62
11/13/2019	Wed			49.4	50.6	549	563	1112	238	224	462	46	52	311	339	650	44	60
11/14/2019	Thu			49.4	50.6	537	549	1086	212	215	427	42	52	325	334	659	53	49
11/15/2019	Fri			46.8	53.2	523	594	1117	222	252	474	43	56	301	342	643	53	64
11/16/2019	Sat			47.8	52.2	562	614	1176	239	231	470	64	62	323	383	706	47	57
11/17/2019	Sun			47.1	52.9	479	539	1018	218	208	426	57	49	261	331	592	48	53
11/18/2019	Mon			47.3	52.7	499	557	1056	226	223	449	42	51	273	334	607	44	62
11/19/2019	Tue			47.6	52.4	521	574	1095	212	238	450	49	58	309	336	645	55	57
11/20/2019	Wed			47.6	52.4	573	632	1205	236	255	491	50	50	337	377	714	49	61
11/21/2019	Thu			46.8	53.2	534	606	1140	205	213	418	45	47	329	393	722	51	63
11/22/2019	Fri			49.1	50.9	616	638	1254	270	266	536	61	48	346	372	718	54	58
11/23/2019	Sat			47.5	52.5	441	488	929	205	201	406	45	40	236	287	523	38	41
11/24/2019	Sun			50.0	50.0	534	534	1068	240	179	419	67	58	294	355	649	44	59
11/25/2019	Mon			48.5	51.5	549	583	1132	224	224	448	36	51	325	359	684	48	60
11/26/2019	Tue			46.8	53.2	517	588	1105	244	229	473	48	47	273	359	632	44	65
11/27/2019	Wed			49.2	50.8	563	582	1145	244	247	491	46	49	319	335	654	59	46
11/28/2019	Thu	*		48.5	51.5	460	489	949	175	168	343	38	47	285	321	606	41	56
11/29/2019	Fri			46.2	53.8	469	546	1015	198	177	375	35	43	271	369	640	40	56
11/30/2019	Sat			48.3	51.7	558	598	1156	256	254	510	67	64	302	344	646	43	68

1 - INCOMPLETE FILE
2 - DIRECTIONAL SPLIT
3 - USER DEFINED ERROR

December, 2019

STATION NO 377073 STATION DESCRIPTION 377073 Kekaulike Hwy, Route 377, M.P. 7.38, Maui

DIRECTION 01 To Kula Hwy, MOV 6

DIRECTION 02 To Jct W/ Kula Hwy & RTE 37, MOV 2

Maui

Date	Day of Week	H / WD	Unsuccessful Polling	24-HOUR TOTAL					A.M. TOTAL					P.M. TOTAL				
				%		Volume			00:00 - 12:00			PEAK HOUR		12:00-24:00			PEAK HOUR	
				D-01	D-02	D-01	D-02	1+2	D-01	D-02	1+2	D-01	D-02	D-01	D-02	1+2	D-01	D-02
12/1/2019	Sun			46.9	53.1	507	575	1082	197	194	391	43	63	310	381	691	57	60
12/2/2019	Mon			46.6	53.4	505	578	1083	197	240	437	42	59	308	338	646	52	62
12/3/2019	Tue			48.5	51.5	588	624	1212	237	221	458	52	58	351	403	754	61	57
12/4/2019	Wed			47.6	52.4	558	615	1173	229	230	459	58	48	329	385	714	54	69
12/5/2019	Thu			47.5	52.5	515	569	1084	204	223	427	46	60	311	346	657	45	62
12/6/2019	Fri			47.1	52.9	512	576	1088	201	231	432	51	48	311	345	656	47	64
12/7/2019	Sat			48.0	52.0	577	624	1201	229	227	456	56	58	348	397	745	77	62
12/8/2019	Sun			49.4	50.6	555	568	1123	234	185	419	58	42	321	383	704	50	59
12/9/2019	Mon			47.5	52.5	530	585	1115	227	238	465	52	49	303	347	650	56	62
12/10/2019	Tue			47.3	52.7	562	626	1188	220	234	454	54	44	342	392	734	60	64
12/11/2019	Wed			47.7	52.3	565	620	1185	222	238	460	49	50	343	382	725	49	63
12/12/2019	Thu			48.4	51.6	493	525	1018	210	214	424	41	48	283	311	594	41	56
12/13/2019	Fri			48.3	51.7	593	636	1229	232	235	467	44	49	361	401	762	56	62
12/14/2019	Sat			48.0	52.0	535	579	1114	221	218	439	47	50	314	361	675	62	54
12/15/2019	Sun			49.6	50.4	541	549	1090	223	186	409	61	48	318	363	681	47	57
12/16/2019	Mon			49.6	50.4	571	581	1152	238	231	469	43	53	333	350	683	56	56
12/17/2019	Tue			48.1	51.9	578	623	1201	223	220	443	46	43	355	403	758	50	74
12/18/2019	Wed			48.3	51.7	557	597	1154	238	228	466	52	43	319	369	688	52	59
12/19/2019	Thu			45.8	54.2	512	605	1117	212	240	452	40	51	300	365	665	44	62
12/20/2019	Fri			48.8	51.2	540	567	1107	225	217	442	45	43	315	350	665	52	54
12/21/2019	Sat			47.3	52.7	477	532	1009	192	201	393	48	50	285	331	616	40	54
12/22/2019	Sun			47.2	52.8	522	584	1106	207	167	374	54	47	315	417	732	55	71
12/23/2019	Mon			47.5	52.5	486	537	1023	204	194	398	46	41	282	343	625	45	49
12/24/2019	Tue			47.9	52.1	511	555	1066	196	188	384	43	43	315	367	682	39	55
12/25/2019	Wed	*		47.9	52.1	376	409	785	147	142	289	36	35	229	267	496	39	41
12/26/2019	Thu			48.9	51.1	517	541	1058	189	179	368	38	47	328	362	690	55	62
12/27/2019	Fri			49.9	50.1	577	579	1156	245	212	457	58	40	332	367	699	42	64
12/28/2019	Sat			47.2	52.8	518	579	1097	222	194	416	74	45	296	385	681	42	64
12/29/2019	Sun			48.4	51.6	522	556	1078	215	176	391	62	54	307	380	687	53	56
12/30/2019	Mon			48.5	51.5	538	571	1109	208	203	411	40	48	330	368	698	49	69
12/31/2019	Tue			46.9	53.1	552	625	1177	211	216	427	38	54	341	409	750	40	61

1 - INCOMPLETE FILE
2 - DIRECTIONAL SPLIT
3 - USER DEFINED ERROR

Year 2025 Synchro Analysis

Intersection	
Int Delay, s/veh	1.5

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	10	53	5	10	53
Future Vol, veh/h	5	10	53	5	10	53
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	11	58	5	11	58

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	141	61	0	0	63	0
Stage 1	61	-	-	-	-	-
Stage 2	80	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	852	1004	-	-	1540	-
Stage 1	962	-	-	-	-	-
Stage 2	943	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	846	1004	-	-	1540	-
Mov Cap-2 Maneuver	846	-	-	-	-	-
Stage 1	962	-	-	-	-	-
Stage 2	936	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.9	0	1.2
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	945	1540	-
HCM Lane V/C Ratio	-	-	0.017	0.007	-
HCM Control Delay (s)	-	-	8.9	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	0.5

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	1	3	55	1	3	55
Future Vol, veh/h	1	3	55	1	3	55
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	3	60	1	3	60

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	127	61	0	0	61	0
Stage 1	61	-	-	-	-	-
Stage 2	66	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	868	1004	-	-	1542	-
Stage 1	962	-	-	-	-	-
Stage 2	957	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	866	1004	-	-	1542	-
Mov Cap-2 Maneuver	866	-	-	-	-	-
Stage 1	962	-	-	-	-	-
Stage 2	955	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	8.7	0	0.4
HCM LOS	A		

Minor Lane/Major Mvmt	NET	NER	NWLn1	SWL	SWT
Capacity (veh/h)	-	-	966	1542	-
HCM Lane V/C Ratio	-	-	0.005	0.002	-
HCM Control Delay (s)	-	-	8.7	7.3	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	10	68	5	10	56
Future Vol, veh/h	5	10	68	5	10	56
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	11	74	5	11	61

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	160	77	0	0	79	0
Stage 1	77	-	-	-	-	-
Stage 2	83	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	831	984	-	-	1519	-
Stage 1	946	-	-	-	-	-
Stage 2	940	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	825	984	-	-	1519	-
Mov Cap-2 Maneuver	825	-	-	-	-	-
Stage 1	946	-	-	-	-	-
Stage 2	933	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	9	0	1.1
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	925	1519	-
HCM Lane V/C Ratio	-	-	0.018	0.007	-
HCM Control Delay (s)	-	-	9	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	0.4

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	1	3	70	1	3	58
Future Vol, veh/h	1	3	70	1	3	58
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	3	76	1	3	63

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	146	77	0	0	77	0
Stage 1	77	-	-	-	-	-
Stage 2	69	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	846	984	-	-	1522	-
Stage 1	946	-	-	-	-	-
Stage 2	954	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	844	984	-	-	1522	-
Mov Cap-2 Maneuver	844	-	-	-	-	-
Stage 1	946	-	-	-	-	-
Stage 2	952	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	8.8	0	0.4
HCM LOS	A		

Minor Lane/Major Mvmt	NET	NER	NWLn1	SWL	SWT
Capacity (veh/h)	-	-	945	1522	-
HCM Lane V/C Ratio	-	-	0.005	0.002	-
HCM Control Delay (s)	-	-	8.8	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-

Intersection	
Int Delay, s/veh	1.3

Movement	WBL	WBR	NBT	NBR	SBL	SBT
Lane Configurations						
Traffic Vol, veh/h	5	10	62	5	10	65
Future Vol, veh/h	5	10	62	5	10	65
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	5	11	67	5	11	71

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	163	70	0	0	72	0
Stage 1	70	-	-	-	-	-
Stage 2	93	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	828	993	-	-	1528	-
Stage 1	953	-	-	-	-	-
Stage 2	931	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	822	993	-	-	1528	-
Mov Cap-2 Maneuver	822	-	-	-	-	-
Stage 1	953	-	-	-	-	-
Stage 2	924	-	-	-	-	-

Approach	WB	NB	SB
HCM Control Delay, s	8.9	0	1
HCM LOS	A		

Minor Lane/Major Mvmt	NBT	NBR	WBLn1	SBL	SBT
Capacity (veh/h)	-	-	929	1528	-
HCM Lane V/C Ratio	-	-	0.018	0.007	-
HCM Control Delay (s)	-	-	8.9	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0.1	0	-

Intersection	
Int Delay, s/veh	0.4

Movement	NWL	NWR	NET	NER	SWL	SWT
Lane Configurations						
Traffic Vol, veh/h	1	3	64	1	3	67
Future Vol, veh/h	1	3	64	1	3	67
Conflicting Peds, #/hr	0	0	0	0	0	0
Sign Control	Stop	Stop	Free	Free	Free	Free
RT Channelized	-	None	-	None	-	None
Storage Length	0	-	-	-	-	-
Veh in Median Storage, #	0	-	0	-	-	0
Grade, %	0	-	0	-	-	0
Peak Hour Factor	92	92	92	92	92	92
Heavy Vehicles, %	2	2	2	2	2	2
Mvmt Flow	1	3	70	1	3	73

Major/Minor	Minor1		Major1		Major2	
Conflicting Flow All	150	71	0	0	71	0
Stage 1	71	-	-	-	-	-
Stage 2	79	-	-	-	-	-
Critical Hdwy	6.42	6.22	-	-	4.12	-
Critical Hdwy Stg 1	5.42	-	-	-	-	-
Critical Hdwy Stg 2	5.42	-	-	-	-	-
Follow-up Hdwy	3.518	3.318	-	-	2.218	-
Pot Cap-1 Maneuver	842	991	-	-	1529	-
Stage 1	952	-	-	-	-	-
Stage 2	944	-	-	-	-	-
Platoon blocked, %			-	-		-
Mov Cap-1 Maneuver	840	991	-	-	1529	-
Mov Cap-2 Maneuver	840	-	-	-	-	-
Stage 1	952	-	-	-	-	-
Stage 2	942	-	-	-	-	-

Approach	NW	NE	SW
HCM Control Delay, s	8.8	0	0.3
HCM LOS	A		

Minor Lane/Major Mvmt	NET	NER	NWLn1	SWL	SWT
Capacity (veh/h)	-	-	948	1529	-
HCM Lane V/C Ratio	-	-	0.005	0.002	-
HCM Control Delay (s)	-	-	8.8	7.4	0
HCM Lane LOS	-	-	A	A	A
HCM 95th %tile Q(veh)	-	-	0	0	-