

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
Division of Forestry and Wildlife
Honolulu, Hawaii 96813

September 11, 2015

Chairperson and Members
Board of Land and Natural Resources
State of Hawaii
Honolulu, Hawaii

Land Board Members:

SUBJECT: REQUEST APPROVAL OF THE WAIMEA VALLEY FOREST
STEWARDSHIP MANAGEMENT PLAN AND FOREST
STEWARDSHIP AGREEMENT WITH HI'IPAKA LLC, TMK (1) 6-1-
002:002, WAIALUA DISTRICT, ISLAND OF O'AHU

AND

REQUEST APPROVAL OF DECLARATION OF EXEMPTION FROM
CHAPTER 343, HRS ENVIRONMENTAL COMPLAINE
REQUIREMENTS FOR THE PROJECT.

BACKGROUND:

The State of Hawaii Forest Stewardship Program (FSP) provides technical and financial assistance to private landowners and land managers committed to the stewardship, conservation and restoration of important forest resources across the state. These private properties provide a variety of public benefits for the residents of Hawaii, including but not limited to: groundwater production, decreased soil erosion, wildlife habitat, timber production, recreational and educational opportunities, and local jobs. The assistance provided by the FSP enables private landowners to develop and implement long-term multi-resource management plans to conserve, restore and maintain forested areas on their property.

The program was established through Chapter 195F-6, Hawaii Revised Statutes (HRS). The Department of Land and Natural Resources (DLNR) has the authority to provide financial assistance to approved Forest Stewardship projects for private landowners to manage, protect, and restore important natural forest resources on forested and formerly forested properties. The Forest Stewardship Program is implemented pursuant to Chapter 195-F, HRS, and Hawaii Administrative Rules (HAR) Chapter 109. The program provides cost-share reimbursement for the development of long term forest management plans and for the implementation of approved Forest Stewardship management plans.

To participate in FSP, interested landowners and managers follow a sequence of application steps to develop of a long-term Forest Stewardship management plans that are submitted to and reviewed by the Forest Stewardship Advisory Committee (FSAC). Landowners interested in FSP submit an application to the FSAC whom recommends the development of a Forest Stewardship management plan based on program eligibility requirements and assures the proposed project is in line with the programs' goals of conservation, restoration and/or forest production. Landowners create a forest management plan that is reviewed by both Division staff and the FSAC, and the committee recommends the management plan for approval by the Division and Department.

The award of cost-share support for Forest Stewardship management plan implementation follows a similar process to the development of a management plan. Upon approval of a project's Forest Stewardship management plan, the FSAC reviews the implementation schedule and budget summary to ensure that the practice costs are reasonable and follow the program's previously approved cost-share rates. The FSAC recommends cost-share support for project implementation based on the 10-year implementation schedule that is then submitted to the Board of Land and Natural Resources (BLNR) for consideration. Review and approval of the Forest Stewardship project and management plan as well as authorization of cost-share support for the project by the BLNR is required in order for DLNR to enter into the Forest Stewardship Agreement with the landowner. The Division has previously worked with the Department of the Attorney General to developing a Forest Stewardship Agreement template (Exhibit A) for eligible projects.

The Waimea Valley Forest Stewardship project proposes to manage the forest found on the approximately 1875 acres, Tax Map Key number (1) 6-1-002:002 in the Waiialua District of Honolulu County. Further the project will undertake active restoration of 101.5 acres with the main objective of conserving and restoring mesic native forest and riparian areas starting with five distinct locations across the larger property. The Forest Stewardship project area is designated by the State of Hawaii as Conservation District in the General and Limited subzone and as preservation by the City and County of Honolulu. Waimea Valley is located to the South of Pūpūkea, or 4.6 miles North of Haleiwa, on O'ahu's Northwestern shore. The parcel is bounded to the South and North by ridge-tops, and encompasses a central ridge (Kalahe'e) defined by two streams. Prior to the middle of the 20th century, forests were removed by a combination of land uses, including grazing, logging, and agriculture. Although Waimea Valley has been a botanical preserve for decades, the consequences of deforestation have remained with most of the vegetation cover in the valley consists of non-native trees and shrubs. Within the larger Waimea Valley are several forest types distinguished by elevation, slope, and species composition. Lowland areas toward the makai portions of the valley tend to be heavily invaded by alien tree and shrub species. In some mauka areas, native species predominate, and these areas have been selected for restoration or reforestation.

Forest Stewardship management plan was developed along the guidelines set forth in a Conservation Action Plan adopted by Waimea Valley in 2011. The FSAC approved the Waimea Valley Forest Stewardship management plan at their meeting on May 2, 2014 and the State Forester/Division Administrator approved the Forest Stewardship Management Plan on February 20, 2015 (Exhibit B).

DISCUSSION:

The Division is requesting approval of a Forest Stewardship Agreement with Hi'ipaka LLC for the implementation of the Waimea Valley Forest Stewardship management plan and project. Over the course of the 10-year management plan the Hi'ipaka LLC intends to promote the recovery of native Hawaiian plant and animal communities across the valley beginning with the restoration of five spatially distinct forest management units, named Mauka restoration area, Kalahe'e reforestation area, Lama forest, Eugenia conservation area, and Wetland/Streamside Management Zones. There is a range of diverse forest types present on the property, ranging from intact native forest to highly-invaded, non-native forest. Management approaches will focus on promoting growth and regeneration of target tree and understory species in areas protected by existing or new proposed fence areas, as well as concentrating on preventing stream bank erosion by planting appropriate native species. In the native dominated areas, management objectives are to maintain and improve existing forest cover. In non-native dominated areas, the objective is to replace the current cover with a site-appropriate native species. Finally, the objective for riparian areas is to establish riparian-adapted native species to prevent stream bank erosion and improve downstream water quality.

For the primarily native forest restoration site, fencing will be the first management activity to occur. Fencing has already been constructed around the one of the five restoration sites, but will need to be constructed around the other forest management areas to ensure that ungulates (principally feral hogs) are excluded. Target invasive tree removal will be a universal practice across all of Waimea Valley and a property-wide monitoring scheme should be implemented to detect any incipient invasions. Restoration plantings will feature endemic or indigenous species documented to occur naturally on their respective restoration sites or in the Northern Ko'olau Mountains. Plant propagation, including seed collection, accession tracking, germination, and nursery production will all be accomplished on site using existing facilities and with pre-trained staff. An integrated pest management will be applied to weed and insect pests, focuses on monitoring potential pest agents, identifying threshold densities or populations at which pests cause unacceptable economic damage, and identifying and applying the most effective control agent.

Due to the large-scale of the Waimea Valley project, Hi'ipaka LLC is seeking cost-share support for the implementation of their management plan from FSP and through partner programs with U.S. Department of Agriculture. One of the objectives of the Hawaii Joint Forestry Memorandum of Understanding (MOU) between the DLNR, Hawaii Association of Conservation Districts (HACD), Natural Resource Conservation Service (NRCS) and U.S. Forest Service (USFS) is to improve communication between agencies and strengthen cooperation for the delivery of forestry-related conservation assistance to private landowners and land managers. As a part of this MOU the partners agreed to use the Forest Stewardship management plans as a way to increase the cooperation and planning for forestry landowners interested in the various assistance programs including FSP, Hawaii Conservation Reserve Enhancement Program (CREP), and Environmental Quality Incentive Program (EQIP). The template for the Forest Stewardship management plans has been modified to incorporate resource concerns, threats and needs that are common among forestry assistance programs with the ultimate goal being utilization of Forest Stewardship management plans for various cost-share assistance programs offered by the partners. The Waimea Valley Forest

Stewardship project is seeking support for implementation of the approved Forest Stewardship management plan from FSP, EQIP, and Hawaii CREP; a different portion of the management plan will be funded by each program. The FSP portion will include those practices and activities under the management plan that will encompass the entirety of the project or resource concerns that need to be managed across the entire property scale. The Hawaii CREP and EQIP portion will target smaller scale restoration sites that can be completed within one to five years per those program requirements.

Hi'ipaka LLC plans to initially enroll five acres in Kalahe'e reforestation area (K1) identified the Waimea Valley Forest Stewardship management plan in EQIP, and three acres (K4) in Hawaii CREP. Hawaii CREP and EQIP are private landowner assistance program implemented by U.S. Department of Agriculture, and are focused on restoring degraded or sensitive agriculture lands to native forest. Within the intended EQIP and CREP project areas, Waimea Valley will prepare the site for planting by removing invasive species and replanting the area with native trees, shrubs, and ferns.

The commitment of the private landowner to restore and manage the EQIP and CREP project for native species and habitat is significant and will work in concert with the Forest Stewardship project to provide a number of public benefits including increased groundwater infiltration, decreased soil erosion, forest health improvements, wildlife habitat and local jobs. As Hawaii CREP and EQIP requires that all management activities be completed within one to five years of enrolling in the programs, Waimea Valley plans enroll future management zones into EQIP and Hawaii CREP over the next ten years following schedule outline in their Forest Stewardship management plan.

A total of **\$422,639.00** in State Forest Stewardship funding is requested to provide cost-share support for the Waimea Valley Forest Stewardship management plan and the Hi'ipaka LLC Forest Stewardship Agreement. Hi'ipaka LLC will be contributing an equal amount of **\$422,639.00** toward the Forest Stewardship Program plus an estimated, additional **\$217,256.50** toward completion of the project with partner programs over the ten year period of the management plan. The costs associated with the proposed practices are consistent with the intensity of management required for this type of project. Cost-share funds are provided as reimbursement payments for implementation of approved management practices through the State fiscal year 2026. In addition Hi'ipaka LLC has agreed to continue maintenance of the installed Forest Stewardship practices for an additional five years following the completion of the State cost-share contributions, or through State fiscal year 2030.

Hi'ipaka LLC has consulted with the Office of Conservation and Coastal Lands (OCCL) regarding their management of the Waimea Valley native forest restoration project, and a Conservation District Use Permit (CDUP) OA-3646 was approved on March 12, 2013.

CHAPTER 343 – ENVIRONMENTAL ASSESSMENT

In accordance with Exemption List for the Division of Forestry and Wildlife and the Department of Land and Natural Resources, reviewed and concurred upon by the Environmental Council on June 12, 2008 and July 13, 2011, the proposed activities are exempt from the preparation of an environmental assessment. Specifically, the proposed activities fall under Exemption Class 1. "Operations, repairs or maintenance of existing structures, facilities, equipment, or topographical

features, involving negligible or no expansion or change of use beyond that previously existing”; Exemption Class 3 “Construction and location of single, new, small facilities or structures and the alternation and modification of same and installation of new, small equipment facilities and the alternation and modification of same”; and Exemption Class 4. “Minor alternation in the condition of land, water, or vegetation.” This project is anticipated to have minimal or no significant negative impact on the environment.

RECOMMENDATIONS:

That the Board:

1. Approve the Waimea Valley Forest Stewardship management plan;
2. Approve cost-share support in the amount of **\$422,639.00** for the implementation of the Waimea Valley Forest Stewardship management plan;
3. Authorize the Chairperson to amend, finalize and execute a Forest Stewardship Agreement with the Hi‘ipaka LLC to participate in the State Forest Stewardship Program subject to the following:
 - A. Availability of State Forest Stewardship funds; and
 - B. Review and approval as to form of the Forest Stewardship Agreement by the Department of the Attorney General.
4. Declare that, after considering the potential effects of the proposed dispositions provided by Chapter 343, HRS, and Chapter 11-200, HAR, this project will likely have minimal or no significant effect on the environment and is therefore exempt from the preparation of an environmental assessment.

Respectfully submitted,



Galen K. Kawakami, Acting Administrator
Division of Forestry and Wildlife

Attachment: (Exhibit A and B)

APPROVED FOR SUBMITTAL:


Suzanne D. Case, Chairperson

**STATE OF HAWAII
FOREST STEWARDSHIP AGREEMENT**

This AGREEMENT, made this _____ day of _____, 20____, by and between the BOARD OF LAND AND NATURAL RESOURCES, STATE OF HAWAII (“STATE”), by its Chairperson, whose address is 1151 Punchbowl Street, Honolulu, Hawaii 96813, and _____, (“LANDOWNER”) whose address and federal and state taxpayer identification numbers are as follows: _____

Business address

Federal and state taxpayer identification numbers

RECITALS

WHEREAS, Chapter 195F, Hawaii Revised Statutes (HRS), provides for the establishment of a forest stewardship program to encourage and assist private landowners in managing, protecting, and restoring important watersheds, native vegetation, fish and wildlife habitats, isolated populations of rare and endangered plants, and other forest lands that are not recognized as potential natural area reserves; and

WHEREAS, in accordance with HRS Chapter 195F and Title 13, Subtitle 5, Part 1, Chapter 109 of the Hawaii Administrative Rules (HAR), the LANDOWNER has applied, and qualifies, for participation in the forest stewardship program; and

WHEREAS, the LANDOWNER has submitted a forest stewardship management plan, as set forth in Exhibit A hereto, that the STATE agrees is consistent with the policies, goals, and objectives of the forest stewardship program; and

WHEREAS, the STATE desires to assist the LANDOWNER in implementing the forest stewardship management plan with financial and other assistance; and

WHEREAS, money is available to fund this agreement pursuant to: Act 195, SLH 1993, Hawaii Revised Statutes, Section 247-7.

NOW, THEREFORE, in consideration of the promises contained in this AGREEMENT, the STATE and the LANDOWNER agree as follows:

A. SCOPE OF SERVICES

The LANDOWNER hereby agrees to implement the forest stewardship management plan set forth in Exhibit A and the project described in the "Scope of Services" set forth in Attachment S1 in proper and satisfactory manner as determined by the STATE, both of which are hereby made a part of this AGREEMENT. The STATE hereby agrees to assist the LANDOWNER in implementing the forest stewardship management plan, all in accordance with the terms and conditions set forth in Attachments S1, S2, S3, S4, S5, and S6, attached hereto.

B. COMPENSATION

The LANDOWNER shall be compensated for performance of the project under this AGREEMENT according to the "Compensation and Payment Schedule," set forth in Attachment S2, which is hereby made a part of this Agreement.

C. TIME OF PERFORMANCE

The performance required of the LANDOWNER under this AGREEMENT shall be completed in accordance with the "Time of Performance" set forth in Attachment S3, which is hereby made a part of this AGREEMENT.

D. CERTIFICATE OF EXEMPTION FROM CIVIL SERVICE

The "State of Hawaii Certificate of Exemption from Civil Service," set forth in Attachment S4, is hereby made a part of the AGREEMENT.

E. OTHER TERMS AND CONDITIONS

The "State of Hawaii Special and General Conditions for Forest Stewardship Program Agreements," set forth in Attachment S5, and the General Conditions attached hereto, are hereby made a part of this AGREEMENT. For the purposes of this AGREEMENT the term "CONTRACTOR" in the "General Conditions" shall mean the LANDOWNER.

F. STANDARDS OF CONDUCT DECLARATION

The "Standards of Conduct Declaration" by LANDOWNER, set forth in Attachment S6, is hereby made a part of this AGREEMENT. For the purposes of this AGREEMENT the term "CONTRACTOR" in the "Standards of Conduct Declaration" shall mean the LANDOWNER.

IN WITNESS WHEREOF, the parties execute this AGREEMENT by their signatures to be effective as of the date first above written.

STATE

By _____
Chairperson of the Board of Land and Natural
Resources

Print Name

Date _____

LANDOWNER

By _____

Print Name

Date _____

Approved by the Board of
Land and Natural Resources on

_____.

APPROVED AS TO FORM:

Deputy Attorney General

LANDOWNER'S ACKNOWLEDGMENT

STATE OF HAWAII)
) SS.
COUNTY OF _____)

On this _____ day of _____, 20____, before me personally appeared _____, to me personally known, who being by me duly sworn, did say the he/she is the _____, the LANDOWNER named in the foregoing instrument, and the he/she is authorized to sign said instrument on behalf of the LANDOWNER, and acknowledges that he/she executed said instrument as the free act and deed of the LANDOWNER.

Notary Public, State of Hawaii

My Commission Expires: _____

Date of the Notarized Document: _____

Number of Pages: _____

Identification or Description of the Document being Notarized: _____

Printed Name of Notary: _____ Circuit

Notary's Signature and Notary's Official Stamp or Seal Date



STATE OF HAWAII
SCOPE OF SERVICES

SECTION 1 - SCOPE OF WORK

- 1.1 MANAGEMENT AREA - The project area to be managed is the _____ Forest Stewardship project area; TMK NUMBER(S) _____ as designated on maps found in Exhibit A to this AGREEMENT.
- 1.2 THE PRIMARY OBJECTIVES - The STATE and LANDOWNER shall direct their efforts under this AGREEMENT to do the following: fund the management of and manage the natural resources of the two hundred seventy-five (275) acres _____ Project Forest Stewardship project area (“Forest Stewardship project area”) in accordance with the MANAGEMENT PLAN, attached as Exhibit A to this AGREEMENT, and all approved amendments thereto, with the intention of providing for protection and restoration of a critically endangered dry-forest ecosystem type in the _____ community.
- 1.3 SCOPE OF WORK - The LANDOWNER shall perform the following technical and professional services:
 - (a) Management plan. The LANDOWNER shall carry out the management activities outlined in the approved MANAGEMENT PLAN, attached as Exhibit A to this AGREEMENT.
 - (b) Consultation. The LANDOWNER shall be available for consultation regarding progress, upon request by the STATE.
- 1.4 AUTHORITY TO CARRY OUT MANAGEMENT PLAN - The LANDOWNER hereby represents that it has authority to carry out the MANAGEMENT PLAN and that it is the landowner of “Forest Stewardship project area” as defined in Section 195F-2, Hawaii Revised Statutes, as amended.
- 1.5 NO INCONSISTENT ACTIVITIES - The LANDOWNER shall not take any action on the “Forest Stewardship project area”, which will undermine or conflict with the approved MANAGEMENT PLAN.



STATE OF HAWAII
SCOPE OF SERVICES

II. SECTION 2 - CONTROL AND PROGRESS OF THE WORK

2.1 REPORTS - The LANDOWNER shall submit to the STATE, reports showing work accomplished at the following times:

- (a) Progress Reports. A progress report shall be due on December 31 of each year under this AGREEMENT for which funding has been approved. This report shall include a description of the approved MANAGEMENT PLAN accomplishments and activities, areas needing technical advice, an accounting of expenditures with documentation, and proposed modifications to the current year's management activities. This report shall be submitted to the STATE within 30 days following the due date. If the LANDOWNER would like more than 2 reimbursements per year, a progress report shall accompany each reimbursement request and the "Forest Stewardship project area" shall be made available for a site visit by Department of Land and Natural Resources personnel.
- (b) Annual Report. An annual report shall be due on or before June 30 of each year under this AGREEMENT for which funding has been approved. In the event the contract is executed less than 6 months prior to June 30, then no annual report is due on June 30 of that year. This report shall include a description of MANAGEMENT PLAN accomplishments and activities, areas needing technical advice, and proposed modifications to the next year's approved management objectives, projects and budget. This report shall also include a detailed accounting of expenditures for the preceding 12-month period to provide the basis for the annual reconciliation of the STATE's and the LANDOWNER's respective shares of funding as determined pursuant to Attachment S2, Section 1.1. This report shall be submitted to the STATE within 60 days of due date. This report may also request, subject to approval by the STATE, changes to the management plan, for either or both the practice implementation schedule and/or the budget/payment schedule in order to best consolidate and rectify the past year's outcomes or lack thereof.



STATE OF HAWAII
SCOPE OF SERVICES

2.2 DELEGATION OF AUTHORITY - As used herein and throughout this AGREEMENT, unless the context clearly indicates otherwise, the STATE shall include the State of Hawaii Department of Land and Natural Resources and its authorized employees, agents and representatives.



STATE OF HAWAII

COMPENSATION AND PAYMENT SCHEDULESECTION 1 – PAYMENT1.1 SCOPE OF PAYMENT -

- (a) STATE's Payment. In full satisfaction of the STATE's funding share of the approved MANAGEMENT PLAN, which is contingent upon satisfactory completion by the LANDOWNER of the management activities described in the approved MANAGEMENT PLAN, attached as Exhibit A to this AGREEMENT, the STATE agrees to pay the LANDOWNER a total sum not to exceed four hundred sixty-six thousand nine hundred thirty-eight and 00/100 Dollars (\$466,938.00) according to the schedule outlined below that includes fiscal year 2010 through 2019 for completion of the management activities described in the approved MANAGEMENT PLAN. Payments shall be made by the STATE to the LANDOWNER as partial annual reimbursements for actual expenditures made by the LANDOWNER in completing the management activities described in the approved MANAGEMENT PLAN only after the corresponding progress or annual report has been reviewed by the STATE and all reported management activity accomplishments have been verified following an inspection of the “Forest Stewardship project area” by the STATE. Actual expenditures may include but are not limited to in-kind services such as heavy equipment operation and sources of labor. All funds to be paid by the STATE to the LANDOWNER shall be encumbered on an annual basis for the forthcoming fiscal year provided that the STATE has approved the continuation of management activities outlined in Exhibit A of this AGREEMENT for the forthcoming fiscal year.

If in any fiscal year the allocated annual funds are not exhausted due to the LANDOWNER not completing all management activities described in the MANAGEMENT PLAN for that year, the LANDOWNER may request that these funds be incorporated in the following year's encumbrances to complete the management activities which were not completed. If there are sufficient funds available to accommodate LANDOWNER's request and the STATE approves the



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COMPENSATION AND PAYMENT SCHEDULE

request, this change will be incorporated by written amendment to the AGREEMENT.

If in any fiscal year the STATE does not appropriate, and/or the STATE does not approve the expenditure of, funds sufficient to meet the STATE's funding share of the approved MANAGEMENT PLAN, this AGREEMENT shall automatically terminate without penalty at the end of the last fiscal year for which any funds have been appropriated and approved, subject to Attachment S5, Section 4.1, regarding partial State funding.

- (b) LANDOWNER's Share. In full satisfaction of the LANDOWNER's funding share of the approved MANAGEMENT PLAN, the LANDOWNER agrees to fully complete the management activities described in the approved MANAGEMENT PLAN, and to initially assume all corresponding actual annual expenditures in expectation of the STATE's partial reimbursement for satisfactory completion of these management activities. Expenditures for implementation of the approved MANAGEMENT PLAN which are less than the amounts allocated in the approved budget may be made by the LANDOWNER in its discretion so long as the quality of materials and work as called for in the approved MANAGEMENT PLAN are not adversely affected.



STATE OF HAWAII

COMPENSATION AND PAYMENT SCHEDULE**PATRICK & SHEILA CONANT FOREST STEWARDSHIP****PROJECT BUDGET/PAYMENT SCHEDULE:**

YEAR	Total Budget	Land Owner share	State Share
1	\$185,950	\$110,950	\$75,000
2	\$156,235	\$84,867.50	\$71,367.50
3	\$108,900	\$61,200	\$47,700
4	\$74,650	\$44,075	\$30,575
5	\$76,463	\$44,981.50	\$31,481.50
6	\$84,963	\$42,981.50	\$41,981.50
7	\$83,963	\$41,981.50	\$41,981.50
8	\$83,963	\$41,981.50	\$41,981.50
9	\$83,963	\$41,981.50	\$41,981.50
10	\$83,963	\$41,981.50	\$41,981.50
Total	\$ 1,023,013	\$556,981.50	\$466,031.50

1.2 PAYMENT SCHEDULE –

- (a) Progress Payment. Within 30 days following receipt of the progress report as provided in Attachment S1, Section 2.1(a) for each year for which the STATE has agreed to pay the LANDOWNER as outlined in the schedule above and for which funding has been appropriated, the STATE shall pay to the LANDOWNER a portion of the STATE's funding share of the approved MANAGEMENT PLAN as a partial reimbursement of actual expenditures made to complete approved management activities. This payment shall be subject to the LANDOWNER's satisfactory completion of the corresponding approved management activities described in the approved MANAGEMENT PLAN, attached as Exhibit A to this AGREEMENT, and calculated on the basis of actual expenditures made by the LANDOWNER. This payment shall also be subject to the STATE's approval of such progress report.
- (b) Annual/Final Payment. Within 30 days of receipt of the annual report as provided in Attachment S1, Section 2.1(b), the STATE shall pay to the LANDOWNER the balance of the STATE's approved annual funding share. This payment shall be subject to the LANDOWNER's satisfactory completion of the corresponding



STATE OF HAWAII

COMPENSATION AND PAYMENT SCHEDULE

annual management activities described in the approved MANAGEMENT PLAN, attached as Exhibit A to this AGREEMENT, and calculated on the basis of actual expenditures made by the LANDOWNER.

- (1) Annual or Final Acceptance and Payment - Annual or final acceptance means a written notice from the STATE to the LANDOWNER advising the LANDOWNER of the satisfactory fulfillment of the AGREEMENT's annual or final requirements.

- 1.3 UNAUTHORIZED WORK - The LANDOWNER shall not receive matching STATE funds for management activities not designated in the approved MANAGEMENT PLAN. All work completed by the LANDOWNER prior to receipt of a fully-executed copy of this AGREEMENT, and prior to STATE approval of funding for any subsequent years and prior to STATE approval of any subsequent amendments to the approved MANAGEMENT PLAN, shall be at the LANDOWNER's own volition and risk, including work performed during the period of any deliberations by the STATE in anticipation of approval; provided, however, that if funding and/or amendments applicable to such work are subsequently approved, the LANDOWNER may be paid for such work even if performed prior to such approval.

SECTION 2 - FISCAL RECORDS MAINTENANCE, RETENTION, AND ACCESS

- 2.1 The LANDOWNER shall maintain, in accordance with generally acceptable accounting practices, fiscal records and supporting documents and related files, papers and reports that adequately reflect all direct and indirect expenditures and management and fiscal practices materially related to the LANDOWNER's performance of services paid for by State funds under this AGREEMENT.
 - (a) The STATE, the Comptroller of the State of Hawaii, and any of their authorized representatives, the committees (and their staff) of the Legislature of the State of Hawaii, and the Legislative Auditor of the State of Hawaii shall have the right of access to any book, document, paper, file, or other records of the LANDOWNER that is materially related to the performance by the LANDOWNER of services



STATE OF HAWAII

COMPENSATION AND PAYMENT SCHEDULE

funded by the STATE under this AGREEMENT, in accordance with generally accepted audit procedures, for the purposes of monitoring and evaluating the LANDOWNER's performance of services and the LANDOWNER's management program and fiscal practices to assure the proper and effective expenditure of funds under this AGREEMENT; provided, however, that no party conducting any such audit or examination shall copy, distribute, or retain any of such information or records, with the understanding that it is not the intention that the LANDOWNER's financial and other records and information be made public.

- (b) The right of access shall not be limited to the required retention period but shall last as long as the records are retained. The LANDOWNER shall retain all records related to the LANDOWNER's performance of services funded under this AGREEMENT for at least 3 years after the date of submission of the LANDOWNER's annual reports for any designated period and payment for such expenditures by the STATE in accordance with its matching share, except that if any litigation, claim, negotiation, investigation, audit, or other action involving the records has been started before the expiration of the 3-year period, the LANDOWNER shall retain the records until completion of the action and resolution of all issues that arise from it or until the end of the regular 3-year retention period, whichever occurs later.



STATE OF HAWAII
TIME OF PERFORMANCE

SECTION 1 - EXECUTION OF AGREEMENT

- 1.1 EXECUTION OF AGREEMENT - This AGREEMENT shall be promptly executed by the STATE and the LANDOWNER upon approval by each party.
- 1.2 CERTIFICATION AND APPROVAL OF AGREEMENT - This AGREEMENT shall not be considered binding upon the STATE, unless the availability of the funds therefore has been duly certified as prescribed by Section 103-39, Hawaii Revised Statutes, as amended. Further, this AGREEMENT shall not be considered to be fully executed unless the Office of the Attorney General of the State of Hawaii has approved this AGREEMENT as to form.

SECTION 2 - TERM

- 2.1 INITIAL TERM - The initial term will be for a minimum of _____ (____) years following the completion of any and all management practices for which the LANDOWNER has received cost-share assistance. Accordingly, this AGREEMENT shall commence on the date of full execution hereof and shall be in effect until **September 25, 2022**; subject, however to earlier termination as provided in this AGREEMENT.
- 2.2 STATE FUNDING CONDITION - This AGREEMENT is subject to continued funding of the STATE's share of the approved management budget as outlined in Attachment S2, Section 1.1. Annual funding is provided by the Conveyance Tax pursuant to Act 195, SLH 1993, Section 247-7, Hawaii Revised Statutes, whereby twenty-five percent of the amount collected from this tax shall be paid into the natural area reserve fund from which funds are dispersed to the natural area partnership and forest stewardship programs, and by way of Act 269, SLH 2000 to projects undertaken in accordance with watershed management plans. Payments are then made through the forest stewardship program to reimburse landowners for implementing approved stewardship management practices. Any balance remaining in this fund at the end of any fiscal year shall be carried forward into the fund for the next fiscal year. If in any fiscal year the STATE does not



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TIME OF PERFORMANCE

appropriate, and/or the STATE does not approve the expenditure of, funds sufficient to meet its share of the approved management budget, this AGREEMENT shall automatically terminate without penalty at the end of the last fiscal year for which any funds have been appropriated and approved, subject to Attachment S5, Section 4.1, regarding partial State funding.



STATE OF HAWAII
**CERTIFICATE OF EXEMPTION
FROM CIVIL SERVICE**

1. By Heads of Departments Delegated by the Director of the Department of Human Resources Development (“DHRD”).*

Pursuant to a delegation of the authority by the Director of DHRD, I certify that the services to be provided under this Contract, and the person(s) providing the services under this Contract are exempt from the civil service, pursuant to § 76-16, Hawaii Revised Statutes (HRS).

(Signature)

(Date)

(Print Name)

(Print Title)

* This part of the form may be used by all department heads and the heads of attached agencies to whom the Director of DHRD expressly has delegated authority to certify § 76-16, HRS, civil service exemptions. The specific paragraph(s) of § 76-16, HRS, upon which an exemption is based should be noted in the contract file. If an exemption is based on § 76-16(b)(15), the contract must meet the following conditions:

- (1) It involves the delivery of completed work or product by or during a specific time;
- (2) There is no employee-employer relationship; and
- (3) The authorized funding for the service is from other than the "A" or personal services cost element.

NOTE: Not all attached agencies have received a delegation under § 76-16(b)(15). If in doubt, attached agencies should check with the Director of DHRD prior to certifying an exemption under § 76-16(b)(15). Authority to certify exemptions under §§76-16(b)(2), and 76-16(b)(12), HRS, has not been delegated; only the Director of DHRD may certify §§ 76-16(b)(2), and 76-16(b)(12) exemptions.

2. By the Director of DHRD, State of Hawaii.

I certify that the services to be provided under this Contract, and the person(s) providing the services under this Contract are exempt from the civil service, pursuant to §76-16, HRS.

(Signature)

(Date)

(Print Name)

(Print Title, if designee of the Director of DHRD)



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SECTION 1 – INSPECTIONS

1.1 The STATE shall have the right to make inspections of the “Forest Stewardship project area” after prior notice to the LANDOWNER. In addition, the STATE shall be obligated to inspect the work on the “Forest Stewardship project area” not less frequently than once per year under this AGREEMENT, and more frequently in the case of a LANDOWNER default as provided in Section 4.1(d) below or when the LANDOWNER makes more than 2 reimbursement requests per year as provided in Attachment S1, Section 2.1. The STATE shall notify the LANDOWNER within a reasonable time thereafter of any perceived defaults in the LANDOWNER's implementation of the approved MANAGEMENT PLAN. The LANDOWNER hereby represents that it has authority to allow access to the “Forest Stewardship project area” by the STATE in connection with this AGREEMENT, conditional upon receipt of a liability waiver, acceptable to the LANDOWNER for all state personnel visiting the “Forest Stewardship project area”.

SECTION 2 - AMENDMENTS

2.1 The LANDOWNER may propose for approval by the STATE, and the STATE may approve, minor alterations to the approved MANAGEMENT PLAN, which will not have a material adverse impact on the achievement of the overall management objectives of the approved MANAGEMENT PLAN. This includes minor changes to the practice implementation schedule and/or changes in the budget/payments schedule so long as the total management activities do not subtract from or exceed the total scope of the approved MANAGEMENT PLAN and the budget/payments schedule does not exceed the total annual budget allocations up to and including the budget request for that year, and so long as the STATE has sufficient funding available to accommodate such a request.

2.1 The LANDOWNER may propose for approval by the STATE, and the STATE may approve, significant changes to the approved MANAGEMENT PLAN or budget to adapt to current conditions. Significant amendments to the approved MANAGEMENT PLAN



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shall include an amended budget, which will increase the overall STATE's funding share above the total amount set forth in the approved budget/payment schedule. The STATE shall make the proposed amendments available for public review prior to final approval.

- 2.3 The proposed amendments may include, without limitation, re-establishment of management priorities, increase or reduction of the specified work, increases to the budget/payments schedule, or time for performance of specified tasks, all as determined considering the natural conditions of the “Forest Stewardship project area,” existing management priorities, threats, potential for decline of the natural resource during any period under consideration, availability of specialized labor or technical expertise, permitting requirements and time needed to obtain permits, and other material factors.
- 2.4 Any proposed expenditures which will increase the overall STATE's funding share above the amount set forth in the approved budget of the approved MANAGEMENT PLAN, which are proposed either as a result of additional costs required to implement the approved MANAGEMENT PLAN or as a result of amendments to the approved MANAGEMENT PLAN, must be mutually agreed upon in advance by and between the STATE and the LANDOWNER. If so agreed upon the approval of these expenditures shall be incorporated in written amendment to this AGREEMENT.
- 2.5 Economic Hardship. Notwithstanding other provisions of this AGREEMENT, in the event that the LANDOWNER determines in good faith that it is financially unable without undue economic hardship to fulfill its funding share as provided in Attachment S2, Section 1.1(b), or to carry out fully the management activities described in the approved MANAGEMENT PLAN, attached as Exhibit A to this AGREEMENT, within the budget and time period established thereby, the LANDOWNER may apply to the STATE to renegotiate the terms thereof.
- (a) Negotiation of Amendment. In such event, the STATE and the LANDOWNER shall meet and negotiate in good faith an acceptable amendment to the approved MANAGEMENT PLAN that seeks to accomplish the significant objectives of the approved MANAGEMENT PLAN reasonably within the LANDOWNER's



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financial means. The amendment may include, without limitation, re-establishment of management priorities and reduction and/or deferral of the specified work, involving significant costs, and/or extension of time for performance of specified tasks, all as determined considering the natural conditions of the “Forest Stewardship project area,” existing management priorities, threats, potential for decline of the natural resource during any period under consideration, other potential sources of funding, and other material factors.

- (b) Disputes. If the STATE and the LANDOWNER are unable to agree reasonably and in good faith on a suitable amendment to the approved MANAGEMENT PLAN, the parties shall refer any such disputes to arbitration as provided in the General Conditions, Section 11.
- (c) No Termination for Economic Hardship. This provision shall not be construed to allow the LANDOWNER or the STATE to terminate this AGREEMENT for economic hardship; it is rather intended to provide a mechanism for reasonable revisions to the approved MANAGEMENT PLAN for economic hardship.

SECTION 3 - PAYBACK OF STATE FUNDS

3.1 In the event that the LANDOWNER sells, conveys, or otherwise transfers LANDOWNER’s right, title, or interest in the “Forest Stewardship project area,” or any portion thereof, during the initial term of this AGREEMENT as defined in Attachment S3, Section 2.1, the LANDOWNER shall within 90 days of the sale, conveyance or transfer of title or interest in the “Forest Stewardship project area,” pay back to the STATE a portion of the amount paid by the STATE to the LANDOWNER pursuant to this AGREEMENT. The amount to be paid back to the STATE shall be that fraction of the total matching funds received by the LANDOWNER under this AGREEMENT that is equal to the fraction of the “Forest Stewardship project area” that is sold, conveyed or otherwise transferred by the LANDOWNER.



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3.2 In the event that the LANDOWNER sells, conveys, or otherwise transfers LANDOWNER's right, title, or interest in the "Forest Stewardship project area," or any portion thereof, during the initial term of this AGREEMENT as defined in Attachment S3, Section 2.1, the LANDOWNER will not be required to reimburse the STATE as set forth in Attachment S5, Section 3.1 for the cost-share assistance received if the person(s) who acquire the property contractually agree to assume full responsibility for this AGREEMENT for the initial term of the AGREEMENT, including but not limited to management and financial responsibilities and penalties contained herein. See Agenda Item C-3, as amend, approved at the Board of Land and Natural Resources June 13, 2008 meeting. Nothing in this provision shall relieve the LANDOWNER of its obligations under this AGREEMENT.

SECTION 4 - TERMINATION; DEFAULT; PENALTY PAYBACK

4.1 TERMINATION OF THE AGREEMENT - It is mutually agreed that this AGREEMENT may be terminated for any one of the following reasons on the following terms:

- (a) No State Funding. This AGREEMENT shall be terminated if the STATE does not approve funding for the forthcoming fiscal year of the approved MANAGEMENT PLAN. In such event, this AGREEMENT shall automatically terminate without penalty at the end of the funding period then in effect.
- (b) Partial State Funding. This AGREEMENT may be terminated by the LANDOWNER if the STATE approves only a portion of its share of funding for the forthcoming fiscal year as outlined in the budget provided in the approved MANAGEMENT PLAN.
 - (1) In such event, the LANDOWNER shall elect, by written notice to the STATE, either:
 - (A) to terminate this AGREEMENT without penalty at the end of the funding period then in effect; or



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- (B) to revise the approved MANAGEMENT PLAN and budget in the LANDOWNER's reasonable discretion to accomplish significant management goals which can reasonably be funded with the amount of STATE funding actually approved.
- (c) Transfer to Government Agency. This AGREEMENT may be terminated without penalty if the “Forest Stewardship project area” is transferred or sold to a government agency committed to forest stewardship and that possesses the technical and professional skills to manage the “Forest Stewardship project area” natural resources.
- (d) LANDOWNER Default. This AGREEMENT may be terminated by the STATE upon substantial evidence that progress being made by the LANDOWNER in carrying out the approved MANAGEMENT PLAN is inadequate, incorrect, or insufficient to substantially complete on a timely basis the work called for in the approved MANAGEMENT PLAN subject to the lack of performance notification provisions set forth below.
- (1) Penalties Apply. In the event of termination for default in accordance with these provisions, the penalty payback provisions set forth below shall apply.
- (2) Lack of Performance Notification. In such event, the STATE may terminate for default, provided the STATE adheres to the following procedures for notice and opportunity to cure prior to termination:
- (A) The STATE shall first notify the LANDOWNER in writing of any perceived inadequacy, incorrectness or insufficient progress. The STATE and the LANDOWNER shall meet within two weeks thereafter, and every three months thereafter until one year following the date of the notice, and discuss in good faith the



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perceived failure and the reasons therefore and any subsequent progress or lack thereof. If the reason for the failure is a good faith inability of the LANDOWNER to carry out the terms of the MANAGEMENT PLAN for reasons beyond the LANDOWNER's reasonable control, including without limitation economic hardship as described in Attachment S5, Section 2.5 above, the STATE and the LANDOWNER shall specifically consider the need to amend the approved MANAGEMENT PLAN, including extending the time to carry out the work called for in the approved MANAGEMENT PLAN and/or revising the budget established in the approved MANAGEMENT PLAN, subject to the provisions of Attachment S1, Section 1.5 and Attachment S5, Section 2 of this AGREEMENT regarding amendments to this AGREEMENT and the approved MANAGEMENT PLAN. Following the date of the notice, the STATE shall be obligated to inspect the "Forest Stewardship project area" once each quarter after notifying the LANDOWNER, to determine the updated status of the perceived default.

- (B) Following the expiration of the one year period following notice of default given by the STATE to the LANDOWNER and failure of the LANDOWNER to remedy the default, or to make significant progress to remedy the default if by its nature the default cannot reasonably be remedied within one year, the STATE may elect to notify the LANDOWNER of its intention to terminate this AGREEMENT for default. Such notice shall be in writing, shall state that the STATE will terminate the AGREEMENT for default on a date not less than 3 months thereafter if the LANDOWNER does not remedy the default, or to make significant progress to remedy the default if by its nature the default cannot reasonably be



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remedied within 3 months, and shall specify that penalties as provided under this AGREEMENT shall apply.

- (C) If the LANDOWNER fails to remedy the default within 3 months thereafter, or to make significant progress to remedy the default if by its nature the default cannot reasonably be remedied within 3 months, the STATE may terminate this AGREEMENT effective immediately for default by written notice thereof to the LANDOWNER.
 - (D) The STATE shall be deemed to have complied with these provisions if it attempts in good faith to meet with the LANDOWNER and to inspect the “Forest Stewardship project area” as provided above, whether or not the LANDOWNER cooperates in such procedures.
- (3) All disputes regarding default and termination under this AGREEMENT, which cannot be resolved by the parties, shall be referred to arbitration as provided in the General Conditions, Section 11.
 - (4) If the LANDOWNER has not fully performed its work under this AGREEMENT on expiration or termination of this AGREEMENT, the STATE may withhold the final payment to the LANDOWNER pending full completion of the LANDOWNER's work. This withheld payment shall be paid by the STATE to the LANDOWNER on final acceptance and tax clearance as provided in Attachment S2, Section 1.2 (b) and the General Conditions, Section 17.

4.2 PENALTY PAYBACK -



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(a) Payback and Penalties. In the event that the LANDOWNER defaults on this AGREEMENT as provided in Attachment S5, Section 4.1(d) above and the STATE has followed the Lack of Performance Notification procedures as outlined in Attachment S5, Section 4.1(d)(2) above, the LANDOWNER shall promptly pay to the STATE the following payback and penalty monies:

(1) Refund of State Funds - 3 Years. All funds paid from the initial date of this AGREEMENT by the STATE to the LANDOWNER in the previous 3 years (or such portion thereof as STATE shall have funded if this AGREEMENT shall have been in effect for less than 3 years) shall be returned to the STATE. In the event that this AGREEMENT shall have been in effect for more than 3 years, the LANDOWNER shall be liable to pay back State funds for the immediately preceding 3 years. In addition, the LANDOWNER shall pay to the STATE a penalty of two percent of the total of funds that are returned to the STATE.

(b) No Other Party Liable. Only the LANDOWNER receiving State funding under the FOREST STEWARDSHIP PROGRAM shall be liable to the STATE under this AGREEMENT for the payback and penalty.

(c) Disputes. The LANDOWNER shall have the right to submit any disputes to the arbitration procedure as outlined in the General Conditions, Section 11 if it feels that the imposition of payback, and/or additional penalties is unwarranted.

4.3 VIOLATIONS OF AGREEMENT - It is expressly understood and agreed that violations which are not caused by the LANDOWNER shall not constitute or give rise to a default by the LANDOWNER under this AGREEMENT and no penalty provisions shall apply to the LANDOWNER.

4.4 EFFECT OF EMINENT DOMAIN -



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- (a) Full Condemnation. If any action in eminent domain for the condemnation of the fee title of the entire “Forest Stewardship project area” described herein is filed, or if the “Forest Stewardship project area” is acquired in lieu of eminent domain for a public improvement by a public agency or person or whenever there is any such action or acquisition by the federal government or the state government or any person, instrumentality or agency acting under authority or power of the federal government or the state government, this AGREEMENT shall be deemed null and void without penalty as to the land actually being condemned or so acquired as of the date the action is filed, and upon the termination of such a proceeding, this AGREEMENT shall be null and void without penalty for all land actually taken or acquired.
- (b) Partial Condemnation. When such an action to condemn or acquire less than all the entire “Forest Stewardship project area” is filed, this AGREEMENT shall be deemed null and void without penalty as to the portion so condemned or acquired.
- (c) Adjustment of approved MANAGEMENT PLAN. The land actually taken by the means set forth above in this Section shall be removed from this AGREEMENT and the approved MANAGEMENT PLAN and budget adjusted accordingly on a reasonable basis by the STATE and the LANDOWNER.

SECTION 5 - INCORPORATION OF CHAPTER 195F, HAWAII REVISED STATUTES

- 5.1 Incorporation. The provisions of chapter 195F, Hawaii Revised Statutes, as amended, are incorporated by reference into this AGREEMENT. In the event that there is any conflict between the provisions of this AGREEMENT and the provisions of chapter 195F, Hawaii Revised Statutes, the latter shall be controlling.
- 5.2 Renumbering. In the event that chapter 195F, or any of the sections under chapter 195F, Hawaii Revised Statutes, are renumbered, any references to the chapter or sections in this AGREEMENT shall be deemed renumbered accordingly.



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EXHIBIT A

Waikoloa Dry Forest Recovery Project Forest Stewardship Management Plan.



STATE OF HAWAII
CONTRACTOR'S
STANDARDS OF CONDUCT DECLARATION

For the purposes of this declaration:

"Agency" means and includes the State, the legislature and its committees, all executive departments, boards, commissions, committees, bureaus, offices; and all independent commissions and other establishments of the state government but excluding the courts.

"Controlling interest" means an interest in a business or other undertaking which is sufficient in fact to control, whether the interest is greater or less than fifty per cent (50%).

"Employee" means any nominated, appointed, or elected officer or employee of the State, including members of boards, commissions, and committees, and employees under contract to the State or of the constitutional convention, but excluding legislators, delegates to the constitutional convention, justices, and judges. (Section 84-3, HRS).

On behalf of _____, CONTRACTOR, the undersigned does declare as follows:

1. CONTRACTOR is* is not a legislator or an employee or a business in which a legislator or an employee has a controlling interest. (Section 84-15(a), HRS).
2. CONTRACTOR has not been represented or assisted personally in the matter by an individual who has been an employee of the agency awarding this Contract within the preceding two years and who participated while so employed in the matter with which the Contract is directly concerned. (Section 84-15(b), HRS).
3. CONTRACTOR has not been assisted or represented by a legislator or employee for a fee or other compensation to obtain this Contract and will not be assisted or represented by a legislator or employee for a fee or other compensation in the performance of this Contract, if the legislator or employee had been involved in the development or award of the Contract. (Section 84-14 (d), HRS).
4. CONTRACTOR has not been represented on matters related to this Contract, for a fee or other consideration by an individual who, within the past twelve (12) months, has been an agency employee, or in the case of the Legislature, a legislator, and participated while an employee or legislator on matters related to this Contract. (Sections 84-18(b) and (c), HRS).

CONTRACTOR understands that the Contract to which this document is attached is voidable on behalf of the STATE if this Contract was entered into in violation of any provision of chapter 84, Hawaii Revised Statutes, commonly referred to as the Code of Ethics, including the provisions which are the source of the declarations above. Additionally, any fee, compensation, gift, or profit received by any person as a result of a violation of the Code of Ethics may be recovered by the STATE.

* Reminder to Agency: If the "is" block is checked and if the Contract involves goods or services of a value in excess of \$10,000, the Contract must be awarded by competitive sealed bidding under section 103D-302, HRS, or a competitive sealed proposal under section 103D-303, HRS. Otherwise, the Agency may not award the Contract unless it posts a notice of its intent to award it and files a copy of the notice with the State Ethics Commission. (Section 84-15(a), HRS).

CONTRACTOR

By _____
(Signature)

Print Name _____

Print Title _____

Name of Contractor _____

Date _____

FACILITATING NATIVE FOREST REGENERATION

Waimea Valley Forest Stewardship Plan



Acacia koa at the Kalahe'e reforestation area, Waimea Valley, O'ahu. Image: T. Baribault.

PO Box 2037
Kamuela, HI 96743
Tel +1 808 776 9900
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Responsible Forester:
Tom Baribault, Ph.D.
tom@hawaiiiforest.com
+1 808 960 1041 (mobile)



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1. APPLICANT AND PROPERTY INFORMATION

1.1. Applicant

Landowner Name: Waimea Valley

Address: Hi'ipaka LLC
59-864 Kamehameha Highway
Hale'iwa, HI 96712

Landowner Contact: Laurent Pool

Address: 59-864 Kamehameha Highway
Hale'iwa, HI 96712

Email: lpool@waimeavalley.net

Phone | Fax: +1 (808) 277-4559 | +1 (808) 638-7776

TMK number: (6)-1-002-002

State and County Zoning: Conservation (General, Limited)

Total property acreage: 1,875 acres

Proposed stewardship area: 101.5 acres

Elevational range: 7 ft – 1080 ft ASL

Slope: 0% - 80%

Streams, gulches: Kamananui Stream (South)
Ka'iwiko'ele Stream (South)
'Elehāhā Stream (North)

1.2. Consultant

Company: Forest Solutions, Inc.

Name: Thomas Baribault, Ph.D.

Title: Research Forester

Address: P.O. Box 2037
Kamuela, HI 96743

Email: tom@hawaiiiforest.com

Phone | Fax: +1 (808) 776-9900 x238 | +1 (808) 776-9901

2. FSP SIGNATURE PAGE

2.1. Professional Resource Consultant Certification:

I have prepared (or revised) this Forest Stewardship Plan. Resource professionals have been consulted and/or provided input as appropriate during the preparation of this plan.

Prepared by: Forest Solutions, Inc.

Professional Resource Consultant's Signature/Date: Tom W Baribault 4/18/2014

Professional Resource Consultant's Name: Thomas Baribault

2.2. Applicant Certification:

I have reviewed this Forest Stewardship Plan and hereby certify that I concur with the recommendations contained within. I agree that resource management activities implemented on the lands described shall be done so in a manner consistent with the practices recommended herein.

Prepared for: Waimea Valley

Applicant: Richard Pezzulo, Executive Director

Applicant's Signature/Date: [Signature] 4/18/14

Applicant's Name: Waimea Valley

2.3. State Forester's Approval:

This plan meets the criteria established for Forest Stewardship Plans by Hawaii's Forest Stewardship Advisory Committee. The practices recommended in the plan are eligible for funding according to state of Hawai'i Forest Stewardship Program guidelines and administrative rules.

Approved by: Division of Forestry and Wildlife Administrator

State Forester's Signature/ Date: [Signature] 2/20/15

State Forester's Name: Lisa J. Hadway

2.4. Forest Stewardship Advisory Committee

Approved by: Cooperative Resource Management Forester

Committee Signature/Date: [Signature]

Printed Name: M. Irene Sprecher

Approved by Forest Stewardship Advisory Committee on 5/2/14.

3. Executive Summary

Waimea Valley proposes a forest management plan (FMP) with the objective of conserving and rehabilitating rare communities in the Ko'olau Watershed, Northwest O'ahu. The Waimea Valley property encompasses 1,875 acres, more than 100 of which would be intensively managed during implementation of the present FMP. The project will pursue the main objective of promoting recovery of native Hawaiian plant and animal communities in five locations across the parcel.

- i. Mauka restoration site: A 16.5-acre fenced enclosure containing a relatively intact native plant community and a manageable invasive weed problem.

Intended outcome: exterminating non-native plant species and restoring the community with a suite of endemic plant species.

- ii. Kalahe'e reforestation area: A 67-acre unfenced, ridge-top area where native plant species have been largely displaced by aggressive invasive trees and grasses.

Intended outcome: Reversing the infestation of non-native plants by fencing to exclude seed-dispersing feral pigs and completing large-scale out-plantings of robust native tree and shrub species.

- iii. Lama forest: A 1-acre unfenced area with a predominantly *Diospyros sandwicensis* (lama) canopy.

Intended outcome: Promote lama growth and regeneration by fencing the area to exclude seed-dispersing ungulates and exterminating invasive plant species.

- iv. *Eugenia* conservation area: A 1.5-acre unfenced area in which the endangered plant species *Eugenia koolauensis* has been identified.

Intended outcome: Eliminate invasive trees and recover a viable, protected *E. koolauensis* population.

- v. Wetland and Streamside Management Zones (SMZ): A nearly 50-acre block containing 10 acres of SMZ and 5 additional acres of heavily invaded forest; influences habitat quality for endangered waterfowl species.

Intended outcome: Stabilize stream banks with native tree and groundcover species to improve native biodiversity and prevent further sedimentation in critical waterfowl habitat downstream.

Forest management activities would take place concurrently at each of these five focal areas, with continuous work and monitoring throughout the ten year period defined in this plan. At the mauka restoration site, invasive tree extermination and native species planting would be completed in the first five years, followed by maintenance and monitoring of the restored system. At the Kalahe'e area, fencing and planting would occur throughout the project period, resulting in more than 67 acres of restored native mesic forest in which biodiversity can subsequently recover. The lama forest enclosure will be managed as a seed source for expanding *Diospyros* populations throughout the valley. Intensive management of the *Eugenia* area is intended to preserve the endangered plant species *Eugenia koolauensis*; wetland SMZ management will improve habitat quality for the endangered Hawaiian moorhen (*Gallinula chloropus sandwicensis*) and other waterfowl. **In summary, the fundamental vision contained in this plan is a large-scale restoration of key plant and animal communities in a locally threatened and globally rare ecosystem.**

4. Introduction

4.1. Project background and objectives

The principal objective for this forest management plan is to conserve mesic native forest and riparian areas in Waimea Valley. The present Forest Stewardship Program (FSP) management plan was developed along guidelines set forth in a Conservation Action Plan¹ (CAP) adopted by Waimea Valley in 2011. The CAP identified five conservation objectives for the whole property, (i) mesic forest conservation, (ii) endangered waterfowl habitat management, (iii) botanical gardens maintenance, (iv) protection of the Kamananui Stream ecosystem, and (v) maintenance of sacred cultural sites (Wahi Pana). Components of the current FSP plan will directly address CAP objectives (i) and (iv), with indirect effects on (ii) and (iii); objective (v), although consistent with the proposed work, is technically beyond the scope of this plan.

Conservation of Waimea Valley mesic forest areas must take into account the diversity of forest types present on the property. Forests range from intact native species composition within fenced areas through unfenced forests completely devoid of native plant species. Management approaches will focus on promoting growth and regeneration of target tree and understory species in areas protected by extant or new fences. Riparian areas are located along streams with strong variation in seasonal depth and a tendency to flash flood; riparian forest management recommendations will concentrate on accomplishing stream bank erosion control by planting native species.

Secondary effects of forest management will include conservation of waterfowl habitat and improvement of the Kamananui Stream aquatic ecosystem. Mauka reforestation and forest restoration will reduce downstream siltation, which simultaneously improves stream water quality and maintains open water of adequate depth for waterfowl habitat. In the broader context of the Ko'olau Mountains watershed, reduced erosion will positively influence marine ecosystems as well.

The remainder of this management plan will present detailed methods, schedules, and budgets for accomplishing forest conservation in five distinct areas within Waimea Valley. One section of the valley has already been fenced; ongoing activities in this Mauka Restoration Area will include invasive plant species eradication, native species planting, and integrated pest management. Other sections of the valley, including ridge-top areas (Kalahe'e), steep slopes (Iama forest), and endangered species habitat (*Eugenia* conservation area) will need to be fenced prior to beginning conservation work. Management in the riparian areas will consist of invasive plant control, erosion control, and planting appropriate native species to stabilize stream banks.

Implementing the prescriptions (aka R_x) in this management plan will require substantial funding. All prescribed forest management activities constitute native forest restoration, with no provisions for commercial forestry or land use. **Given no intention for tree harvesting or profit generation from restored areas, this plan features no financial analysis. The landowner, a non-profit company, intends to pursue cost-shared funding from FSP, reimbursement funding from relevant federal programs (e.g. EQIP), as well as grant funding from private and public sources yet to be identified.**

¹ Gon, S., Pool, L., Sumiye, J. 2011. Waimea Valley Conservation Action Plan. Hi'ipaka LLC.

4.2. Site description

4.2.1. Parcel and location

Waimea Valley is located immediately to the South of Pūpūkea, or 4.6 miles (7.4 km) North of Haleiwa, on O‘ahu’s Northwestern shore. The parcel is bounded to the South and North by ridge-tops, and encompasses a central ridge (Kalahe‘e) defined by two streams. The Kamananui and Ka‘iwiko‘ele Streams to the south include the Waimea Valley Waterfall, to which there is road access. To the North, the ‘Elehāhā Stream parallels the main 4x4 access into the mauka areas of Waimea Valley.

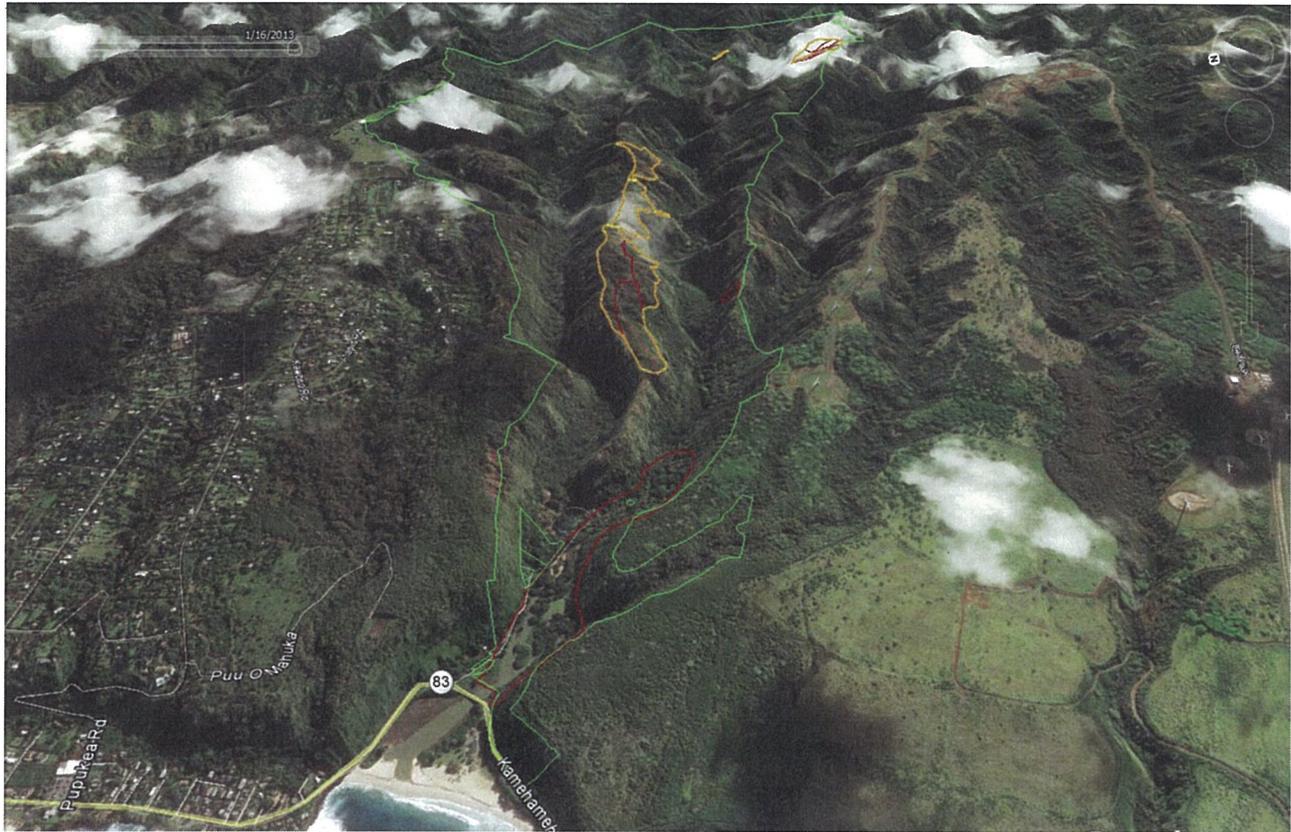


Figure 1. Perspective map of Waimea Valley, showing Pūpūkea to the North (left). The Kalahe‘e ridge is at the center of this image (orange fence outline), with Kamananui Stream to the right and ‘Elehāhā Stream to the left.

Prior to the middle of the 20th century, forests were removed by a combination of land uses, including grazing, logging, and agriculture. Although Waimea Valley has been a botanical preserve for decades, the consequences of deforestation have remained. Most of the vegetation cover consists of non-native trees and shrubs, and these weed species have radiated outward from their points of introduction to infest areas that were originally unaffected by agricultural land uses.

4.2.2. Plant ecosystem types

Within the Waimea Valley (WV) TMK are several forest types distinguished by elevation, slope, and species composition. Formulations of management R_x are determined in large part by the preexisting vegetation, so it will be useful to review the major forest type categories. Lowland areas toward the makai portions of the valley tend to be heavily invaded by alien tree and shrub species, some with extremely high weed risk

assessment values (Table 2, Table 3). Mauka and ridge-top areas are also infested with invasive plant species, but usually to a lesser degree. In some mauka areas, native species (Table 1) predominate, and these areas have been selected for restoration or reforestation. The streamside management zones (SMZ) in the wetland are almost entirely populated by non-native plants with the exception of some out-planted *Cyperus* (Table 3). Vegetation growth habits represented include tall and short trees, shrubs, vines, herbaceous types, ferns, and grasses and sedges (Table 1, Table 2, Table 3).

Table 1. Endemic and indigenous tree species are most abundant in mauka areas of Waimea Valley. This species list was derived from surveys completed by Waimea Valley as well as during site reconnaissance for this management plan.

Species name	Species	Abundance [†]	Origin	Flower	Fruit	Seed
koa	<i>Acacia koa</i>	5	Endemic			X
ahakea	<i>Bobea spp.</i>	2	Endemic			
lama	<i>Diospyros hillebrandii</i>	2	Endemic			
lama	<i>Diospyros sanwicensis</i>	3	Endemic			
kalia	<i>Elaeocarpus bifidus</i>	1	Endemic			
ni'oi	<i>Eugenia koolauensis</i>	2	Endemic			
'ōhi'a	<i>Metrosideros polymorpha</i>	3	Endemic			
kolea	<i>Myrsine lessertiana</i>	1	Endemic			
olopua	<i>Nestegis sandwicensis</i>	3	Endemic			
holei	<i>Ochrosia compta</i>	2	Endemic	X	X	
ho'awa	<i>Pittosporum confertiflorum</i>	4	Endemic		X	
halapepe	<i>Pleomele halapepe</i>	3	Endemic			
ala'a	<i>Pouteria sandwicensis</i>	1	Endemic			
ala'a	<i>Pouteria spathulata</i>	3	Endemic			
kopiko	<i>Psychotria mariniana</i>	3	Endemic			
hao	<i>Rauvolfia sandwicensis</i>	2	Endemic	X		
'iliahi	<i>Santalum freycinetianum</i>	3	Endemic			
maua	<i>Xylosma spp.</i>	2	Endemic	X		
hala	<i>Pandanus tectorius</i>	3	Indigenous		X	
alaha'e	<i>Psydrax odorata</i>	4	Indigenous			
kukui	<i>Aleurittes moluccana</i>	2	Polynesian		X	X
hau	<i>Hibiscus tilliacius</i>	3	Polynesian	X		

Source: Plant Survey for Waimea Valley Native Forest Restoration Project (7-20-12)¹

† Abundance metrics: (5) abundant, (4) common, (3) occasional, (2) scarce, (1) 1x, 2x

¹ Surveyors: Lau, J., Tsuneyoshi, A., Rorher, J., Hoh, J., Orr, D., Pool, L., Belcher, R.

4.2.2.1. Mesic mid-elevation native forest

Relatively few areas of WV remain forested with a primarily native species assemblage; these areas are limited to mauka sections (§5.1) best characterized as mid-elevation mesic native forest. The USDA NRCS has not yet developed ecological site descriptions (ESD) for O'ahu, but elements of several Hawai'i Island

ESD² accurately describe Waimea Valley. Dominant native tree species at the highest elevations and on exposed ridge-tops include *Acacia koa* (koa), *Metrosideros polymorpha* ('ōhi'a), *Santalum freycinetianum* ('iliahi), and *Psydrax odorata* (alahe'e). All of the preceding species are also present in forests growing on slopes below the ridge crests. These more protected areas also support many other native trees, including *Diospyros sandwicensis* and *hillebrandii* (lama), *Pleomele halapepe* (halapepe), *Myrsine lessertiana* (kolea), and *Pittosporum confertiflorum* (ho'awa), among many others (Table 1).

Table 2. Many alien tree species have invaded Waimea Valley, including several with extremely high weed risk scores³. Highest density and diversity of non-native / invasive trees occurs in the valley floors; mauka and ridge-top

Species name	Species	Abundance [†]	Origin	HWRA [‡]	Flower	Fruit	Seed
Formosan koa	<i>Acacia confusa</i>	3	Alien	10	X		X
ironwood	<i>Casuarina equisetifolia</i>	3	Alien	21			
satinleaf	<i>Chrysophyllum oliviforme</i>	5	Alien	7	X		
Spanish elm	<i>Cordia alliodora</i>	4	Alien	8		X	X
Eucalyptus	<i>Eucalyptus spp.</i>	3	Alien	(>5)			
Albizia	<i>Falcataria moluccana</i>	5	Alien	8			
figus	<i>Ficus spp.</i>	2	Alien	(>10)		X	
silk oak	<i>Grivellea robusta</i>	4	Alien	(>10)			
haole koa	<i>Leucaena leucocephala</i>	2.5	Alien	15			
bingabinga	<i>Macaranga mapp</i>	5	Alien	11	X		
punktree	<i>Melaluca quinquinervia</i>	3	Alien	(>10)			
strawberry guava	<i>Psidium cattleianum</i>	5	Alien	18		X	
common guava	<i>Psidium guajava</i>	4	Alien	21		X	
African tulip tree	<i>Spathodea campanulata</i>	3	Alien	14	X	X	
Java plum	<i>Syzygium cumini</i>	2	Alien	9			
gunpowder	<i>Trema orientalis</i>	3	Alien	(>10)			

Source: Plant Survey for Waimea Valley Native Forest Restoration Project (7-20-12)¹

[†] Abundance metrics: (5) abundant, (4) common, (3) occasional, (2) scarce, (1) 1x, 2x

¹ Surveyors: Lau, J., Tsuneyoshi, A., Rorher, J., Hoh, J., Orr, D., Pool, L., Belcher, R.

4.2.2.2. Mesic invaded forest

Mauka forests at WV typically support at least some non-native or invasive tree species, with the most common including *Chrysophyllum oliviforme* (satinleaf), *Casuarina equisetifolia* (ironwood), *Acacia confusa* (Formosan koa), *Grivellea robusta* (silk oak), and several species of *Eucalyptus* (Table 2). Forests in the valley floors around the watercourses of Kamananui and 'Elehāhā Streams consist almost entirely of non-native species. Canopy trees in these areas include *Falcataria moluccana* (albizia), *Syzygium cumini* (Java plum), *Spathodea campanulata* (African tulip tree), and *Trema orientalis* (gunpowder), with essentially no native canopy species (Table 2). Subcanopy species are overwhelmingly invasive taxa as well (Table 2), dominated by *Macaranga mapp*, *Psidium cattleianum*, and woody shrubs (Table 3) such as *Ardesia*

² http://efotg.nrcs.usda.gov/references/public/HI/F162XY501HI_Lama-Alahee-Pandanus_Coastal_Forest.doc

http://efotg.nrcs.usda.gov/references/public/HI/F162XY500HI_Ohia_Lama_Pandanus_Coastal_Forest.doc

http://efotg.nrcs.usda.gov/references/public/HI/F161BY503HI_Koa_Sandalwood_Mamane_Forest.doc

³ <https://sites.google.com/site/weedriskassessment/home>

humilis (inkberry) and *Clidemia hirta* (Koster's curse).

4.2.2.3. Riparian forest and wetlands

The species composition of riparian forests changes dramatically along the length of the two major streams on the WV parcel. In mauka areas, streamside species are typical of the mesic invaded forest, while at the coastal extremes the major invasive tree species are *F. moluccana* and *Cordia alliodora* (Spanish elm). Although these tree species serve a useful purpose in stabilizing steep banks and preventing erosion, they are incompatible with a native species assemblage because of their extremely aggressive reproduction and growth habits. Streamside management must include replacement of these species with native trees, shrubs, and water-adapted species (e.g. sedges).

Table 3. An assortment of native (endemic, indigenous) and introduced (Polynesian, post-Polynesian) non-tree plants are common in Waimea Valley. In general, native shrubs are restricted to mauka forest areas and native grasses, sedges,

etc., to the wetlands and SMZ. Non-native plants occupy a majority of WV in terms of space and total population.

Species name	Species	Abundance [†]	Origin	HWRA [‡]	Flower	Fruit	Seed
Bushes/Shrubs							
inkberry	<i>Ardesia humilis</i>	3	Alien	(>10)			
ko'oloa 'ula	<i>Abutilon mensiesii</i>		Endemic	---			
Koster's Curse	<i>Clidemia hirta</i>	5	Alien	(>20)	X		
ki	<i>Cordyline fruticosa</i>	3	Polynesian	---			
a'a li'i	<i>Dodonea viscosa</i>	4	Endemic	---			X
ginger	<i>Hedychium gardnerianum</i>	3	Alien	16	X		
lantana	<i>Lantana camara</i>	2.5	Alien	32	X		X
ulei	<i>Osteomeles anthyllidifolia</i>	3	Endemic	---	X		
pluchea	<i>Pluchea carolinensis</i>	2	Alien	15			
rubus	<i>Robus rosifolius</i>	2.5	Alien	(>15)			
naupaka kuahiwi	<i>Scaevola gaudichaudiana</i>	3	Endemic	---			
puki'awe	<i>Styphelia tameiameia</i>	3	Endemic	---		X	
akia	<i>Wikstroemia oahuensis</i>	2	Endemic	---		X	
Grass and Sedges							
sedge	<i>Carex meyenii</i>	4	Endemic	---			
sedge	<i>Carex wahuensis</i>	3	Endemic	---			
sedge	<i>Cyperus javanicus</i>	3	Endemic	---	X		
pili	<i>Heteropogon contortus</i>	3	Endemic	---			X
guinea grass	<i>Panicum maximum</i>	2.5	Alien	17	X		
Ferns							
pa'i'iha	<i>Christella dentata</i>	4	Alien	NA			
hāpu'u	<i>Cibotium glaucum</i>	2	Endemic	---			
uluhe	<i>Dicranopteris linearis</i>	5	Indigenous	---			
lace fern	<i>Sphenomeris spp.</i>	2.5	Native	---			
Vines and herbaceous plants							
maile	<i>Alixia oliviformis</i>	4	Endemic	---	X		X
cape (German) ivy	<i>Delairea odorata</i>	3	Alien	14	X		
'ie 'ie	<i>Freycinetia arborea</i>	3	Indigenous	---			
cork passionflower	<i>Passiflora suberosa</i>	4	Alien	12			
'ilie'e	<i>Plumbago zeylanica</i>	2	Endemic	---	X		
ala ala wainui	<i>Piperomia spp.</i>	2	Endemic	---			

Source: Plant Survey for Waimea Valley Native Forest Restoration Project (7-20-12)¹

[†] Abundance metrics: (5) abundant, (4) common, (3) occasional, (2) scarce, (1) 1x, 2x

¹ Surveyors: Lau, J., Tsuneyoshi, A., Rorher, J., Hoh, J., Orr, D., Pool, L., Belcher, R.

[‡] <https://sites.google.com/site/weedriskassessment/>

4.2.3. Soils and rainfall

4.2.3.1. Soil classification

An extensive diversity of soil types exist on the WV parcel, from highly erodible clays on ridges to deep organic muck soils in the wetland areas. Soil descriptions for the major constituents are included below, at-length quotation from the USDA NRCS Soil Data Viewer⁴.

HLMG - Helemano silty clay, 30 to 90 percent slopes:

The Helemano component makes up 100 percent of the map unit. Slopes are 30 to 90 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

HnA - Hanalei silty clay, 0 to 2 percent slopes:

The Hanalei component makes up 85 percent of the map unit. Slopes are 0 to 2 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is poorly drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is moderate. This soil is frequently flooded. It is occasionally ponded. A seasonal zone of water saturation is at 42 inches during January, February, March, April, May, June, July, August, September, October, November, December. Organic matter content in the surface horizon is about 4 percent. Nonirrigated land capability classification is 2w. Irrigated land capability classification is 2w. This soil does not meet hydric criteria. The soil has a slightly sodic horizon within 30 inches of the soil surface.

KIG - Kapaa silty clay, 40 to 100 percent slopes:

The Kapaa component makes up 100 percent of the map unit. Slopes are 40 to 99 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 9 percent. Nonirrigated land capability classification is 7e. This soil does not meet hydric criteria.

KlaB - Kawaihapai stony clay loam, 2 to 6 percent slopes:

The Kawaihapai component makes up 100 percent of the map unit. Slopes are 2 to 6 percent. Depth to a root restrictive layer is greater than 60 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is moderately high. Available water to a depth of 60 inches is moderate. Shrink-swell potential is low. This soil is occasionally flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 2 percent. Nonirrigated land capability classification is 2e. Irrigated land capability classification is 2e. This soil does not meet hydric criteria.

rRT - Rough mountainous land:

The Rough mountainous land component makes up 100 percent of the map unit. Slopes are 50 to 99 percent. Depth to a root restrictive layer, bedrock, paralithic, is 20 to 40 inches. The natural drainage class is well drained. Water movement in the most restrictive layer is high. Available water to a depth of 60 inches is low. Shrink-swell potential is low. This soil is not flooded. It is not ponded. There is no zone of water saturation within a depth of 72 inches. Organic matter content in the surface horizon is about 25 percent. Nonirrigated land capability classification is 8e. This soil does not meet hydric criteria.

⁴ <http://soildatamart.nrcs.usda.gov/templates.aspx>

4.2.3.2. Rainfall patterns

Mean annual rainfall at Waimea Valley is relatively low, ranging from just over 50 mm per month in the dry summer months to more than 150 mm per month (Figure 2) in November or December⁵. Mean annual rainfall between 1,200 mm and 1,325 mm is typically sufficient to support restoration plantings without the use of supplemental irrigation. Soils are typically well-drained and non-hydric (4.2.3.1), but the lack of a strong seasonal drought should mean that restoration plantings will be relatively immune to drought-related mortality. Nonetheless, the project is equipped with water catchment at both the mauka restoration and the Kalahe'e reforestation area (see §4.3) to water seedlings or for emergency irrigation.

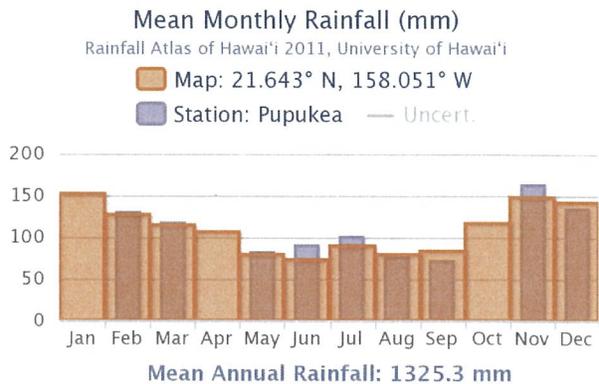
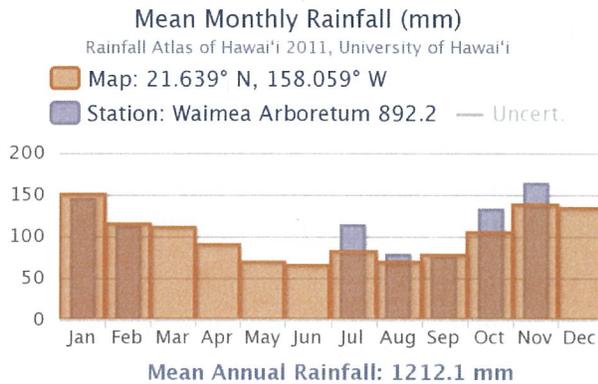
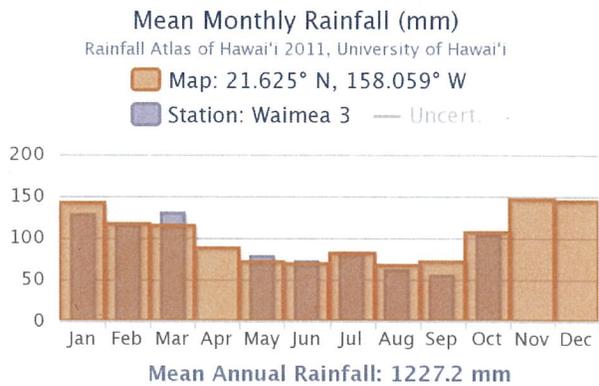
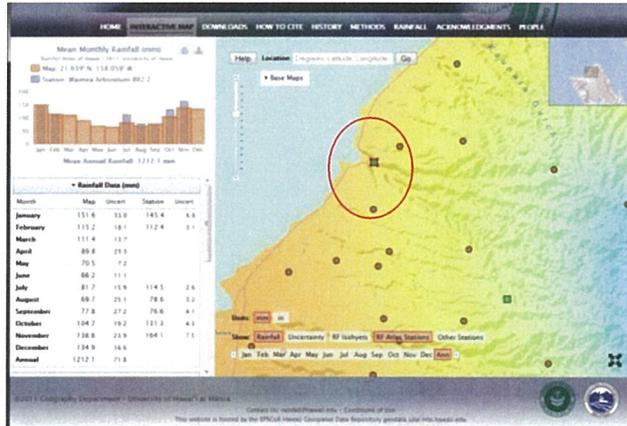


Figure 2. Rainfall at Waimea Valley is somewhat seasonal, with approximately twice as much rain falling from November to February as during the rest of the year. Overall, the site is mesic to dry-mesic, with up to 150 mm of rain falling per month in the winter. Three proximate weather stations (red circle) show a similar range of likely precipitation.

4.2.4. Threatened and endangered species

4.2.4.1. Flora

The main plant species of concern in Waimea Valley is ni'oi, or *Eugenia koolauensis*. This shrub or small tree is constrained to an area just North of the Mauka Restoration Area (Figure 4), and will be a target for conservation under this FMP (see §5.1). Other threatened or endangered species may be encountered during the course of rare habitat monitoring (see §5.7.1). In the event of such an encounter, WV will

⁵ Giambelluca, T.W., Q. Chen, A.G. Frazier, J.P. Price, Y.-L. Chen, P.-S. Chu, J.K. Eischeid, and D.M. Delparte, 2013: Online Rainfall Atlas of Hawai'i. *Bull. Amer. Meteor. Soc.* 94, 313-316, doi: 10.1175/BAMS-D-11-00228.1.

update this management plan to include (1) a description of the endangered species, (2) the location of individuals or of the focal population, (3) a management strategy to safeguard existing populations and work toward restoration of the species to broader areas.

4.2.4.2. Fauna

Two endangered animal species will be of concern in the management of Waimea Valley. These species are the Hawaiian moorhen ('alae 'ula, *Gallinula chloropus sandvicensis*) and the Hawaiian hoary bat ('ope'ape'a, *Lasiurus cinereus semotus*). Presence of the Hawaiian moorhen, Hawaiian coot (*Fulica alai*), and other waterfowl has been documented in the WV CAP (Gon et al. 2011), and the Hawaiian hoary bat is also known to occur based on encountering one dead animal⁶. Since practices such as canopy tree felling are not proposed in this management plan, detrimental effects on bat habitat will not occur and further documentation of bat presence will be passive. The management plan as written is fully consistent with supporting existing bat habitat and developing new habitat areas. Monitoring the status of endangered fauna will be a component of rare habitat monitoring (see §5.7).

4.2.5. Threat assessments

The Waimea Valley CAP (Gon and Sumiye, 2011) proposes a threat matrix (Table 4) for each of its conservation objectives, including the FMU proposed in this management plan (§5.1) as well as the indirect conservation targets (alae 'ula, botanical garden, Wahi Pana).

Table 4. Aggregate threat assessments for conservation targets in Waimea Valley.

Threat	Alae 'ula	Kamananui Stream	Botanical Garden	Lowland Mesic Forest	Wahi Pana	Summary Rating
Ungulates	NA	High	High	High	Low	High
Invasive weeds	Medium	Medium	High	High	Low	High
Fire	NA	Medium	Medium	Medium	Low	Medium
Human misuse	Medium	Low	Low	Medium	Low	Medium
Pests, pathogens	Medium	Medium	Medium	High	NA	Medium
Flooding	Low	NA	Medium	NA	Low	Low
Summary Rating	Medium	Medium	High	High	Low	High

4.2.5.1. Invasive species

By a large margin, invasive species present the most serious persistent threat to integrity of native Hawaiian forest ecosystems in Waimea Valley. Indeed, most of the forest areas are already substantially invaded by non-native trees and shrubs, often to the total exclusion of native flora. The few remaining areas of significant native plant populations are constrained to mauka areas and are by no means free of invasive taxa. Invasive animal species also threaten native ecosystems. The most destructive of these species are feral hogs (*Sus scrofa*) and rats (*Rattus rattus*, *R. norvegicus*). Feral hogs destroy native plant species and disperse the seeds of invasive plants. Rats consume the seeds of rare and common native plants alike, thereby preventing natural regeneration even in areas protected by topography from e.g. feral hog damage. Strategies to combat feral hogs focus on fencing (§5.2) and to some extent trapping,

⁶ L. Pool, R. Belcher, pers. comm. 2014.

while rat control strategies fall into the rubric of Integrated Pest Management (IPM, §5.6.2).

4.2.5.2. Fire risk

Fire risk in Waimea Valley is medium for most areas except streams and wetlands (Figure 22).

4.2.5.3. Flood risk

Both main streams (Kamananui, 'Elehāhā) may flash flood during any time of the year. Flash flooding is unlikely to affect the mauka, Kalahe'e, *Eugenia*, or lama forest restoration areas (Figure 5, Figure 6), but the wetland SMZ restoration will be subject to flooding (Figure 9). Waimea Valley infrastructure (buildings, roads) was designed with the assumption that flooding will occur in riparian and wetland areas. Erosion control measures must be taken in SMZ restoration (bank stabilization, geotextiles, timing planting to ensure establishment prior to most frequent flood seasons (October to March).

4.2.5.4. Human access control

Although identified as only a low or potentially medium threat by the CAP (Table 4), damage by humans to forest management projects is nonetheless a concern. The greatest deterrent to vandalism or other problems will be a sustained presence on the property, including staff and volunteers working in the various FMU. Likely human-related problems could be trespassing (e.g. to access the Waimea Valley Waterfall), unauthorized hunting, fence destruction, or introducing feral pigs to fenced areas.

4.3. Institutional capabilities

4.3.1. Staffing and volunteer labor

Waimea Valley employs two full-time staff with expertise in botanical identification, nursery operations, ungulate control, fence maintenance, invasive plant control, integrated pest management, GIS, reporting, and grant writing. The current plan could support hiring one additional person dedicated to field labor, or up to four interns annually. As a non-profit company, WV has and will continue to accomplish native forest restoration with the assistance of volunteers. The staff at WV is experienced in the organization and effective deployment of volunteer forest restoration crews, and this labor source will be instrumental to completing the forest management activities proposed in this plan.

4.3.2. Equipment

All essential forest management equipment for native species restoration is available at Waimea Valley. Equipment includes 4x4 vehicles for site access, an agricultural tractor for hauling, mix tanks for herbicide spraying, catchment surfaces and tanks for supplemental water, and a full-service greenhouse (Figure 3).

4.3.3. Nursery, greenhouse, and botanical garden

The Waimea Valley botanical garden is fully equipped as a plant species preservation facility (Figure 3). Although many of the specimens in the living collection are non-native, the native Hawaiian component is significant and will serve as a seed source for mauka restoration efforts. Native species appropriate for out-planting in the Ko'olau Range will be used exclusively, with accessions collected either in Waimea Valley itself or in adjacent valleys or ridge-tops. Maintenance of the botanical garden itself is not a feature of this management plan; the State of Hawai'i Kaulunani Urban and Community Forest Program⁷ is

⁷ <http://dlnr.hawaii.gov/forestry/lap/kaulunani/>

recommended as a potential additional source of funding for botanical garden maintenance.

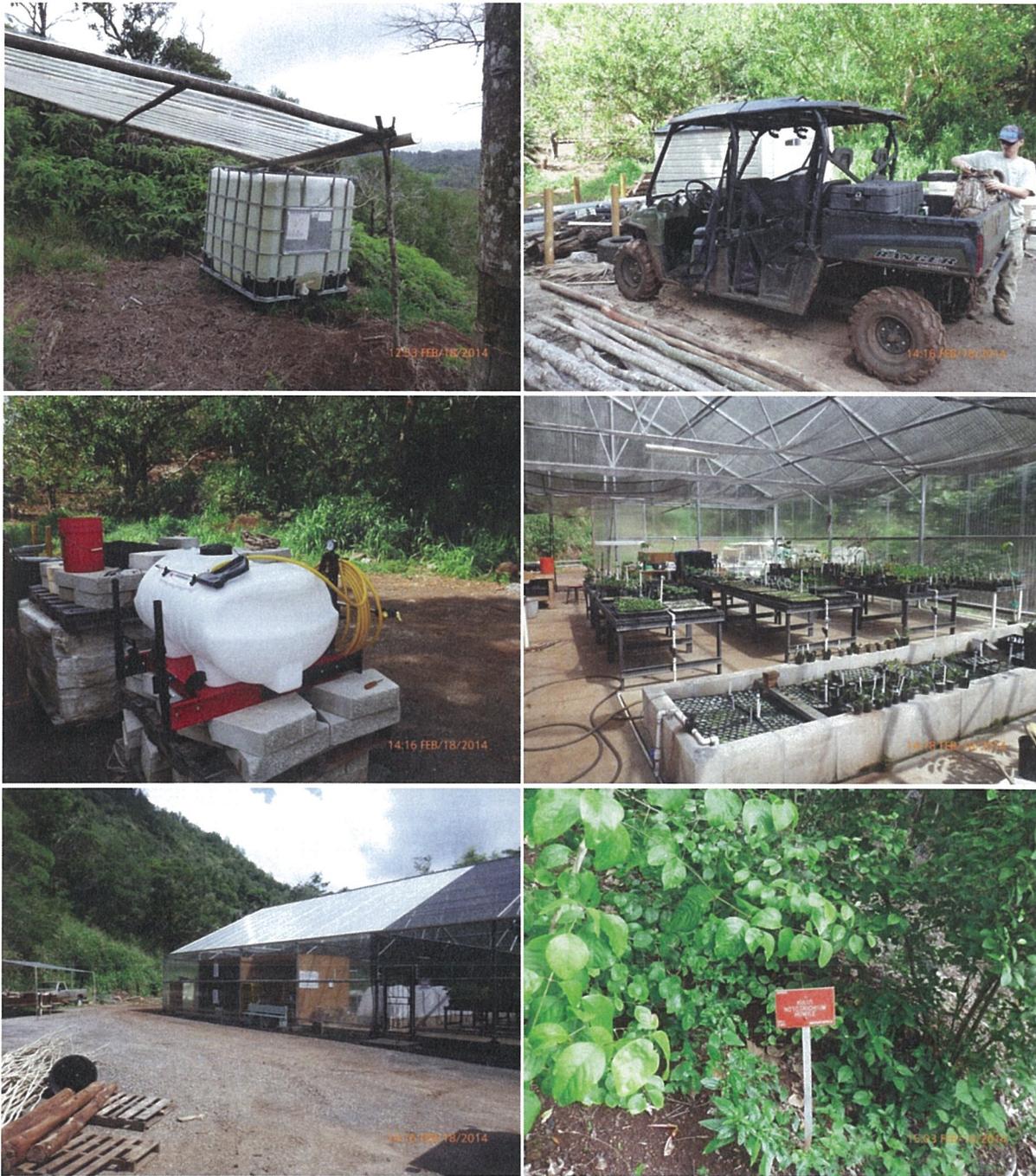


Figure 3. Equipment already available at Waimea Valley includes (top left) water catchments and tanks, (top right) 4x4 vehicles for site access and volunteer transportation, (middle left) herbicide spray / mix tanks, (middle right, bottom left) a fully equipped greenhouse and nursery, and (bottom right) a botanical garden with numerous accessions of plant species native to the Ko'olau Mountains.

5. Management Prescriptions

5.1. Forest management units

A set of forest management R_x will be presented for each of five spatially distinct forest management units (FMU). In particular, management activities are defined for (1) the Mauka Restoration Area, (2) the Kalahe'e ridge-top reforestation area, (3) a fenced enclosure for rehabilitating *Eugenia koolauensis*, (4) a fenced enclosure containing lama (*Diospyros sandwicensis*) forest, and (5) streamside management zones (SMZ) within the wetland portion of the property (Table 5). At the Mauka Restoration Area and lama forest, the management objectives are to maintain and improve existing native forest cover. In contrast, vegetation cover at Kalahe'e is primarily non-native, so the objective will be to replace the current cover with a site-appropriate native species composition. In the *Eugenia* restoration area, the primary focus will be to establish a viable population of *Eugenia koolauensis*, but other native species will be planted as well. Finally, the objective for the wetland area will be to establish riparian-adapted native species in order to prevent stream bank erosion and improve downstream water quality.

Forest management unit	Area		Perimeter		
	acre	hectare	m	ft	
Mauka Restoration	M1	1.21	0.49	280	918
	M2	2.16	0.88	397	1,303
	M3	2.59	1.05	448	1,469
	M4	2.14	0.87	424	1,392
	M5	1.86	0.75	400	1,314
	M6	1.17	0.47	300	984
	M7	1.81	0.73	360	1,182
	M8	1.14	0.46	303	993
	M9	2.40	0.97	371	1,217
Subtotal:		16.48	6.67	3,283	10,771
Kalahe'e	K1	14.61	5.91	1,319	4,328
	K2	16.56	6.70	1,996	6,549
	K3	11.19	4.53	1,320	4,330
	K4	14.73	5.96	1,449	4,753
	K5	10.25	4.15	1,170	3,840
Subtotal:		67.34	27.25	7,254	23,799
Lama forest	L1	1.00	0.40	254	833
Wetland	W1	15.25	6.17	1,145	3,756
<i>Eugenia</i> area	E1	1.44	0.58	364	1,195
Total:		101.50	41.08	12,300	40,355

Forest management unit	Area		Perimeter		
	acre	hectare	m	ft	
Mauka restoration	16.48	6.67	1,042	3,419	
Kalahe'e Fence 1	42.36	17.14	2,447	8,028	
Kalahe'e Fence 2	14.73	5.96	1,449	4,753	
Kalahe'e Fence 3	10.25	4.15	1,170	3,840	
Lama forest	0.99	0.40	254	832	
<i>Eugenia</i> area	1.44	0.58	364	1,195	
Total:		86.24	34.90	6,726	22,067

Table 5. Forest Management Units in the WV project will include the mauka restoration site, the Kalahe'e reforestation area, enclosures around lama forest and the *Eugenia* conservation area, and a SMZ in the wetland. In terms of acreage, the Kalahe'e reforestation area represents the largest sub-project at more than 67 acres. The wetland area is the second largest net acreage, but forest management activities will be focused on a 15-acre portion of the overall wetland. Together, FMU in the mauka restoration site sum to nearly 16.5 acres, and this area will be managed to control invasive trees and restore native plant taxa. Fencing has already been constructed around the mauka restoration, but will need to be constructed at Kalahe'e, the lama forest, and the *Eugenia* conservation area.

The mauka restoration site is a roughly square unit divided into nine (9) fields (Figure 4) and encompassing nearly 16.5 acres (Table 5). Certain management activities (fencing maintenance, IPM) will occur across the entire FMU every year, while other activities are concentrated in single (e.g. site preparation, planting) or alternate years (e.g. rare habitat monitoring). The five units constituting the Kalahe'e reforestation area (Figure 7) sum to a total of more than 67 acres (Table 5). In a given year, only a small portion of each FMU will be slated for restoration activities, but the complete acreage would be reforested by the end of the

decade-long project period. Forest management in the wetland area (Figure 9) would focus on two SMZ of just over five (5) acres each (Figure 8), with additional invasive tree control in adjacent areas (principally herbicide control of *Cordia alliodora*). Activities in the *Eugenia* area (Figure 4) and lama forest (Figure 7) would focus on endangered species preservation and invasive species removal.

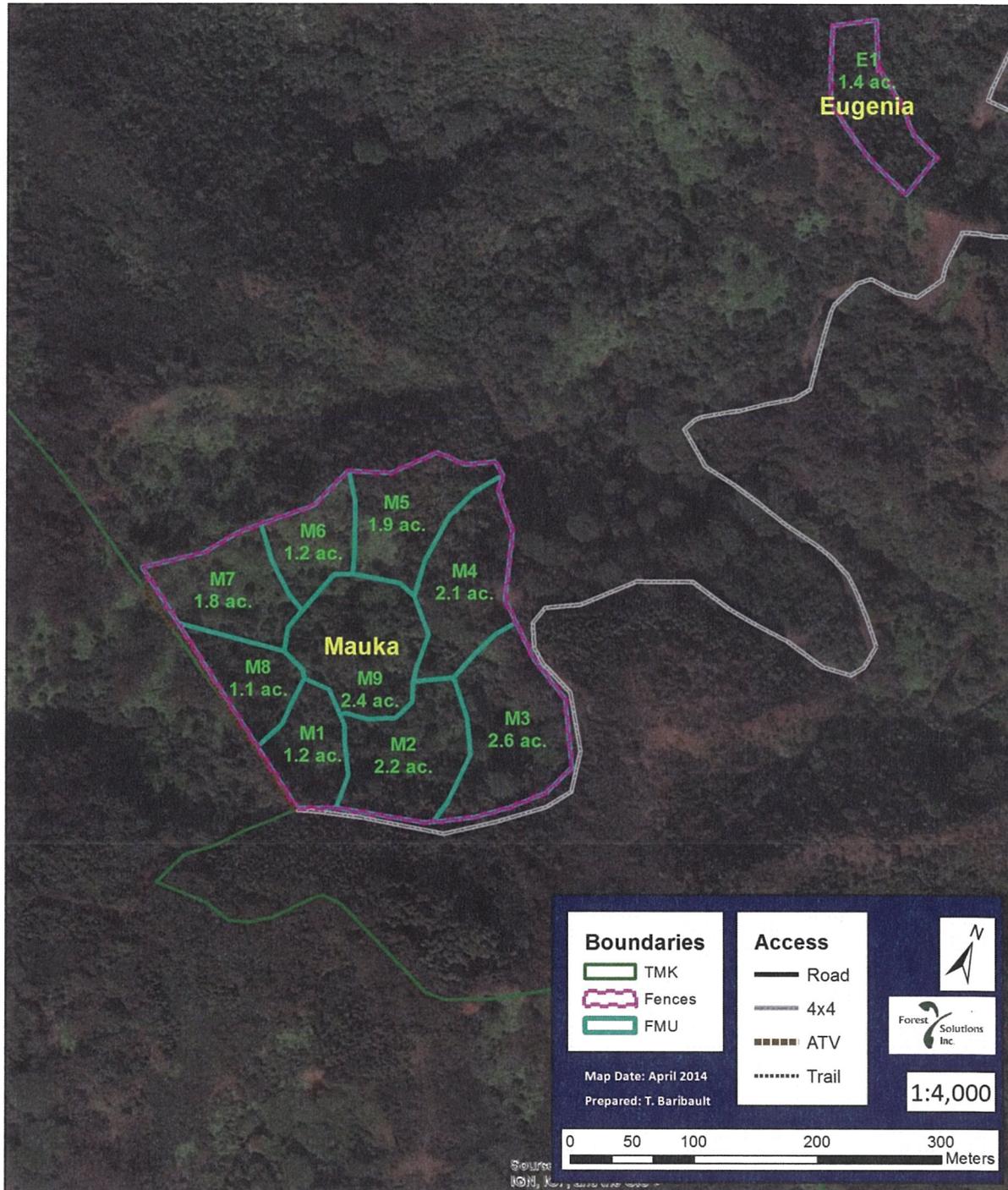


Figure 4. Mauka restoration area and sub-units M1 – M9 (blue). Fencing has already been constructed around this FMU (pink), and areas are ready for invasive tree control (brush management) and native species out-planting.



Figure 5. Perspective map of the mauka restoration site shows steep banks and uluhe fern punctuated by trees.



Figure 6. Perspective map of the proposed Kalahe'e reforestation exclosures. The lama forest area is located on the

right-hand (Southern) valley wall.

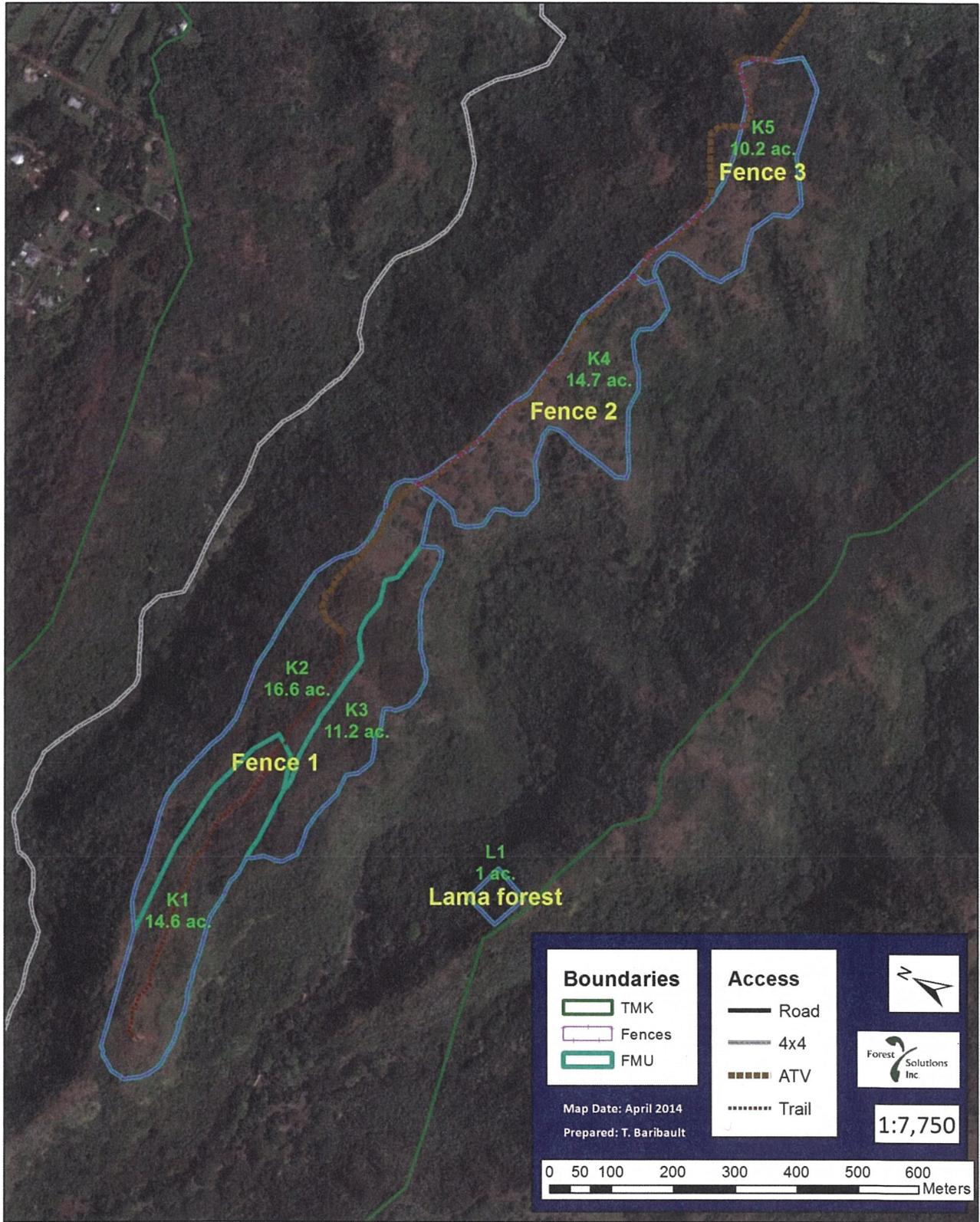


Figure 7. The Kalahe'e reforestation area will be divided into three fenced sections and managed as five (5) sub-units

called F1 – F5. The lama forest (center bottom) will be fenced and managed to exclude invasive plant species.

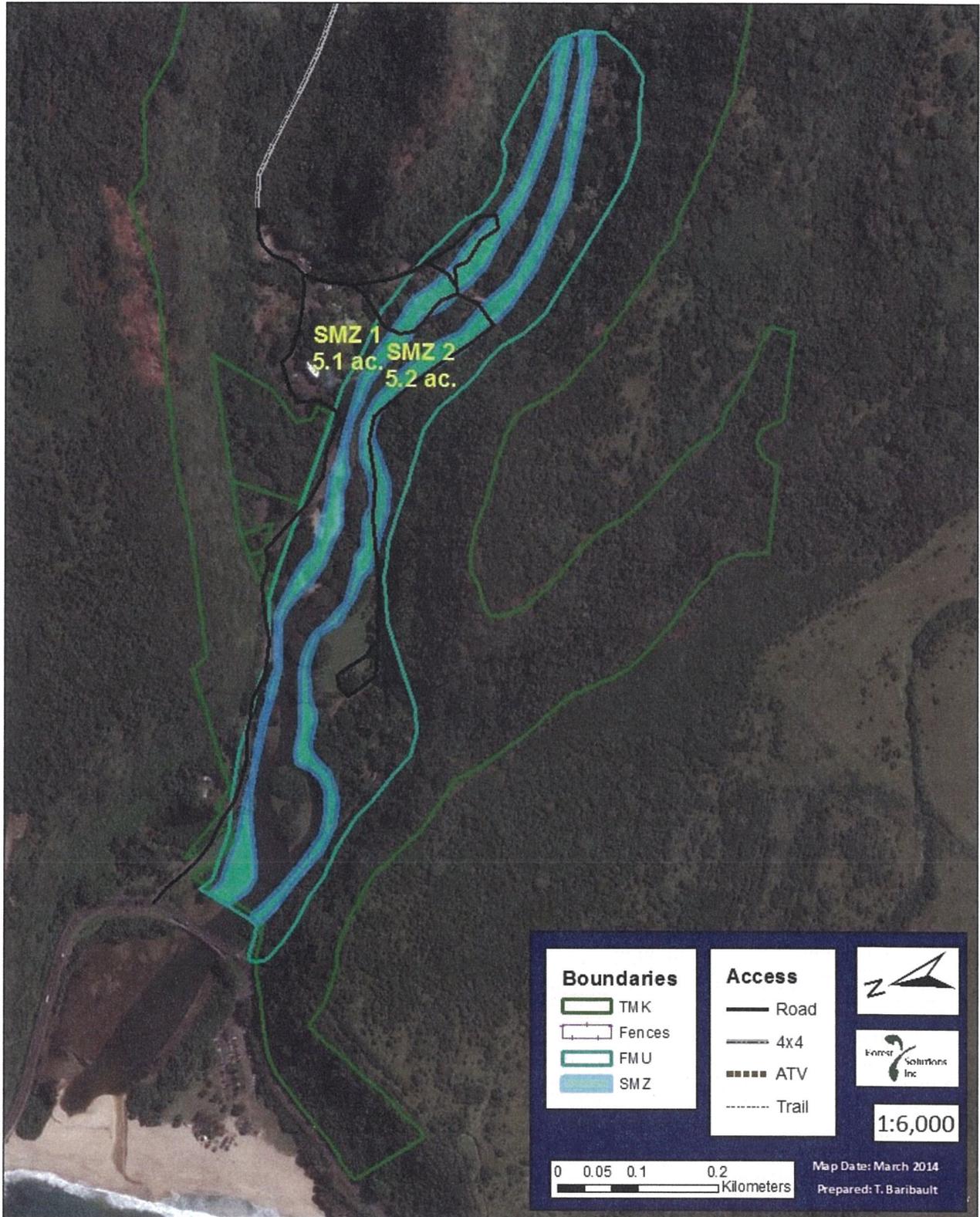


Figure 8. Streamside management zones in the wetland area that surrounds the Waimea Valley botanical garden.

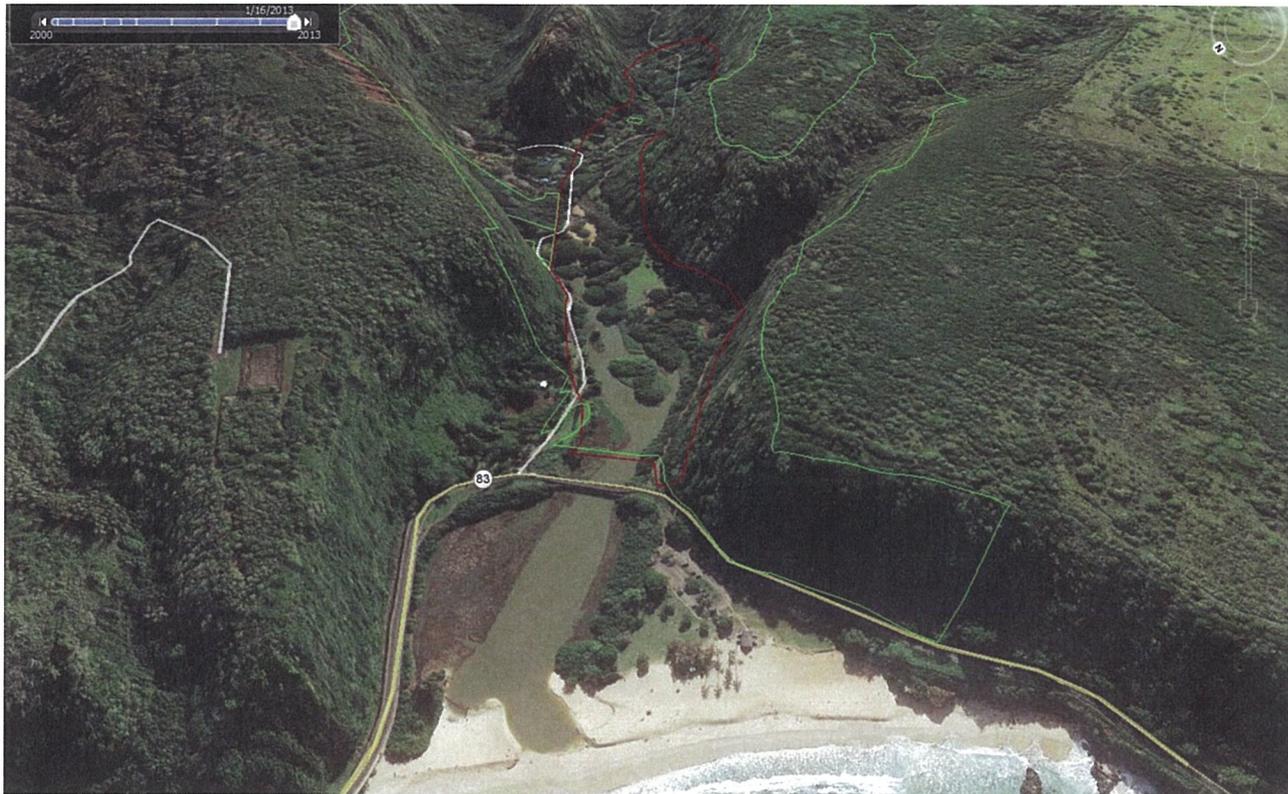


Figure 9. Perspective map of the wetland area at the makai end of Waimea Valley.

5.2. Access control

5.2.1. Fencing

For the mauka restoration, Kalahe'e reforestation, lama forest, and *Eugenia* conservation areas, fencing will be the first management activity to occur. Fencing has already been constructed around the mauka restoration, but will need to be constructed around the other three forest management areas to ensure that ungulates (principally feral hogs) are excluded (Appendix **Error! Reference source not found.**). Extant and future fences will require annual maintenance, which has been factored as an annual per-foot cost varying by topography (steeper slopes corresponding to greater maintenance expense (\$5.8)). Fencing also serves as a reminder to staff and volunteers to practice good hygiene against vectoring weed seeds. At the mauka restoration site, a boot brush has been installed at the main access style; comparable foot cleaning installations are recommended at other access points in the mauka section as well as at Kalahe'e, lama, and *Eugenia*.

5.2.2. Roads

The road and trail network in Waimea Valley is adequate for all forest management activities prescribed in this plan; specific road related activities are not included in the budget or prescriptions. Should road repairs become necessary, e.g. after a landslide, earthquake, or flood, all construction or repair activities

should conform to the State of Hawai'i Best Management Practices (BMP) for forestry roads⁸.

5.3. Invasive tree removal

5.3.1. Brush management: chemical and manual

Invasive tree removal, interchangeably called brush management in accordance with the relevant NRCS practice code, will be a universal practice across all of the FMU at WV. Target species vary by site: principal targets at the mauka restoration are *C. oliviforme*, *M. quinquinervia*, and *Eucalyptus spp.* At Kalahe'e, the majority of non-native stems are *C. equisetifolia*, followed by varying components of *P. cattleianum*, *P. guajava*, *A. confusa*, and *S. cumini*. The *Eugenia* conservation area is infested with *P. cattleianum*, while the wetland SMZ has infestations of *S. cumini*, *C. alliodora*, and minor amounts of *F. moluccana*.

Regardless of the target species, chemical brush management will be accomplished using a frill or drill application (Figure 10) of concentrated herbicide agents effective against the target. Certain weed species resist common herbicides such as glyphosate or triclopyr. For example, *P. cattleianum* and *P. guajava* with diameters of 2" or less may be killed using a frill / drill application of at least 6 ml glyphosate (Roundup PowerMax) or 3 ml triclopyr (Garlon 4, Element 4), but the same trees are easily killed using only 1 or 2 ml of aminopyralid (Milestone) or aminocyclopyrachlor (Perspective). In contrast, *F. moluccana* trees may be killed in the most cost effective way using glyphosate, which is substantially cheaper than other herbicide options. An intermediate cost solution is imazapyr (Polaris AC), which has been documented to terminate such challenging species as *Morella faya* (not present at WV).



Figure 10. Frill (left), drill (center), or single incision (right) methods for administering optimized doses of herbicides to invasive tree species. Effective herbicide agents for this application type include Milestone, Polaris AC, Roundup PowerMax, and Garlon 4 / Element 4; effects vary strongly by target species. (Right image: Leary et al. 2012)

Following chemical control of invasive tree cover, manual removal of dead brush may be necessary. For example, *C. equisetifolia* stems at Kalahe'e are so densely distributed that no planting would be possible without first chain-sawing the debris and organizing it into piles or wind-rows. Debris may also be used to

⁸ <http://www.hawaiiforest.org/files/Bestmana.pdf>

prevent erosion (i.e. wattles or check dams). In contrast, *C. oliviforme* in the mauka site may be allowed to stand in place with native species planted in the understory.

5.3.2. Brush maintenance: chemical

Some regeneration is inevitable following the initial treatment of invasive tree species. The invasive trees may regenerate from root sprouts, incompletely killed stems, or from seed. In most cases, this regeneration is best controlled using a timely foliar application of appropriate herbicides. The herbicide Streamline (aminocyclopyrachlor and metsulfuron methyl) is highly effective particularly against *P. cattleianum*, a species that stubbornly resists damage by reasonable doses of many other herbicides. Streamline is an effective broadleaf herbicide appropriate for mauka areas (i.e. no applications with rain forecasted, no applications near surface water or in areas with low water table). Any herbicide agent should not be applied in a manner that may result in ground- or stream-water contamination.

5.4. Restoration plantings

5.4.1. Species selection

Plantings will feature endemic or indigenous species documented to occur naturally on their respective restoration sites or in the Northern Ko'olau Mountains. Plant propagation, including seed collection, accession tracking, germination (or air layering or cutting), and nursery production, will all be accomplished on site using existing facilities and with pre-trained staff. All propagation will conform to the Waimea Valley Plant Collections Policy (Ho 2010) also in use at the botanical garden.

Table 6. Species selected for planting in the mauka restoration site (left), and at either Kalahe'e or both mauka and Kalahe'e (right). The species designated Kalahe'e only are so identified because they are (1) robust to poor soils, strong winds, and dry conditions, and (2) because they already exist in the Kalahe'e area. Species appropriate for the mauka area

are less capable of tolerating harsher conditions of Kalahe'e. *E. koolauensis* and other species will occupy the *Eugenia* site.

Species name	Species	Form	Species name	Species	Form	FMU
ko'oloa 'ula	<i>Abutilon mensiesii</i>	Shrub	pili	<i>Heteropogon contortus</i>	Grass	K
ahakea	<i>Bobea spp.</i>	Tree	ulei	<i>Osteomeles anthyllidifolia</i>	Shrub	K
hāpu'u	<i>Cibotium glaucum</i>	Fern	'ilie'e	<i>Plumbago zeylanica</i>	Herb	K
'aku 'aku	<i>Cyanea tritomantha</i>	Herb	akia	<i>Wikstroemia oahuensis</i>	Shrub	K
uluhe	<i>Dicranopteris linearis</i>	Fern	koa	<i>Acacia koa</i>	Tree	M,K
lama	<i>Diospyros hillebrandii</i>	Tree	maile	<i>Alixia oliviformis</i>	Vine	M,K
kalia	<i>Elaeocarpus bifidus</i>	Tree	awe'owe'o	<i>Chenopodium oahuense</i>	Shrub	M,K
'le 'ie	<i>Freycinetia arborea</i>	Vine	a'a li'i	<i>Dodonea viscosa</i>	Shrub	M,K
kolea	<i>Myrsine lessertiana</i>	Tree	wili wili	<i>Erythrina sanwicensis</i>	Tree	M,K
olopua	<i>Nestegis sandwicensis</i>	Tree	'ōhi'a	<i>Metrosideros polymorpha</i>	Tree	M,K
holei	<i>Ochrosia compta</i>	Tree	alaha'e	<i>Psydrax odorata</i>	Tree	M,K
ala ala wainui	<i>Piperomia spp.</i>	Herb	'iliahi	<i>Santalum freycinetianum</i>	Tree	M,K
mamaki	<i>Pipturus albida</i>	Tree	puki'awe	<i>Styphelia tameiameiae</i>	Shrub	M,K
ho'awa	<i>Pittosporum confertiflorum</i>	Tree	maua	<i>Xylosma spp.</i>	Tree	M,K
halapepe	<i>Pleomele halapepe</i>	Tree				
ala'a	<i>Pouteria sandwicensis</i>	Tree				
kopiko	<i>Psychotria mariniana</i>	Tree				
hao	<i>Rauvolfia sandwicensis</i>	Tree				
naupaka kuahiwi	<i>Scaevola gaudichaudiana</i>	Shrub				
Schidea	<i>Schiedea obovata</i>	Shrub				

All species proposed for out-planting in either mauka, Kalahe'e, or SMZ sites can be produced by WV on site. Precise per-seedling costs vary somewhat depending on germination rate, benching time, etc., but a realistic aggregate cost of \$5.35 per seedling will be used for budgeting purposes. Tree species with poor germination rates (e.g. 'iliahi) and extremely slow growth rates have a real seedling cost closer to \$12.00. In contrast, the sedges, with good germination rates, short bench times, and limited horticultural requirements, likely cost closer to \$1.00 to produce. On average, WV has found the \$5.35 cost to reflect an integrated price per plant across all of the species on these lists (Table 6, Table 7).

Table 7. Species designated for planting in the wetland SMZ.

Species name	Species	Form	FMU
'ae'ae	<i>Bacopa monnieri</i>	Herb	SMZ
bayonet grass	<i>Bolboschoenus maritimus</i>	Sedge	SMZ
sedge	<i>Carex meyenii</i>	Sedge	SMZ
sedge	<i>Carex wahuensis</i>	Sedge	SMZ
kou	<i>Cordia subcordata</i>	Tree	SMZ
sedge	<i>Cyperus javanicus</i>	Sedge	SMZ
'ehu'awa	<i>Cyperus laevigatus</i>	Sedge	SMZ
sedge	<i>Cyperus polystachos</i>	Sedge	SMZ
hala	<i>Pandanus tectorius</i>	Tree	SMZ
loulu	<i>Pritchardia kahukuensis</i>	Tree	SMZ
hāwane	<i>Pritchardia martii</i>	Tree	SMZ
ohe makai	<i>Reynoldsia sandwicensis</i>	Tree	SMZ
milo	<i>Thespesia populnea</i>	Tree	SMZ

5.4.2. Site preparation and planting

Planting site preparation and planting may occur several months after removal of invasive trees (brush management). In areas with dense invasive tree overstory, brush debris must be removed prior to site preparation; debris can be used in check dams or wattles, or composted for amendments to future plantings. Brush killed with imazapyr or aminopyalid should not be used as compost for at least two years. Areas (e.g. mauka site) with relatively sparse, larger invasive overstory (*Chrysophyllum*) may be planted without removal of the dead overstory. Certain portions of Kalahe'e where the dominant cover consists of non-native grasses should be sprayed with an imazapyr-glyphosate mixture at least three months before site preparation. Circular areas should be sprayed with a 1 m radius around each planting location.

At Kalahe'e, harder, compacted soils must be loosened with a motorized auger. In other areas, soils may be prepared either with the auger or with hand tools (pick, shovel, bar). Planting holes should be dug at least one inch (2.54 cm) deeper than the depth of the seedling pot; any shallower cavity will result in part of the root system being exposed to air. Soil should be packed firmly around each seedling, with the exception of air layered seedlings whose roots tend to be easily dislodged from the stem. In the mauka and Kalahe'e areas, trees and shrubs are prescribed to be planted at a density of 200 seedlings per acre (unless otherwise prescribed), or at a square lattice spacing of 14.5 ft apart. This relatively sparse geometry allows for remaining overstory trees in the mauka site, and will reduce intraspecific competition in the drier Kalahe'e reforestation area. In the SMZ, woody species should be planted at 300 plants per acre (12 ft square lattice).



Figure 11. The most challenging planting area in the whole project is located in a small, highly eroded portion of the Kalahe'e reforestation area, sub-unit F0. Species including a'a li'i and 'ilie'e were planted in this area by blasting through clay hardpan using a motorized auger. Supplemental water from the on-site catchment (top left) was provided at planting. At six months after planting, both species, as well as several koa, were thriving despite only moderate rainfall and a lack of proper soil. Other planting zones in WV are far more favorable, promising positive outcomes for the project in general.

5.4.3. Out-planting maintenance

Extant out-plantings, e.g. at Kalahe'e (Figure 11) have shown good survival and growth despite being planted in harsh conditions on heavily eroded soils. In contrast, other seedlings planted into grassy areas (also at Kalahe'e (Figure 12)) have suffered from apparently slow growth rates. It appears that the most influential factor in seedling performance throughout the restoration areas has been competition. For example, koa and a'a li'i growth rates were good at the mauka site immediately after planting when weed control was recent, but have since slowed in the presence of rampant *Clidemia hirta* growth (Figure 12). In general, this FMP will recommend herbicide or manual control of any competing weeds through at least 18 months after planting. This corresponds to three competition control entries spaced six (6) months apart.



Figure 12. Koa seedling suffering from competition with surrounding grass at Kalahe'e (left). Koa and a'a li'i seedlings grew at phenomenal rates in the mauka site until they were overtaken by nearby *Clidemia hirta* (right).

5.5. Streamside management zones

Special procedures will be required for out-planting in the SMZ. The species list for the SMZ (Table 7) contains plants adapted to riparian conditions, periodic flooding, warmer temperatures, less well-drained soils, and even some saline tolerance. Site preparation in the SMZ should not rely on herbicide applications because of the immediate proximity of standing and moving water (Figure 13). Many of the herbicides recommended for mauka and Kalahe'e could potentially contaminate the stream and wetland when applied as a foliar spray in the SMZ. Glyphosate (e.g. Roundup PowerMax, Accord XRT II, Aquamaster) is a potential exception, and should not contaminate groundwater when carefully applied so as to avoid any contact with open water. Brush management using IPA is, however, a safe technique for the SMZ. To prepare planting site in areas with existing non-native vegetation, plants should be removed manually. Planting holes should then be dug by motorized auger or pick as appropriate, per instructions above. Planting densities in the SMZ should vary by growth habit, with trees planted at a relatively sparse density (300 per acre, 12' x 12' spacing) and sedges or other ground cover stabilizers planted more closely together (for example, 3' x 3' spacing). Both trees and groundcovers should be planted in areas where they may successfully establish before serious erosion from flash flooding is expected. Unlike other areas where planting should take place in November to capitalize on winter rainfall, SMZ planting should occur at the end of the rainy season (approximately April) to minimize risk of flooding to new plantings.

Additional techniques may be used in the SMZ to facilitate plant establishment and reduce erosion damage. Seedlings can be planted downstream from physical barriers, including naturally occurring large rocks (Figure 13) or installed structures such as wire cages filled with smaller rocks and affixed to the banks. Seedling size is another factor to consider more carefully in the SMZ. Elsewhere, relatively small seedlings are suitable and even preferable to minimize transplant shock. Here, however, small seedlings may be washed away by floods (Figure 13). Larger trees and well-established sedges or grasses have a better chance of withstanding floods. Trees with larger stems may be staked to reinforcing rods or bigger trees (Figure 13) resist breakage during moderate floods. Sedge clumps (Figure 13) with large root systems will more rapidly establish and tolerate inundation as well as moving water.



Figure 13. Planting areas in the SMZ include stream banks susceptible to erosion (top), as well as areas where floodwaters are slow-moving and plants can more easily establish (bottom right). Rocks and other obstructions that slow the rate of flow during floods can facilitate establishment (bottom left).

Stream banks that already exhibit serious erosion problems (Figure 13) may be stabilized first with geotextiles or rock cages; after silt accumulates behind these physical barriers, planting may become possible in these locations where it is currently infeasible.

5.6. Objectives for the entire parcel

Although specific prescriptions (e.g. herbicides, seedling spacing, species selection) are not relevant for the majority of the remaining areas on the rest of the 1,800 acres of Waimea Valley, several vital forest

management practices should be implemented across the property. Monitoring for incipient invasive weed species (§5.6.1) and implementing an integrated pest management (IPM) framework for the entire parcel (§5.6.2) may be modeled on those presented here, but would require alternate funding.

5.6.1. Incipient invasive weed monitoring

With lax import regulations and an ideal climate for rapid plant growth, Hawai'i suffers from aggressive invasive plant species infestations. Reversing the tide of long-established infestations across large areas is widely recognized to be impossible with realistic levels of funding, but preventing the incursion of new species can be done in a cost effective way. A property-wide monitoring scheme should be implemented to detect any incipient invasions. Such a program can focus on primary vector paths, especially roadsides, but should also periodically scan back-country locations in a systematic way to check for bird- or pig-dispersed species. This monitoring should be considered a part of IPM (see next section).

5.6.2. Integrated pest management

The IPM approach, which can be applied to both weed and insect pests, focuses on (1) monitoring potential pest agents, (2) identifying threshold densities or populations at which pests cause unacceptable economic damage, and (3) identifying and applying the most effective control agent. To control insect pests in IPM, the first step is to identify potential pest species. This requires a monitoring program that can take on varying degrees of sophistication. When damaging levels of the pest are discovered, the first option for control methods is typically a pheromone-based trapping system or adhesive traps. Chemical insecticides are used if control is impossible with more benign methods.

Generalist insect pests likely on the site include the Chinese rose beetle (*Adoretus sinicus*) and the black twig borer (*Xylosandrus compactus*). These pests are not typically problematic for native species, but damage levels should be monitored. Of substantial concern is the fungus *Fusarium oxysporum*, which could cause koa wilt disease at elevations below 2000 feet above sea level (asl). To date, WV personnel have not observed any symptoms of koa wilt, but the fungus is transported in soil and could easily be vectored by e.g. contaminated boots or tires. Development of a *Fusarium* hygiene program is strongly recommended, the basics of which would include chlorine bleach sterilization of all staff and volunteer footwear prior to entering the site. Because koa wilt has not yet been observed, *A. koa* planting should proceed; monitoring for wilt may be able to identify and curtail future infestations.

Other pests and pathogens can also be addressed in an IPM framework⁹. Feral hogs (*S. scrofa*) and rats (*R. rattus*, *R. norvegicus*) are known to be present on the site and have caused extensive damage to previous restoration efforts. In particular, Maintaining vigor and overall plant health is the first line of defense against insect and fungal pathogens. Pests and pathogens are ubiquitous, but vigorous trees resist attacks more effectively. Selecting species adapted (i.e. endemic) to the locale will mitigate pest and pathogen problems to a large extent. Some plants may be vulnerable to certain diseases, however, but they are nonetheless worth planting. For example, 'ōhi'a may be susceptible to the fungal pathogen *Puccinia psidii*, but 'ōhi'a is the one of the best options for restoration at Kalahe'e, so this risk should be taken.

⁹ Flint et al. 2003.

The final phase of IPM involves intervention with appropriate control methods. For animal pests, control options should focus on exclusion (e.g. hogs), but extermination may be necessary in exclosures (e.g. using traps for hogs, traps or poison for rats). For weed pests, the most effective control may not always be herbicide application, although herbicides are certainly an indispensable tool. Manual removal of weeds may be preferable especially for extremely high-threat species (e.g. *Miconia calvescens*, *Cyathea cooperi*) if any individuals are detected before populations become established.

5.7. Ecological monitoring

Effectiveness of the R_x, detecting incipient invasive species, and tracking progress of endangered species conservation can all be accomplished with an ecological monitoring program concentrating on rare habitat monitoring (designated NRCS practice).

5.7.1. Vegetation monitoring

Standard vegetation monitoring protocols should be implemented at WV, including point-based sampling in active restoration areas and line-intersect, transect, or non-systematic methods in areas not under intensive management. At the mauka restoration site, circular permanent sampling plots (PSP) with a radius of 5 m are recommended for each FMU. That is, a total of nine (9) PSP should be installed directly following the first out-planting. Trees and shrubs should be measured across the entire plot, while groundcovers and small seedlings should be measured on a smaller sub-plot of radius 2 m. At Kalahe'e, at least two PSP should be installed in each sub-unit, for a total of ten (10) PSP in the FMU after five years. In these areas, PSP should be measured on an annual schedule, preferably at the same date each year.

Vegetation monitoring in the lama forest should occur on the level of the whole exclosure. There are relatively few extant trees, and all new plantings can be tracked by individual. Similarly, out-planting survival of *Eugenia koolauensis* must, according to federal law, be measured for at least two years after establishment, and measures taken to ensure survival. On the rest of the property, vegetation monitoring may be limited to incipient weed detection programs (see §5.6.1).

5.7.2. Zoological monitoring

Although zoological monitoring is outside the purview of FSP, and therefore beyond the scope of this management plan, a low-level or passive zoological monitoring program may be implemented as part of the vegetation monitoring activities. For example, whilst walking invasive weed transects through the parcel outside of the FMU, staff or volunteers should watch out for native bird species or native tree snails. Similarly, if native bird sightings occur at any of the FMU PSP, especially as the project advances, these should be noted in the same dataset. Sightings of endangered waterfowl or the hoary bat may also be reported with vegetation datasets for this plan.

5.8. Property-wide management

5.8.1. Incipient weed control

Although much of the Waimea Valley parcel is already occupied with a known set of invasive weeds, there is a considerable risk from incipient weed species. The area experience heavy animal traffic both human (staff, volunteers, trespassers) and not (feral pigs, birds, rodents), which poses a significant threat of factoring weed seeds from elsewhere on the island(s). Two additional measures are recommended to combat the incipient weed threat, boot scrubbers and a property-wide monitoring program. It is already standard practice at the mauka site to scrub boots prior to entering the enclosure. This plan recommends expanding the boot cleaning protocol to the forest as a whole; requiring staff and volunteers to thoroughly clean footwear will improve the chances of avoiding importation of high-threat, especially small-seeded species such as the spore-dispersed Australian tree fern. Furthermore, asking volunteers to pre-clean footwear and inspect clothing for weed seeds should be emphasized during recruitment.

Controlling non-human animal vectors is a more challenging proposition. To some extent, feral pig control (§5.8.2) will reduce local seed movements and limit disturbances that facilitate germination of weed seeds. Importation of seeds by birds and rodents, however, will be virtually impossible to prevent, so the effects must be addressed by monitoring. Human-vectored weeds will grow primarily in the vicinity of trails, roads, fences, and work areas, which improves chances of detection. Pig, bird, or rodent-dispersed weeds, in contrast, may appear anywhere on the property. A monitoring program should cover areas inaccessible by road using a transect scheme that can be intensified over time in reaction to detection of new weed species or, inversely, scaled back if the apparent rate of introductions is low.

One strategy for such a monitoring program is to survey the property on an annual basis via a lattice of sampling points. Given the size of the parcel, a lattice 100 m by 400 m would adequately cover the area. Transects would be spaced 400 m apart, with sample points 100 m apart along the lines. Detailed species composition data would be recorded at sample points¹⁰, while presence or absence of species could be recorded whilst walking between points. Annually for a 1,900-acre parcel, approximately 160 person-hours of staff time would be required for field surveys, 40 hours for data processing and visualization, and supplemental time for eradication should any incipient weeds be detected.

5.8.2. Feral ungulate control

One of the most significant threats to native forest integrity is Waimea Valley is the large feral pig population. In the first third of 2014, staff and contract hunters removed 158 animals from the property; estimated staff time required on a weekly basis for activities related to pig control is 15 hours¹¹. At this point, staff are actively participating in trapping, snaring, and hunting (Figure 14). In the future, Waimea Valley will work to outsource pig control to contract hunters and potentially form a hunting club or cooperative. In either case, comparable staff time will be required for administration of these groups. Overall, feral ungulate removal can both achieve conservation objectives of weed control and disturbance reduction, as well as provide opportunities for responsible members of the hunting community.

¹⁰ Sample point configuration may vary with forest density, from a 5 m radius circle to smaller plots in dense forest

¹¹ L. Pool, Pers. Comm.



Figure 14. Waimea Valley staff control feral pigs using a combination of rifle hunting (left), snaring (center), and trapping (right). Feral pig control will continue to be a focus in this management plan, with outsourcing of the hunting activities as much as possible to afford full-time staff more opportunities to work directly with forest restoration.

5.8.3. Fire management

The Waimea Valley parcel is considered a medium fire risk area overall, but on a smaller scale certain areas are much drier than others. The wetland and lama forest are sufficiently damp to be low fire risks, but Kalahe'e and the *Eugenia* are can become quite dry on a seasonal basis. Fire breaks should be maintained around these two exclosures, with a clear width of at least twice the height of surrounding tree vegetation and six times the height of grasses. At Kahale'e, the firebreak will travel through grass and also ironwood (*Casuarina equisetifolia*) stands, potentially requiring firebreaks from 3 m to 10 m. Construction of the exclosure fences will typically clear a path wide enough to quality as a fire break; the areas should be kept vegetation-free likely using herbicides as the most cost-effective method. A broad-spectrum formulation with post- and pre-emergent activity (e.g. glyphosate and sulfometuron methyl) would be preferred.

5.8.4. Access maintenance

Road infrastructure across Waimea Valley totals approximately 10 miles, and consists principally of dirt surfaced 4x4 paths with several concrete stream fords. The roads are generally stable despite frequent and unpredictable flash flood conditions. Nevertheless, these access routes are critical to completing the forest management activities proposed in this plan, and their maintenance must be considered as part of the project cost. At the same time, the roads serve as potential corridors for invasive weed introduction or further movement of extant weeds within the property. Two types of road maintenance are recommended for this plan, (1) surface repair and maintenance as necessary, and (2) roadside weed control to prevent incipient weed establishment and contain existing species. The relevant access maintenance NRCS practice code is 518, particularly Non-Recreational routes of trail classes 3 – 5 (Accessible Routes, e.g. for volunteer and contract hunter access).

6. Budget and Schedule

The preceding management R_x are planned around a specific budget and implementation schedule for each FMU. Each R_x is assigned to a corresponding USDA NRCS code, and is given a per-unit cost. Costs of fencing (construction, maintenance) are assessed on per-foot basis. Seedling costs are assessed per plant, and integrated across species to an aggregate value of \$5.35. Remaining practices are assessed on a per-area basis, either of the FMU, the sub-unit (M1, etc., K1, etc.), or the annual managed acreage within a subunit. Specific budgets and schedules of operation are presented separately for the mauka restoration site, Kalahe'e reforestation area, lama forest, *Eugenia* conservation area, and wetland SMZ. Budget and schedule formatting are preserved across FMU. Detailed budgets are presented for each of the ten (10) years of the project, and summary budgets for the entire project duration. Schedules are presented on an annual basis, and R_x are implemented in the years in which corresponding cells are shaded dark green.

If property-wide management activities are funded by FSP (Table 8), costs would increase by the amounts required for ungulate control, access maintenance, incipient weed monitoring, and fuel break maintenance.

Table 8. Annual expenditures by FMU for the Waimea Valley forest management plan.

Period	Applicant	FSP	Mauka	Period	Applicant	FSP	Kalahe'e	Period	Applicant	FSP	Lama, Eug, Wetland	Annual Total
Year 1	\$ 3,145	\$ 3,145	\$ 6,290	Year 1	\$ 20,055.00	\$ 17,295.00	\$ 37,350	Year 1	\$ 2,789.00	\$ 2,789.00	\$ 5,578	\$ 49,218
Year 2	\$ 819	\$ 819	\$ 1,638	Year 2	\$ 3,586.00	\$ 826.00	\$ 4,412	Year 2	\$ 2,789.00	\$ 2,789.00	\$ 5,578	\$ 11,628
Year 3	\$ 4,306	\$ 4,306	\$ 8,612	Year 3	\$ 3,586.00	\$ 826.00	\$ 4,412	Year 3	\$ 2,789.00	\$ 2,789.00	\$ 5,578	\$ 18,602
Year 4	\$ 3,244	\$ 3,244	\$ 6,488	Year 4	\$ 3,586.00	\$ 826.00	\$ 4,412	Year 4	\$ 2,789.00	\$ 2,789.00	\$ 5,578	\$ 16,478
Year 5	\$ 1,770	\$ 1,770	\$ 3,540	Year 5	\$ 3,586.00	\$ 826.00	\$ 4,412	Year 5	\$ 2,789.00	\$ 2,789.00	\$ 5,578	\$ 13,530
Year 6	\$ 3,013	\$ 3,013	\$ 6,026	Year 6	\$ 51,366.00	\$ 51,366.00	\$ 102,732	Year 6	\$ 10,857.00	\$ 10,857.00	\$ 21,714	\$ 130,472
Year 7	\$ 4,566	\$ 4,566	\$ 9,132	Year 7	\$ 6,918.00	\$ 6,918.00	\$ 13,836	Year 7	\$ 3,393.00	\$ 3,393.00	\$ 6,786	\$ 29,754
Year 8	\$ 11,019	\$ 11,019	\$ 22,038	Year 8	\$ 6,997.00	\$ 6,997.00	\$ 13,994	Year 8	\$ 3,379.00	\$ 3,379.00	\$ 6,758	\$ 42,790
Year 9	\$ 10,528	\$ 10,528	\$ 21,056	Year 9	\$ 6,693.00	\$ 6,693.00	\$ 13,386	Year 9	\$ 3,393.00	\$ 3,393.00	\$ 6,786	\$ 41,228
Year 10	\$ 3,618	\$ 3,618	\$ 7,236	Year 10	\$ 13,487.00	\$ 13,487.00	\$ 26,974	Year 10	\$ 3,379.00	\$ 3,379.00	\$ 6,758	\$ 40,968
FMU Total:	\$ 46,028	\$ 46,028	\$ 92,056	Total:	\$ 119,860.00	\$ 106,060.00	\$ 225,920	Total:	\$ 38,346.00	\$ 38,346.00	\$ 76,692	\$ 394,668

Property-wide mgmt	Annual total w/ property-wide
\$ 38,001	\$ 87,219
\$ 43,401	\$ 55,029
\$ 43,401	\$ 62,003
\$ 43,401	\$ 59,879
\$ 43,401	\$ 56,931
\$ 43,401	\$ 173,873
\$ 43,401	\$ 73,155
\$ 43,401	\$ 86,191
\$ 43,401	\$ 84,629
\$ 43,401	\$ 84,369
\$ 428,610	\$ 823,278

**Waimea Valley Forest Stewardship management plan
Implementation Schedule**

Year 1 Mauka Site	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	14.1	\$60.71	\$856.00	\$428.00	\$428.00			M1-M8
Integrated pest mgmt	1.1	\$259.09	\$285.00	\$142.50	\$142.50			M8
Brush management (chem)	1.2	\$351.67	\$422.00	\$211.00	\$211.00			M1
Access control	2.3	\$102.17	\$235.00	\$117.50	\$117.50			M1,M8
Rare habitat monitoring	2.3	\$66.09	\$152.00	\$76.00	\$76.00			M1,M8
Brush management (manu)	1.2	\$553.33	\$664.00	\$332.00	\$332.00			M1
Woody residue treatment	1.2	\$251.67	\$302.00	\$151.00	\$151.00			M1
Seedlings	1.2	\$1,075.83	\$1,291.00	\$645.50	\$645.50			M1
Critical area planting	1.2	\$276.67	\$332.00	\$166.00	\$166.00			M1
Competition control	1.2	\$221.67	\$266.00	\$133.00	\$133.00			M1
TOTAL			\$4,805.00	\$2,402.50	\$2,402.50	\$0.00	\$0.00	

Year 1 Kalah'e	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence construction	14.6	\$2,369.18	\$34,590.00	\$17,295.00	\$17,295.00			K1
Brush management (chem)	5	\$3,582.40	\$17,912.00	\$8,956.00		\$8,956.00		K4
Tree/Shrub Site Prep	1	\$2,540.00	\$2,540.00	\$1,270.00			\$1,270.00	K1 (CREP(a), 1 acre)
Access control	2	\$0.00						
Rare habitat monitoring	1	\$0.00						
Brush management (manu)	1	\$414.00	\$414.00	\$212.00			\$212.00	K1 (CREP(a), 1 acre)
Woody residue treatment	5	\$1,158.80	\$5,794.00	\$2,897.00		\$2,897.00		K4
Competition control	2	\$0.00						
Seedlings	1	\$0.00						
Critical area planting	0							
TOTAL			\$61,250.00	\$30,630.00	\$17,295.00	\$11,853.00	\$1,482.00	

Year 1 Wetland, Lama forest, Euge forest	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence construction								
Brush management (chem)	1	\$1,625.00	\$1,625.00	\$812.50	\$812.50			W1
Access control	1	\$100.00	\$100.00	\$50.00	\$50.00			W1
Integrated pest management	1	\$250.00	\$250.00	\$125.00	\$125.00			W1
Rare habitat monitoring								
Seedlings	1	\$1,873.00	\$1,873.00	\$936.50	\$936.50			W1
SMZ improvement	1	\$1,400.00	\$1,400.00	\$700.00	\$700.00			W1
Competition control	1	\$220.00	\$220.00	\$110.00	\$110.00			W1
TOTAL			\$5,468.00	\$2,734.00	\$2,734.00	\$0.00	\$0.00	

Year 1 Property Wide Mgmt	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Ungulate control	1875	\$14.50	\$27,187.50	\$13,593.75	\$13,593.75			WVP
Trail Maintenance	10 mi	\$166.00	\$4,150.00	\$2,075.00	\$2,075.00			RD
Roadside weed control	10 mi	\$333.00	\$3,330.00	\$1,665.00	\$1,665.00			RD
Fuel break	1 mi	\$333.00	\$333.00	\$166.50	\$166.50			FB
TOTAL			\$35,000.50	\$17,500.25	\$17,500.25	\$0.00	\$0.00	

Year 1 Total \$106,523.50 \$53,266.75 \$39,931.75 \$11,853.00 \$1,482.00

Year 2 Mauka Site	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	6.6	\$63.48	\$419.00	\$209.50	\$209.50			M2,M4,M6,M8
Integrated pest mgmt	1.2	\$251.67	\$302.00	\$151.00	\$151.00			M1
Access control	2.3	\$102.17	\$235.00	\$117.50	\$117.50			M1,M8
Competition control	1.2	\$221.67	\$266.00	\$133.00	\$133.00			M1
Rare habitat monitoring	2.3	\$66.09	\$152.00	\$76.00	\$76.00			M1,M8
Competition control	1.2	\$221.67	\$266.00	\$133.00	\$133.00			M1
TOTAL			\$1,640.00	\$820.00	\$820.00	\$0.00	\$0.00	

Year 2 Kalah'e	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence construction	0							
Fence maintenance	14.6	\$39.18	\$572.00	\$286.00	\$286.00			K1
Access control	2	\$0.00						
Brush management (manu)	2	\$414.00	\$828.00	\$414.00			\$414.00	CREP (b)
Tree/Shrub Site Prep	7	\$3,284.57	\$22,992.00	\$11,496.00		\$8,956.00	\$2,540.00	K4 (EQUIP, 5 acres), K1 (CREP (b), 2 acres)
Competition control	2	\$0.00						
Rare habitat monitoring	1	\$0.00						
Herbaceous weed mgmt (manu)	1	\$328.00	\$328.00	\$164.00			\$164.00	K1 CREP(a)
Woody residue treatment	1	\$0.00						
Competition control	2	\$0.00						
Seedlings (Rip. Forest Buffer)	1	\$21,930.00	\$21,930.00	\$10,965.00			\$10,965.00	K1 CREP(a)
Critical area planting	0							
TOTAL			\$46,650.00	\$23,325.00	\$286.00	\$8,956.00	\$14,083.00	

Year 2 Wetland, Lama forest, Euge Units	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance								
Access control	1	\$100.00	\$100.00	\$50.00	\$50.00			W1
Integrated pest management	1	\$250.00	\$250.00	\$125.00	\$125.00			W1
Brush management (chem)	1	\$1,625.00	\$1,625.00	\$812.50	\$812.50			W1
Competition control	1	\$220.00	\$220.00	\$110.00	\$110.00			W1
Rare habitat monitoring								
Competition control	1	\$110.00	\$110.00	\$55.00	\$55.00			W1
Seedlings	1	\$1,873.00	\$1,873.00	\$936.50	\$936.50			W1
SMZ improvement	1	\$1,400.00	\$1,400.00	\$700.00	\$700.00			W1
TOTAL			\$5,578.00	\$2,789.00	\$2,789.00	\$0.00	\$0.00	

Year 2 Property Wide Mgmt	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Ungulate control	1875	\$14.50	\$27,187.50	\$13,593.75	\$13,593.75			WVP
Trail Maintenance	10 mi	\$166.00	\$4,150.00	\$2,075.00	\$2,075.00			RD
Roadside weed control	10 mi	\$333.00	\$3,330.00	\$1,665.00	\$1,665.00			RD
Fuel break	1 mi	\$333.00	\$333.00	\$166.50	\$166.50			FB
Incipient weed mgmt	1875	\$4.48	\$8,400.00	\$4,200.00	\$4,200.00			WVP
TOTAL			\$43,400.50	\$21,700.25	\$21,700.25	\$0.00	\$0.00	

YEAR 2 Total \$97,268.50 \$48,634.25 \$25,595.25 \$8,956.00 \$14,083.00

Year 3 Mauka Site	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	7.5	\$58.27	\$437.00	\$218.50	\$218.50			M1,M3,M5,M7
Integrated pest mgmt	3.3	\$250.30	\$826.00	\$413.00	\$413.00			M2,M8
Access control	6.3	\$100.32	\$632.00	\$316.00	\$316.00			M1,M2,M7,M8
Brush management (chem)	2.2	\$540.91	\$1,190.00	\$595.00	\$595.00			M2
Competition control	0		\$0.00	\$0.00	\$0.00			
Rare habitat monitoring	6.3	\$65.24	\$411.00	\$205.50	\$205.50			M1,M2,M7,M8
Brush management (manu)	2.2	\$540.91	\$1,190.00	\$595.00	\$595.00			M2
Woody residue treatment	2.2	\$245.91	\$541.00	\$270.50	\$270.50			M2
Competition control	2.2	\$216.36	\$476.00	\$238.00	\$238.00			M2
Seedling	2.2	\$1,052.27	\$2,315.00	\$1,157.50	\$1,157.50			M2
Critical area planting	2.2	\$270.45	\$595.00	\$297.50	\$297.50			M2
TOTAL			\$8,613.00	\$4,306.50	\$4,306.50	\$0.00	\$0.00	

Year 3 Kalah'e		Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	14.6	\$39.18	\$572.00	\$286.00	\$286.00	\$0.00			K1
Access control	2	\$0.00		\$0.00		\$0.00			
Tree/Shrub Site Prep	2	\$2,540.00	\$5,080.00	\$2,540.00				\$2,540.00	K1 CREP@
Herbaceous Weed mgmt	2	\$328.00	\$656.00	\$328.00				\$328.00	K1 CREP(b)
Competition control	2	\$220.00	\$440.00	\$220.00		\$220.00			
Rare habitat monitoring	1	\$65.00	\$65.00	\$32.50					
Brush management (manu)	2	\$414.00	\$828.00	\$414.00				\$414.00	K1 CREP@
Mulching	5	\$1,492.40	\$7,462.00	\$3,731.00			\$3,731.00		K4
Woody residue treatment	1	\$250.00	\$250.00	\$125.00					
Competition control	2	\$220.00	\$440.00	\$220.00		\$220.00			
Seedlings (Rip. Forest Buffer)	2	\$21,930.00	\$43,860.00	\$21,930.00				\$21,930.00	K1 CREP (b)
Seedlings	5	\$30,976.00	\$154,880.00	\$77,440.00			\$77,440.00		K4
TOTAL			\$214,533.00	\$107,266.50	\$726.00	\$81,171.00	\$25,212.00		

Year 3 Wetland, Lama forest, Euge forest, Fuge Units		Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Access control	1	\$100.00	\$100.00	\$50.00	\$50.00				W1
Integrated pest management	1	\$250.00	\$250.00	\$125.00	\$125.00				W1
Brush management (chem)	1	\$1,625.00	\$1,625.00	\$812.50	\$812.50				W1
Competition control	1	\$220.00	\$220.00	\$110.00	\$110.00				W1
Competition control 2	1	\$110.00	\$110.00	\$55.00	\$55.00				W1
Seedlings	1	\$1,873.00	\$1,873.00	\$936.50	\$936.50				W1
SMZ improvement	1	\$1,400.00	\$1,400.00	\$700.00	\$700.00				W1
TOTAL			\$5,578.00	\$2,789.00	\$2,789.00	\$0.00	\$0.00	\$0.00	

Year 3 Property Wide Mgmt		Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Ungulate control	1875	\$14.50	\$27,187.50	\$13,593.75	\$13,593.75				WVP
Trail Maintenance	10 mi	\$166.00	\$4,150.00	\$2,075.00	\$2,075.00				RD
Roadside weed control	10 mi	\$333.00	\$3,330.00	\$1,665.00	\$1,665.00				RD
Fuel break	1 mi	\$333.00	\$333.00	\$166.50	\$166.50				FB
Incipient weed mgmt	1875	\$4.48	\$8,400.00	\$4,200.00	\$4,200.00				WVP
TOTAL			\$43,400.50	\$21,700.25	\$21,700.25	\$0.00	\$0.00	\$0.00	

YEAR 3 Total	\$272,124.50	\$136,062.25	\$29,521.75	\$81,171.00	\$25,212.00
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Year 4 Property Wide Mgmt	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Ungulate control	1875	\$14.50	\$27,187.50	\$13,593.75	\$13,593.75			WVP
Trail Maintenance	10 mi	\$166.00	\$4,150.00	\$2,075.00	\$2,075.00			RD
Roadside weed control	10 mi	\$333.00	\$3,330.00	\$1,665.00	\$1,665.00			RD
Fuel break	1 mi	\$333.00	\$333.00	\$166.50	\$166.50			FB
Incipient weed mgmt	1875	\$4.48	\$8,400.00	\$4,200.00	\$4,200.00			WVP
TOTAL			\$43,400.50	\$21,700.25	\$21,700.25	\$0.00	\$0.00	

YEAR 4 Total \$110,260.50 \$53,840.25 \$28,020.25 \$772.00 \$25,048.00

Year 5 Mauka Site	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	7.5	\$58.27	\$437.00	\$218.50	\$218.50			M1,M3,M5,M7
Integrated pest mgmt	4.5	\$248.67	\$1,119.00	\$559.50	\$559.50			M2,M6,M8
Access control	7.5	\$99.87	\$749.00	\$374.50	\$374.50			M1,M2,M6,M7,M8
Brush management (chem)	0							
Competition control	1.1	\$228.18	\$251.00	\$125.50	\$125.50			M8
Rare habitat monitoring	9.9	\$65.15	\$645.00	\$322.50	\$322.50			M1,M2,M6,M7,M8,M9
Brush management (manu)	0			\$0.00	\$0.00			
Woody residue treatment	0			\$0.00	\$0.00			
Competition control	1.1	\$228.18	\$251.00	\$125.50	\$125.50			M8
Seedling	0							
Critical area planting	0							
TOTAL			\$3,452.00	\$1,726.00	\$1,726.00	\$0.00	\$0.00	

Year 5 Kalahole	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	14.6	\$39.18	\$572.00	\$286.00	\$286.00			K1,K3,K5
Access control	2	\$100.00	\$200.00	\$100.00	\$100.00			K1-K5
Brush management (chem)	1	\$825.00	\$825.00	\$412.50				K1-K5
Tree/Shrub Site Prep	2	\$2,540.00	\$5,080.00	\$2,540.00			\$2,540.00	K1 CREP {e}
Competition control	2	\$220.00	\$440.00	\$220.00	\$220.00			K1-K5
Herbaceous Weed mgmt	2	\$164.00	\$328.00	\$164.00			\$164.00	K1 CREP (d)
Seedlings (Rip. Forest Buffer)	2	\$21,930.00	\$43,860.00	\$21,930.00			\$21,930.00	K1 CREP (d)
Rare habitat monitoring	1	\$65.00	\$65.00	\$32.50				K1-K5
Brush management (manu)	1	\$550.00	\$550.00	\$275.00				K1-K5
Brush management (manu)	2	\$275.00	\$550.00	\$414.00			\$414.00	K1 CREP {e}
Woody residue treatment	1	\$250.00	\$250.00	\$125.00				K1-K5
Competition control	2	\$220.00	\$440.00	\$220.00	\$220.00			K1-K5
Seedlings	1	\$1,070.00	\$1,070.00	\$535.00				K1-K5
Critical area planting	0							
TOTAL			\$54,230.00	\$27,254.00	\$826.00	\$0.00	\$25,048.00	

Year 5 Wetland, Lama forest, Euge Units									
	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU	
Fence maintenance									
Access control	1	\$100.00	\$100.00	\$50.00	\$50.00			W1	
Integrated pest management	1	\$250.00	\$250.00	\$125.00	\$125.00			W1	
Brush management (chem)	1	\$1,560.00	\$1,560.00	\$780.00	\$780.00			W1	
Competition control	1	\$220.00	\$220.00	\$110.00	\$110.00			W1	
Rare habitat monitoring									
Competition control 2	1	\$110.00	\$110.00	\$55.00	\$55.00			W1	
Seedlings	1	\$1,873.00	\$1,873.00	\$936.50	\$936.50			W1	
SMZ improvement	1	\$1,400.00	\$1,400.00	\$700.00	\$700.00			W1	
TOTAL			\$5,513.00	\$2,756.50	\$2,756.50	\$0.00	\$0.00		

Year 5 Property Wide Mgmt									
	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU	
Ungulate control	1875	\$14.50	\$27,187.50	\$13,593.75	\$13,593.75			WVP	
Trail Maintenance	10 mi	\$166.00	\$4,150.00	\$2,075.00	\$2,075.00			RD	
Roadside weed control	10 mi	\$333.00	\$3,330.00	\$1,665.00	\$1,665.00			RD	
Fuel break	1 mi	\$333.00	\$333.00	\$166.50	\$166.50			FB	
Incipient weed mgmt	1875	\$4.48	\$8,400.00	\$4,200.00	\$4,200.00			WVP	
TOTAL			\$43,400.50	\$21,700.25	\$21,700.25	\$0.00	\$0.00		

YEAR 5 Total \$106,595.50 \$53,336.75 \$27,008.75 \$0.00 \$25,048.00

Year 6 Mauka Site									
	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU	
Fence maintenance	6.6	\$63.48	\$419.00	\$209.50	\$209.50			M2,M4,M6,M8	
Integrated pest mgmt	3.6	\$250.28	\$901.00	\$450.50	\$450.50			M1,M9	
Access control	7.5	\$99.87	\$749.00	\$374.50	\$374.50			M1,M2,M6,M7,M8	
Competition control	0	0	\$0.00	\$0.00	\$0.00				
Brush management (chem)	3	\$552.67	\$1,658.00	\$829.00	\$829.00			M1,M7	
Rare habitat monitoring	9.9	\$64.95	\$643.00	\$321.50	\$321.50			M1,M2,M6,M7,M8,M9	
Brush management (manu)	3	\$552.67	\$1,658.00	\$829.00	\$829.00			M1,M7	
Competition control	0	0	\$0.00	\$0.00	\$0.00				
TOTAL			\$6,028.00	\$3,014.00	\$3,014.00	\$0.00	\$0.00		

Year 6 Kalah'e									
	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU	
Fence construction	31.3	\$2,899.87	\$90,766.00	\$45,383.00	\$45,383.00			K2,K4	
Fence maintenance	0	0	\$0.00						
Access control	5	\$100.00	\$500.00	\$250.00	\$250.00			K1,K2,K4	
Brush suppression (chem)	3	\$200.00	\$600.00	\$300.00	\$300.00			K2,K4	
Brush management (chem)	3	\$825.00	\$2,475.00	\$1,237.50	\$1,237.50			K2,K4	
Competition control	3	\$220.00	\$660.00	\$330.00	\$330.00			K1,K4	

Herbaceous Weed mgmt	2	\$164.00	\$328.00	\$164.00				\$164.00	K1 CREP {e}
Seedlings (Rip. Forest Buffer)	2	\$21,930.00	\$43,860.00	\$21,930.00				\$21,930.00	K1 CREP {e}
Rare habitat monitoring	3	\$65.00	\$195.00	\$97.50				\$97.50	K2,K4
Brush management (manu)	3	\$550.00	\$1,650.00	\$825.00				\$825.00	K2,K4
Woody residue treatment	3	\$250.00	\$750.00	\$375.00				\$375.00	K2,K4
Competition control	5	\$220.00	\$1,100.00	\$550.00				\$550.00	K1,K2,K4
Seedlings	3	\$1,070.00	\$3,210.00	\$1,605.00				\$1,605.00	K2,K4
Critical area planting	3	\$275.00	\$825.00	\$412.50				\$412.50	K2,K4
TOTAL			\$146,919.00	\$73,459.50	\$51,365.50	\$0.00	\$22,094.00		

Year 6 Wetland, Lama forest, Euge forest, Euge Units									
Fence construction	2.4		\$14,188.00	\$7,094.00	\$7,094.00				E1,L1,W1
Fence maintenance									
Access control	3.4	\$101.18	\$344.00	\$172.00				\$172.00	E1,L1,W1
Integrated pest management	3.4	\$252.65	\$859.00	\$429.50				\$429.50	E1,L1,W1
Brush management (chem)	2.4	\$1,067.08	\$2,561.00	\$1,280.50				\$1,280.50	E1,W1
Competition control	1	\$220.00	\$220.00	\$110.00				\$110.00	W1
Rare habitat monitoring	2.4	\$66.25	\$159.00	\$79.50				\$79.50	E1,L1
Competition control 2	1	\$110.00	\$110.00	\$55.00				\$55.00	W1
Seedlings	1	\$1,873.00	\$1,873.00	\$936.50				\$936.50	W1
SMZ improvement	1	\$1,400.00	\$1,400.00	\$700.00				\$700.00	W1
TOTAL			\$21,714.00	\$10,857.00	\$10,857.00	\$0.00	\$0.00		

Year 6 Property Wide Mgmt									
Ungulate control	1875	\$14.50	\$27,187.50	\$13,593.75	\$13,593.75				WVP
Trail Maintenance	10 mi	\$166.00	\$4,150.00	\$2,075.00	\$2,075.00				RD
Roadside weed control	10 mi	\$333.00	\$3,330.00	\$1,665.00	\$1,665.00				RD
Fuel break	1 mi	\$333.00	\$333.00	\$166.50	\$166.50				FB
Incipient weed mgmt	1875	\$4.48	\$8,400.00	\$4,200.00	\$4,200.00				WVP
TOTAL			\$43,400.50	\$21,700.25	\$21,700.25	\$0.00	\$0.00		

Year 6 Total			\$218,061.50	\$109,030.75	\$86,936.75	\$0.00	\$22,094.00		
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Year 7 Mauka Site	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	8.7	\$60.34	\$525.00	\$262.50	\$262.50			M1,M3,M5,M6,M7
Access control	14.1	\$99.86	\$1,408.00	\$704.00	\$704.00			M1-M8
Integrated pest mgmt	8.4	\$250.71	\$2,106.00	\$1,053.00	\$1,053.00			M2,M4,M6,M7,M8
Competition control								
Brush management (chem)	2.3	\$552.61	\$1,271.00	\$635.50	\$635.50			M6,M8
Rare habitat monitoring	16.5	\$64.91	\$1,071.00	\$535.50	\$535.50			M1-M9
Brush management (manu)	1.1	\$570.00	\$627.00	\$313.50	\$313.50			M8
Woody Residue treatment	1.2	\$244.17	\$293.00	\$146.50	\$146.50			M6
Competition control	1.2	\$214.17	\$257.00	\$128.50	\$128.50			M6
Seedling	1.2	\$1,043.33	\$1,252.00	\$626.00	\$626.00			M6
Critical area planting	1.2	\$268.33	\$322.00	\$161.00	\$161.00			M6
TOTAL			\$7,008.00	\$4,566.00	\$4,566.00	\$0.00	\$0.00	

Year 7 Kalah'e	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	45.9	\$44.25	\$2,031.00	\$1,015.50	\$1,015.50			K1,K2,K4
Access control	5	\$100.00	\$500.00	\$250.00	\$250.00			K1,K2,K4
Brush suppression (chem)	0							
Brush management (chem)	3	\$825.00	\$2,475.00	\$1,237.50	\$1,237.50			K2,K4
Competition control	5	\$220.00	\$1,100.00	\$550.00	\$550.00			K1,K2,K4
Rare habitat monitoring	5	\$39.00	\$195.00	\$97.50	\$97.50			K2,K4
Brush management (manu)	3	\$550.00	\$1,650.00	\$825.00	\$825.00			K2,K4
Woody residue treatment	3	\$250.00	\$750.00	\$375.00	\$375.00			K2,K4
Competition control	5	\$220.00	\$1,100.00	\$550.00	\$550.00			K1,K2,K4
Seedlings	3	\$1,070.00	\$3,210.00	\$1,605.00	\$1,605.00			K2,K4
Critical area planting	3	\$275.00	\$825.00	\$412.50	\$412.50			K2,K4
TOTAL			\$13,836.00	\$6,918.00	\$6,918.00	\$0.00	\$0.00	

Year 7 Wetland, Lama forest, Euge Units	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	1.4	\$187.86	\$263.00	\$131.50	\$131.50			E1
Access control	3.4	\$101.18	\$344.00	\$172.00	\$172.00			E1,L1,W1
Integrated pest management	3.4	\$252.65	\$859.00	\$429.50	\$429.50			E1,L1,W1
Brush management (chem)	1	\$1,625.00	\$1,625.00	\$812.50	\$812.50			W1
Competition control	1	\$220.00	\$220.00	\$110.00	\$110.00			W1
Rare habitat monitoring	1.4	\$67.14	\$94.00	\$47.00	\$47.00			E1
Competition control 2	1	\$110.00	\$110.00	\$55.00	\$55.00			W1
Seedlings	1	\$1,873.00	\$1,873.00	\$936.50	\$936.50			W1
SMZ improvement	1	\$1,400.00	\$1,400.00	\$700.00	\$700.00			W1
TOTAL			\$6,788.00	\$3,394.00	\$3,394.00	\$0.00	\$0.00	

Year 7 Property Wide Mgmt	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Ungulate control	1875	\$14.50	\$27,187.50	\$13,593.75	\$13,593.75			WVP
Trail Maintenance	10 mi	\$166.00	\$4,150.00	\$2,075.00	\$2,075.00			RD
Roadside weed control	10 mi	\$333.00	\$3,330.00	\$1,665.00	\$1,665.00			RD
Fuel break	1 mi	\$333.00	\$333.00	\$166.50	\$166.50			FB
Incipient weed mgmt	1875	\$4.48	\$8,400.00	\$4,200.00	\$4,200.00			WVP
TOTAL			\$43,400.50	\$21,700.25	\$21,700.25	\$0.00	\$0.00	

Year 7 Total \$71,403,250 \$36,578.25 \$36,578.25 \$0.00 \$0.00

Year 8 Mauka Site	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	6.6	\$63.48	\$419.00	\$209.50	\$209.50			M2,M4,M6,M8
Access control	12	\$99.50	\$1,194.00	\$597.00	\$597.00			M1-M3,M5-M8
Integrated pest mgmt	12	\$223.33	\$2,680.00	\$1,340.00	\$1,340.00			M1,M3,M4,M5,M7,M8
Competition control	1.2	\$214.17	\$257.00	\$128.50	\$128.50			M6
Brush management (chem)	6.9	\$549.42	\$3,791.00	\$1,895.50	\$1,895.50			M2,M3,M4
Rare habitat monitoring	16.5	\$64.91	\$1,071.00	\$535.50	\$535.50			M1-M8
Brush management (manu)	6.9	\$549.42	\$3,791.00	\$1,895.50	\$1,895.50			M2,M3,M4
Woody residue treatment	4.7	\$251.49	\$1,182.00	\$591.00	\$591.00			M3,M4
Competition control	5.9	\$219.83	\$1,297.00	\$648.50	\$648.50			M3,M4,M6
Seedlings	4.7	\$1,076.38	\$5,059.00	\$2,529.50	\$2,529.50			M3,M4
Critical area planting	4.7	\$276.60	\$1,300.00	\$650.00	\$650.00			M3,M4
TOTAL			\$9,412.00	\$11,020.50	\$11,020.50	\$0.00	\$0.00	

Year 8 Kalah'e	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	31.3	\$46.61	\$1,459.00	\$729.50	\$729.50			K2,K4
Access control	5	\$100.00	\$500.00	\$250.00	\$250.00			K1-K5
Brush suppression (chem)	3	\$200.00	\$600.00	\$300.00	\$300.00			K2,K4
Brush management (chem)	3	\$825.00	\$2,475.00	\$1,237.50	\$1,237.50			K2
Competition control	5	\$220.00	\$1,100.00	\$550.00	\$550.00			K1,K2,K4
Rare habitat monitoring	5	\$65.00	\$325.00	\$162.50	\$162.50			K1-K5
Brush management (manu)	3	\$550.00	\$1,650.00	\$825.00	\$825.00			K2
Woody residue treatment	3	\$250.00	\$750.00	\$375.00	\$375.00			K2
Competition control	5	\$220.00	\$1,100.00	\$550.00	\$550.00			K1,K2,K4
Seedlings	3	\$1,070.00	\$3,210.00	\$1,605.00	\$1,605.00			K2
Critical area planting	3	\$275.00	\$825.00	\$412.50	\$412.50			K2
TOTAL			\$13,994.00	\$6,997.00	\$6,997.00	\$0.00	\$0.00	

Year 8 Wetland, Lama forest, Euge forest	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	2.4	\$109.58	\$263.00	\$131.50	\$131.50			L1
Access control	3.4	\$101.18	\$344.00	\$172.00	\$172.00			E1,L1,W1
Integrated pest management	3.4	\$252.65	\$859.00	\$429.50	\$429.50			E1,L1,W1
Brush management (chem)	1	\$1,625.00	\$1,625.00	\$812.50	\$812.50			W1
Competition control	1	\$220.00	\$220.00	\$110.00	\$110.00			W1
Rare habitat monitoring	1	\$65.00	\$65.00	\$32.50	\$32.50			L1
Competition control 2	1	\$110.00	\$110.00	\$55.00	\$55.00			W1
Seedlings	1	\$1,873.00	\$1,873.00	\$936.50	\$936.50			W1
SMZ improvement	1	\$1,400.00	\$1,400.00	\$700.00	\$700.00			W1
TOTAL			\$6,759.00	\$3,379.50	\$3,379.50	\$0.00	\$0.00	

Year 8 Property Wide Mgmt	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Ungulate control	1875	\$14.50	\$27,187.50	\$13,593.75	\$13,593.75			WVP
Trail Maintenance	10 mi	\$166.00	\$4,150.00	\$2,075.00	\$2,075.00			RD
Roadside weed control	10 mi	\$333.00	\$3,330.00	\$1,665.00	\$1,665.00			RD
Fuel break	1 mi	\$333.00	\$333.00	\$166.50	\$166.50			FB
Incipient weed mgmt	1875	\$4.48	\$8,400.00	\$4,200.00	\$4,200.00			WVP
TOTAL			\$43,400.50	\$21,700.25	\$21,700.25	\$0.00	\$0.00	

YEAR 8 Total **\$73,565.50** **\$43,097.25** **\$43,097.25** **\$0.00** **\$0.00**

Year 9 Mauka Site	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	7.5	\$58.27	\$437.00	\$218.50	\$218.50			M1,M3,M5,M7
Integrated pest mgmt	9	\$330.22	\$2,972.00	\$1,486.00	\$1,486.00			M2,M4,M6,M8,M9
Access control	14.1	\$99.86	\$1,408.00	\$704.00	\$704.00			M1-M8
Brush management (chem)	6.1	\$547.05	\$3,337.00	\$1,668.50	\$1,668.50			M5,M7,M9
Competition control	4.7	\$221.28	\$1,040.00	\$520.00	\$520.00			M3,M4
Brush management (manu)	3.7	\$545.68	\$2,019.00	\$1,009.50	\$1,009.50			M5,M7
Rare habitat monitoring	16.5	\$64.91	\$1,071.00	\$535.50	\$535.50			M1-M9
Woody residue treatment	4.3	\$247.67	\$1,065.00	\$532.50	\$532.50			M5,M9
Competition control	9	\$219.67	\$1,977.00	\$988.50	\$988.50			M3,M4,M5,M9
Seedlings	4.3	\$1,060.23	\$4,559.00	\$2,279.50	\$2,279.50			M5,M9
Critical area planting	4.3	\$272.56	\$1,172.00	\$586.00	\$586.00			M5,M9
TOTAL			\$21,057.00	\$10,528.50	\$10,528.50	\$0.00	\$0.00	

Year 9 Kalaha'e	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	45.9	\$44.25	\$2,031.00	\$1,015.50	\$1,015.50			K1,K2,K4
Access control	5	\$100.00	\$500.00	\$250.00	\$250.00			K1,K2,K4
Brush suppression (chem)	2	\$150.00	\$300.00	\$150.00	\$150.00			K1
Brush management (chem)	3	\$825.00	\$2,475.00	\$1,237.50	\$1,237.50			K2,K4
Competition control	3	\$220.00	\$660.00	\$330.00	\$330.00			K2,K4
Rare habitat monitoring	5	\$65.00	\$325.00	\$162.50	\$162.50			K1,K2,K4
Brush management (manu)	3	\$550.00	\$1,650.00	\$825.00	\$825.00			K2,K4
Woody residue treatment	3	\$250.00	\$750.00	\$375.00	\$375.00			K2,K4
Competition control	3	\$220.00	\$660.00	\$330.00	\$330.00			K2,K4
Seedlings	3	\$1,070.00	\$3,210.00	\$1,605.00	\$1,605.00			K2,K4
Critical area planting	3	\$275.00	\$825.00	\$412.50	\$412.50			K2,K4
TOTAL			\$13,386.00	\$6,693.00	\$6,693.00	\$0.00	\$0.00	

Year 9 Wetland, Lama forest, Euge forest	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	2.4	\$109.58	\$263.00	\$131.50	\$131.50			E1
Access control	3.4	\$101.18	\$344.00	\$172.00	\$172.00			E1,L1,W1
Integrated pest management	3.4	\$252.65	\$859.00	\$429.50	\$429.50			E1,L1,W1
Brush management (chem)	1	\$1,625.00	\$1,625.00	\$812.50	\$812.50			W1
Competition control	1	\$220.00	\$220.00	\$110.00	\$110.00			W1
Rare habitat monitoring	1.4	\$67.14	\$94.00	\$47.00	\$47.00			E1
Competition control 2	1	\$110.00	\$110.00	\$55.00	\$55.00			W1
Seedlings	1	\$1,873.00	\$1,873.00	\$936.50	\$936.50			W1
SMZ improvement	1	\$1,400.00	\$1,400.00	\$700.00	\$700.00			W1
TOTAL			\$6,788.00	\$3,394.00	\$3,394.00	\$0.00	\$0.00	

Year 9 Property Wide Mgmt	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Ungulate control	1875	\$14.50	\$27,187.50	\$13,593.75	\$13,593.75			WVP
Trail Maintenance	10 mi	\$166.00	\$4,150.00	\$2,075.00	\$2,075.00			RD
Roadside weed control	10 mi	\$333.00	\$3,330.00	\$1,665.00	\$1,665.00			RD
Fuel break	1 mi	\$333.00	\$333.00	\$166.50	\$166.50			FB
Incipient weed mgmt	1875	\$4.48	\$8,400.00	\$4,200.00	\$4,200.00			WVP
TOTAL			\$43,400.50	\$21,700.25	\$21,700.25	\$0.00	\$0.00	

YEAR 9 Total			\$84,631.50	\$42,315.75	\$42,315.75	\$0.00	\$0.00	
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Year 10 Mauka Site	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	6.6	\$63.48	\$419.00	\$209.50	\$209.50			M2,M4,M6,M8
Access control	12.2	\$100.16	\$1,222.00	\$611.00	\$611.00			M1-M4, M6-M8
Integrated pest mgmt	9.9	\$249.09	\$2,466.00	\$1,233.00	\$1,233.00			M1,M3,M5,M7,M9
Competition control	4.3	\$217.91	\$937.00	\$468.50	\$468.50			M5,M9
Brush management (chem)	1.9	\$97.89	\$186.00	\$93.00	\$93.00			M5
Rare habitat monitoring	10.2	\$64.71	\$660.00	\$330.00	\$330.00			M3-M6, M9
Competition control	6.1	\$172.95	\$1,055.00	\$527.50	\$527.50			M5,M7,M9
Critical area planting	4.5	\$65.11	\$293.00	\$146.50	\$146.50			M1,M2,M8
TOTAL			\$7,238.00	\$3,619.00	\$3,619.00	\$0.00	\$0.00	

Year 10 Kalah'e	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence construction	21.4	\$2,004.44	\$42,895.00	\$21,447.50	\$21,447.50			K3,K5
Fence maintenance	3	\$486.33	\$1,459.00	\$729.50	\$729.50			K2,K4
Access control	67.3	\$13.37	\$900.00	\$450.00	\$450.00			K1-K5
Brush suppression (chem)	3	\$200.00	\$600.00	\$300.00	\$300.00			K2,K4
Brush management (chem)	7	\$825.00	\$5,775.00	\$2,887.50	\$2,887.50			K2-K5
Competition control	5	\$220.00	\$1,100.00	\$550.00	\$550.00			K2,K4,K5
Rare habitat monitoring	9	\$65.00	\$585.00	\$292.50	\$292.50			K1-K5
Brush management (manu)	7	\$550.00	\$3,850.00	\$1,925.00	\$1,925.00			K2-K5
Woody residue treatment	7	\$250.00	\$1,750.00	\$875.00	\$875.00			K2-K5
Competition control	7	\$220.00	\$1,540.00	\$770.00	\$770.00			K2-K5
Seedlings	7	\$1,070.00	\$7,490.00	\$3,745.00	\$3,745.00			K2-K5
Critical area planting	7	\$275.00	\$1,925.00	\$962.50	\$962.50			K2-K5
TOTAL			\$69,869.00	\$34,934.50	\$34,934.50	\$0.00	\$0.00	

Year 10 Wetland, Lama forest, Eug Units	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Fence maintenance	2.4	\$109.58	\$263.00	\$131.50	\$131.50			L1
Access control	3.4	\$101.18	\$344.00	\$172.00	\$172.00			E1,L1,W1
Integrated pest management	3.4	\$252.65	\$859.00	\$429.50	\$429.50			E1,L1,W1
Brush management (chem)	1	\$1,625.00	\$1,625.00	\$812.50	\$812.50			W1
Competition control	1	\$220.00	\$220.00	\$110.00	\$110.00			W1
Rare habitat monitoring	1	\$65.00	\$65.00	\$32.50	\$32.50			E1
Competition control 2	1	\$110.00	\$110.00	\$55.00	\$55.00			W1
Seedlings	1	\$1,873.00	\$1,873.00	\$936.50	\$936.50			W1
SMZ improvement	1	\$1,400.00	\$1,400.00	\$700.00	\$700.00			W1
TOTAL			\$6,759.00	\$3,379.50	\$3,379.50	\$0.00	\$0.00	

Year 10 Property Wide Mgmt	Units	Cost/Unit	Total Cost	Applicant Share	FSP Share	EQUIP Share	CREP Share	FMU
Ungulate control	1875	\$14.50	\$27,187.50	\$13,593.75	\$13,593.75			WVP
Trail Maintenance	10 mi	\$166.00	\$4,150.00	\$2,075.00	\$2,075.00			RD
Roadside weed control	10 mi	\$333.00	\$3,330.00	\$1,665.00	\$1,665.00			RD
Fuel break	1 mi	\$333.00	\$333.00	\$166.50	\$166.50			FB
Incipient weed mgmt	1875	\$4.48	\$8,400.00	\$4,200.00	\$4,200.00			WVP
TOTAL			\$43,400.50	\$21,700.25	\$21,700.25	\$0.00	\$0.00	

YEAR 10 Total \$127,266.50 \$63,633.25 \$63,633.25 \$0.00 \$0.00

Total Project Cost \$1,267,330.00 \$639,895.50 \$422,639.00 \$102,752.00 \$112,967.00

6.1.2. Schedule

Activity	NRCS code	Year	Start month	Field								
				M1	M2	M3	M4	M5	M6	M7	M8	M9
Year 1 (2015)												
Fence maintenance	382	2014	6	█	█	█	█	█	█	█	█	█
Integrated pest mgmt.	595	2015	6									█
Brush management (chem)	314	2014	6	█								
Access control	472	2014	6	█								█
Rare habitat monitoring	643	2014	8	█								█
Brush management (manu)	314	2014	8	█								
Woody residue treatment	384	2014	9	█								
Seedlings	342	2014	11	█								
Critical area planting	342	2014	11	█								
Competition control	315	2014	12	█								

Year 2 (2016)												
Fence maintenance	382	2015	1		█		█		█		█	
Integrated pest mgmt.	595	2015	1	█								█
Access control	472	2015	1	█								█
Brush management (chem)	314	2015	3									
Competition control	315	2015	3	█								
Rare habitat monitoring	643	2015	8	█								█
Brush management (manu)	314	2015	8									
Woody residue treatment	384	2015	10									
Competition control	315	2015	11	█								
Seedlings	342	2015	12									
Critical area planting	342	2015	12									

Year 3 (2017)												
Fence maintenance	382	2016	1	█		█		█		█		
Integrated pest mgmt.	595	2015	1		█						█	█
Access control	472	2016	2	█	█					█	█	
Brush management (chem)	314	2016	3		█							
Competition control	315	2016	3									
Rare habitat monitoring	643	2016	8	█	█					█	█	
Brush management (manu)	314	2016	8		█							
Woody residue treatment	384	2016	10		█							
Competition control	315	2016	11		█							
Seedlings	342	2016	12		█							
Critical area planting	342	2016	12		█							

Year 7 (2021)				
Fence maintenance	382	2016	1	
Access control	472	2016	1	
Integrated pest mgmt.	595	2016	1	
Competition control	315	2016		
Brush maintenance (chem)	314	2016	3	
Rare habitat monitoring	643	2016	8	
Brush management (manu)	314	2016	8	
Woody residue treatment	384	2016	10	
Competition control	315	2016	11	
Seedlings	342	2016	12	
Critical area planting	342	2016	12	

Year 8 (2022)				
Fence maintenance	382	2016	1	
Access control	472	2016	1	
Integrated pest mgmt.	595	2016	1	
Competition control	315	2016	3	
Brush management (chem)	314	2016	3	
Rare habitat monitoring	643	2016	8	
Brush management (manu)	314	2016	8	
Rare habitat monitoring	643	2016	8	
Brush management (manu)	314	2016	8	
Woody residue treatment	384	2016	10	
Competition control	315	2016	11	
Seedlings	342	2016	12	
Critical area planting	342	2016	12	

Year 9 (2023)				
Fence maintenance	382	2016	1	
Access control	472	2016	1	
Brush management (chem)	314	2016	3	
Competition control	315	2016	3	
Brush management (manu)	314	2016	8	
Integrated pest mgmt.	595	2015	1	
Rare habitat monitoring	643	2016	8	
Woody residue treatment	384	2016	10	
Competition control	315	2016	11	
Seedlings	342	2016	12	
Critical area planting	342	2016	12	

Year 10 (2024)												
Fence maintenance	382	2016	1									
Access control	472	2016	1									
Integrated pest mgmt.	595	2014	1									
Competition control	643	2014	3									
Brush management (chem)	314	2016	3									
Brush management (manu)	314	2016	8									
Rare habitat monitoring	643	2016	8									
Competition control	643	2016	8									
Woody residue treatment	384	2016	10									
Competition control	315	2016	11									
Seedlings	342	2016	12									
Critical area planting	342	2016	12									

6.2. Kalahe'e reforestation area

6.2.1. Budget

Table 10. Management activities at Kalahe'e are prescribed in five fields, K1 – K5.. Fields K4 and K5 are positioned such that separate fences make sense for each field. Fencing, site preparation (brush management), and planting activities (seedlings, critical area planting, competition control) will be focused earlier in the project period. Maintenance activities will continue throughout the decade.

Waimea plans to obtain funds from Hawaii CREP for restoration work in K1 in the Kalahe'e site. FSP is being asked for funds related to fencing for K1. Waimea is also in contract with EQIP to restore 5 acres within K4.

Table 11. Annual budget totals for Kalahe'e FMU.

Period	Applicant	FSP	Kalahe'e
Year 1	\$ 11,084.00	\$ 8,324.00	\$ 19,408
Year 2	\$ 3,586.00	\$ 826.00	\$ 4,412
Year 3	\$ 3,586.00	\$ 826.00	\$ 4,412
Year 4	\$ 3,586.00	\$ 826.00	\$ 4,412
Year 5	\$ 3,586.00	\$ 826.00	\$ 4,412
Year 6	\$ 51,366.00	\$ 51,366.00	\$102,732
Year 7	\$ 6,918.00	\$ 6,918.00	\$ 13,836
Year 8	\$ 6,997.00	\$ 6,997.00	\$ 13,994
Year 9	\$ 6,693.00	\$ 6,693.00	\$ 13,386
Year 10	\$ 13,487.00	\$ 13,487.00	\$ 26,974
Total:	\$ 110,889.00	\$ 97,089.00	\$207,978

6.2.2. Schedule

Activity	NRCS code	Year	Start month	Field				
				K1	K2	K3	K4	K5
				14.6 ac	16.6 ac	11.2 ac	14.7 ac	10.2 ac
Year 1 (2015)								
Fence construction	382	2015	6					
Brush management (chem)	314	2015	6					
Access control	472	2015	6					
Rare habitat monitoring	643	2015	8					
Brush management (manu)	314	2015	8					
Woody residue treatment	384	2015	9					
Seedlings	342	2015	11					
Critical area planting	342	2015	11					
Competition control	315	2015	12					
Year 2 (2016)								
Fence construction	382	2014	---					
Fence maintenance	382	2016	---					
Access control	472	2016	2					
Brush management (chem)	314	2016	3					
Competition control	315	2016	3					
Rare habitat monitoring	643	2016	8					
Brush management (manu)	314	2016	8					
Woody residue treatment	384	2016	10					
Competition control	315	2016	11					
Seedlings	342	2016	12					
Critical area planting	342	2016	12					

				Year 3 (2017)			
Fence construction	382	2014	6				
Fence maintenance	382	2017	6	■			
Access control	472	2017	2	■			
Brush management (chem)	314	2017	3			■	
Competition control	315	2017	3	■			
Rare habitat monitoring	643	2017	8			■	
Brush management (manu)	314	2017	8			■	
Woody residue treatment	384	2017	10			■	
Competition control	315	2017	11	■			
Seedlings	342	2017	12			■	
Critical area planting	342	2017	12				

				Year 4 (2018)			
Fence maintenance	382	2014	2	■			
Access control	472	2018	2	■			
Brush management (chem)	314	2018	3			■	
Competition control	315	2018	3	■			
Rare habitat monitoring	643	2018	8			■	
Brush management (manu)	314	2018	8			■	
Woody residue treatment	384	2018	10			■	
Competition control	315	2018	11	■			
Seedlings	342	2018	12			■	
Critical area planting	342	2018	12				

				Year 5 (2019)			
Fence maintenance	382	2014	2	■			
Access control	472	2019	2	■			
Brush management (chem)	314	2019	3			■	
Competition control	315	2019	3	■			
Rare habitat monitoring	643	2019	8			■	
Brush management (manu)	314	2019	8			■	
Woody residue treatment	384	2019	10			■	
Competition control	315	2019	11	■			
Seedlings	342	2019	12			■	
Critical area planting	342	2019	12				

Year 6 (2020)							
Fence construction	382	2020	2				
Fence maintenance	382	2020	2				
Access control	472	2020	2				
Brush suppression (chem)	314	2020	2				
Brush management (chem)	314	2020	3				
Competition control	315	2020	3				
Rare habitat monitoring	643	2020	8				
Brush management (manu)	314	2020	8				
Woody residue treatment	384	2020	10				
Competition control	315	2020	11				
Seedlings	342	2020	12				
Critical area planting	342	2020	12				

Year 7 (2021)							
Fence maintenance	382	2016	2				
Access control	472	2021	2				
Brush suppression (chem)	314	2021	2				
Brush management (chem)	314	2021	3				
Competition control	315	2021	3				
Rare habitat monitoring	643	2021	8				
Brush management (manu)	314	2021	8				
Woody residue treatment	384	2021	10				
Competition control	315	2021	11				
Seedlings	342	2021	12				
Critical area planting	342	2021	12				

Year 8 (2022)							
Fence maintenance	382	2016	2				
Access control	472	2022	2				
Brush suppression (chem)	314	2022	2				
Brush management (chem)	314	2022	3				
Competition control	315	2022	3				
Rare habitat monitoring	643	2022	8				
Brush management (manu)	314	2022	8				
Woody residue treatment	384	2022	10				
Competition control	315	2022	11				
Seedlings	342	2022	12				
Critical area planting	342	2022	12				

Year 9 (2023)						
Fence maintenance	382	2016	2			
Access control	472	2023	2			
Brush suppression (chem)	314	2023	2			
Brush management (chem)	314	2023	3			
Competition control	315	2023	3			
Rare habitat monitoring	643	2023	8			
Brush management (manu)	314	2023	8			
Woody residue treatment	384	2023	10			
Competition control	315	2023	11			
Seedlings	342	2023	12			
Critical area planting	342	2023	12			

Year 10 (2024)						
Fence construction	382	2016	2			
Fence maintenance	382	2024	2			
Access control	472	2024	2			
Brush suppression (chem)	314	2024	2			
Brush management (chem)	314	2024	3			
Competition control	315	2024	3			
Rare habitat monitoring	643	2024	8			
Brush management (manu)	314	2024	8			
Woody residue treatment	384	2024	10			
Competition control	315	2024	11			
Seedlings	342	2024	12			
Critical area planting	342	2024	12			

6.3.2. Schedule

Activity	NRCS code	Year	Start month	Field		
				E1	L1	W1
				1.4 ac	1 ac	43.2 ac
Year 1 (2015)						
Fence construction	382	2020	6			
Brush management (chem)	314	2015	6			
Access control	472	2015	6			
Integrated pest mgmt.	595	2015	6			
Rare habitat monitoring	643	2015	8			
Seedlings	342	2015	9			
SMZ improvement	395	2015	11			
Competition control	315	2015	11			
Year 2 (2016)						
Fence maintenance	382	2015	2			
Access control	472	2015	2			
Integrated pest mgmt.	595	2015	6			
Brush management (chem)	314	2015	3			
Competition control	315	2015	3			
Rare habitat monitoring	643	2015	8			
Competition control 2	315	2015	9			
Seedlings	342	2015	11			
SMZ improvement	395	2015	11			
Year 3 (2017)						
Fence maintenance	382	2021	2			
Access control	472	2015	2			
Integrated pest mgmt.	595	2015	6			
Brush management (chem)	314	2015	3			
Competition control	315	2015	3			
Rare habitat monitoring	643	2015	8			
Competition control 2	315	2015	9			
Seedlings	342	2015	11			
SMZ improvement	395	2015	11			

Year 4 (2018)				
Fence maintenance	382	2021	2	
Access control	472	2015	2	
Integrated pest mgmt.	595	2015	6	
Brush management (chem)	314	2015	3	
Competition control	315	2015	3	
Rare habitat monitoring	643	2015	8	
Competition control 2	315	2015	9	
Seedlings	342	2015	11	
SMZ improvement	395	2015	11	

Year 5 (2019)				
Fence maintenance	382	2021	2	
Access control	472	2015	2	
Integrated pest mgmt.	595	2015	6	
Brush management (chem)	314	2015	3	
Competition control	315	2015	3	
Rare habitat monitoring	643	2015	8	
Competition control 2	315	2015	9	
Seedlings	342	2015	11	
SMZ improvement	395	2015	11	

Year 6 (2020)				
Fence construction	382	2021	2	
Fence maintenance	382	2015	2	
Access control	472	2015	2	
Integrated pest mgmt.	595	2015	6	
Brush management (chem)	314	2015	3	
Competition control	315	2015	3	
Rare habitat monitoring	643	2015	8	
Competition control 2	315	2015	9	
Seedlings	342	2015	11	
SMZ improvement	395	2015	11	

Year 7 (2021)				
Fence maintenance	382	2021	2	
Access control	472	2015	2	
Integrated pest mgmt.	595	2015	6	
Brush management (chem)	314	2015	3	
Competition control	315	2015	3	
Rare habitat monitoring	643	2015	8	
Competition control 2	315	2015	9	
Seedlings	342	2015	11	
SMZ improvement	395	2015	11	

Year 8 (2022)						
Fence maintenance	382	2021	2			
Access control	472	2015	2			
Integrated pest mgmt.	595	2015	6			
Brush management (chem)	314	2015	3			
Competition control	315	2015	3			
Rare habitat monitoring	643	2015	8			
Competition control 2	315	2015	9			
Seedlings	342	2015	11			
SMZ improvement	395	2015	11			

Year 9 (2023)						
Fence maintenance	382	2021	2			
Access control	472	2015	2			
Integrated pest mgmt.	595	2015	6			
Brush management (chem)	314	2015	3			
Competition control	315	2015	3			
Rare habitat monitoring	643	2015	8			
Competition control 2	315	2015	9			
Seedlings	342	2015	11			
SMZ improvement	395	2015	11			

Year 10 (2024)						
Fence maintenance	382	2021	2			
Access control	472	2015	2			
Integrated pest mgmt.	595	2015	6			
Brush management (chem)	314	2015	3			
Competition control	315	2015	3			
Rare habitat monitoring	643	2015	8			
Competition control 2	315	2015	9			
Seedlings	342	2015	11			
SMZ improvement	395	2015	11			

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8. Maps

Waimea Valley FSP | Forest Management Units

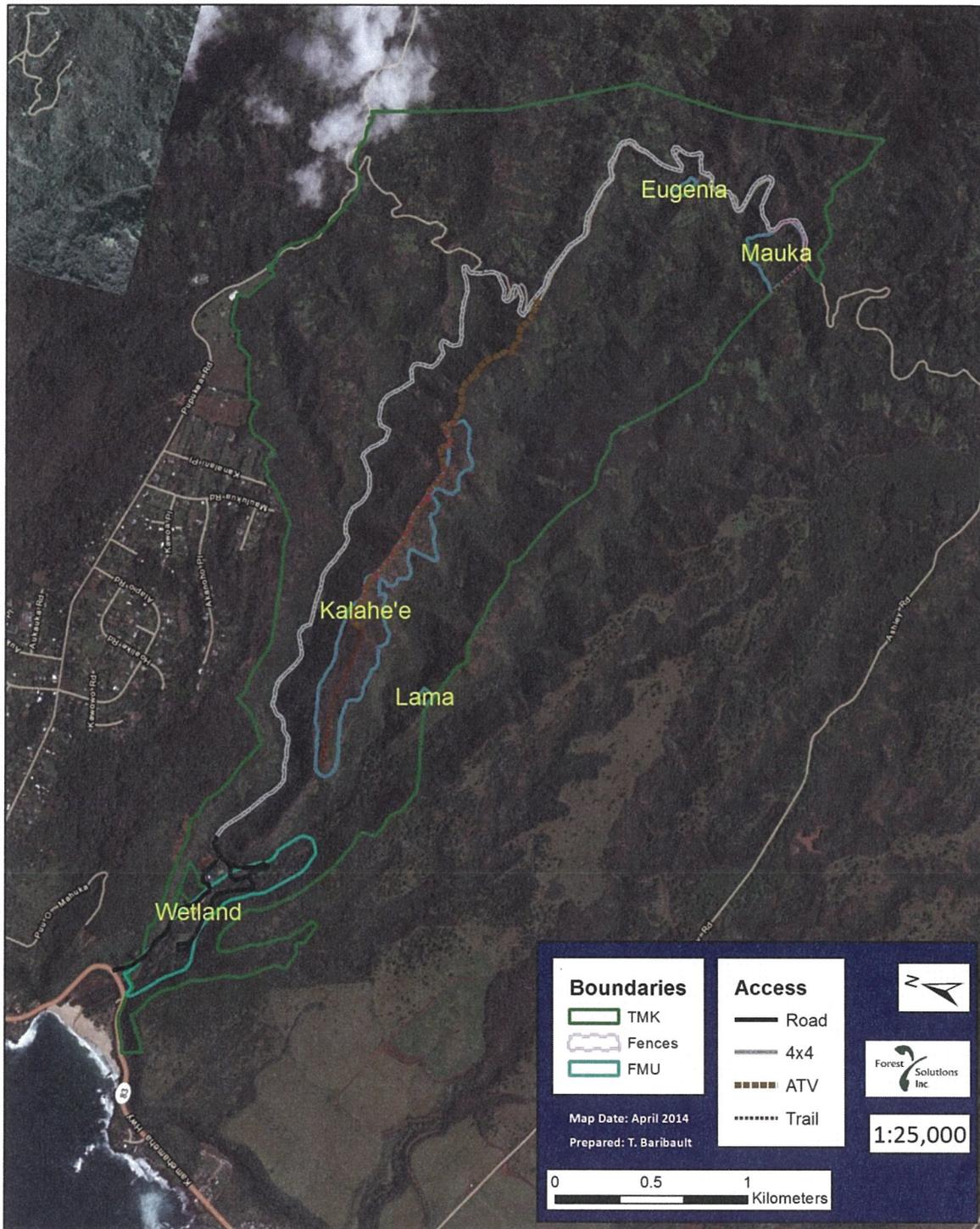


Figure 15. Forest management units at Waimea Valley (blue), with fences (pink), bounded by TMK (green).

Waimea Valley Forest Stewardship Program Units

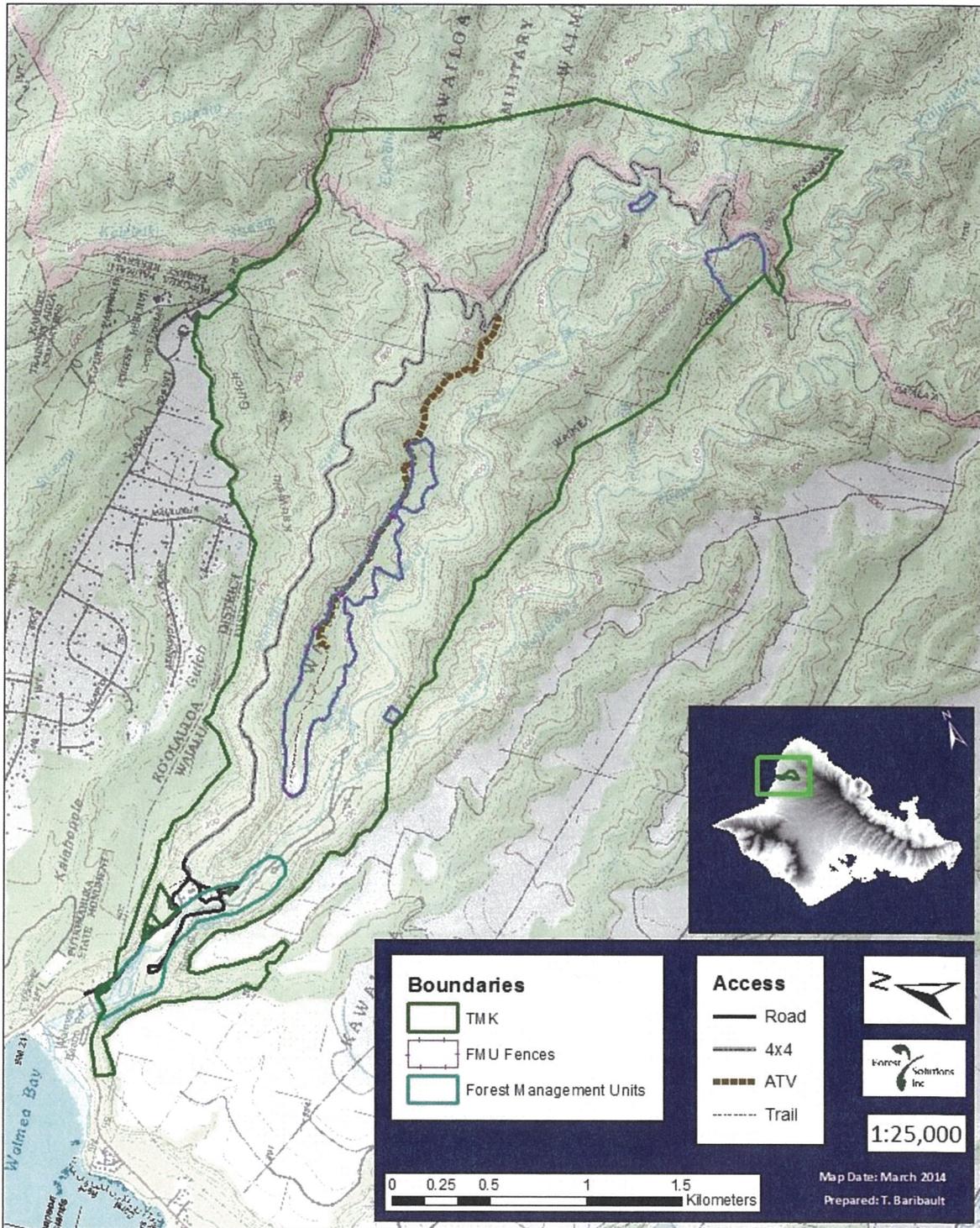


Figure 16. Topographic map of Waimea Valley, with TMK boundary (green), FMU (blue), and access routes.

Waimea Valley FSP | State Land Use Districts

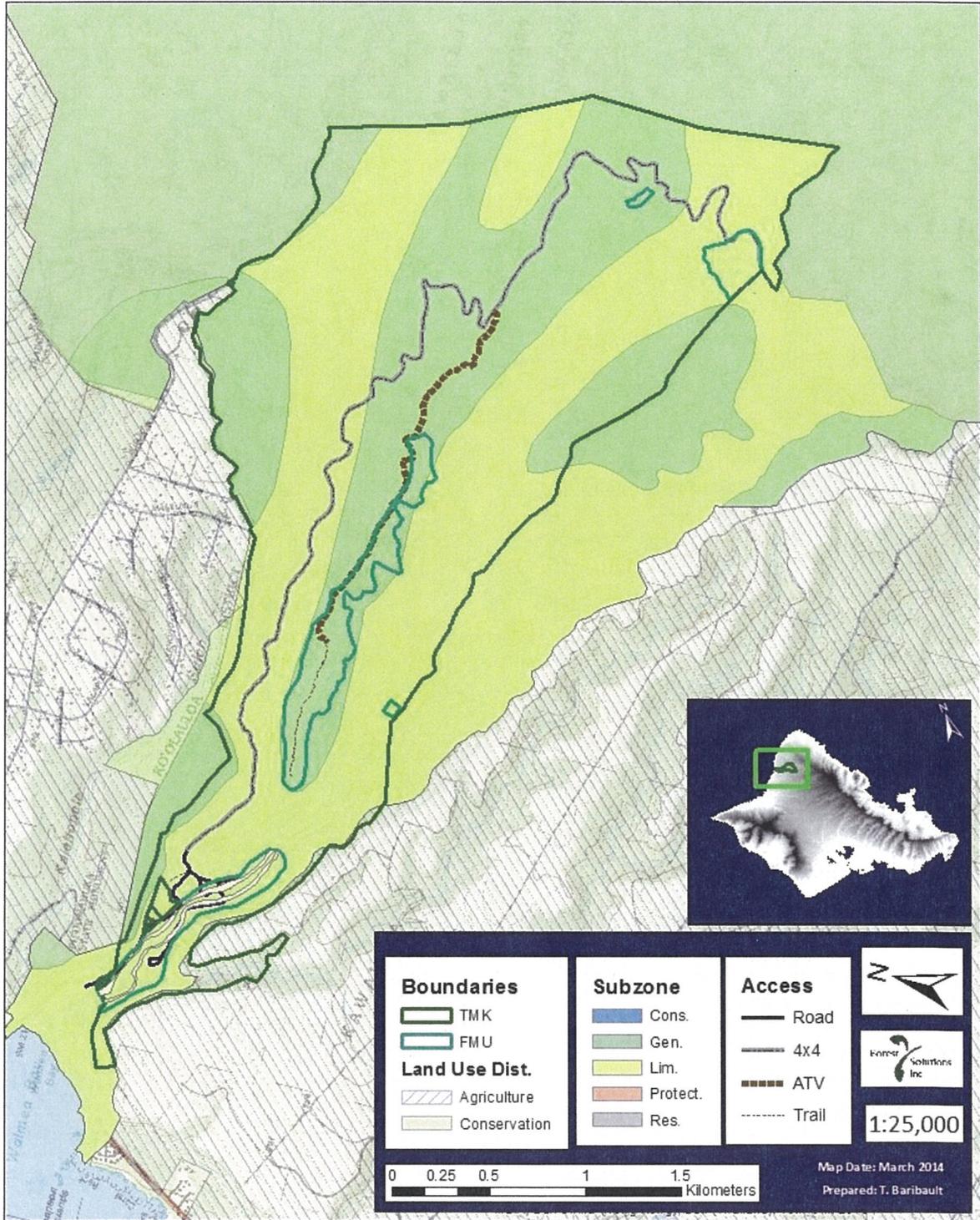


Figure 17. Waimea valley comprises conservation district subzones General (green) and limited (yellow).

Waimea Valley | Soil Properties

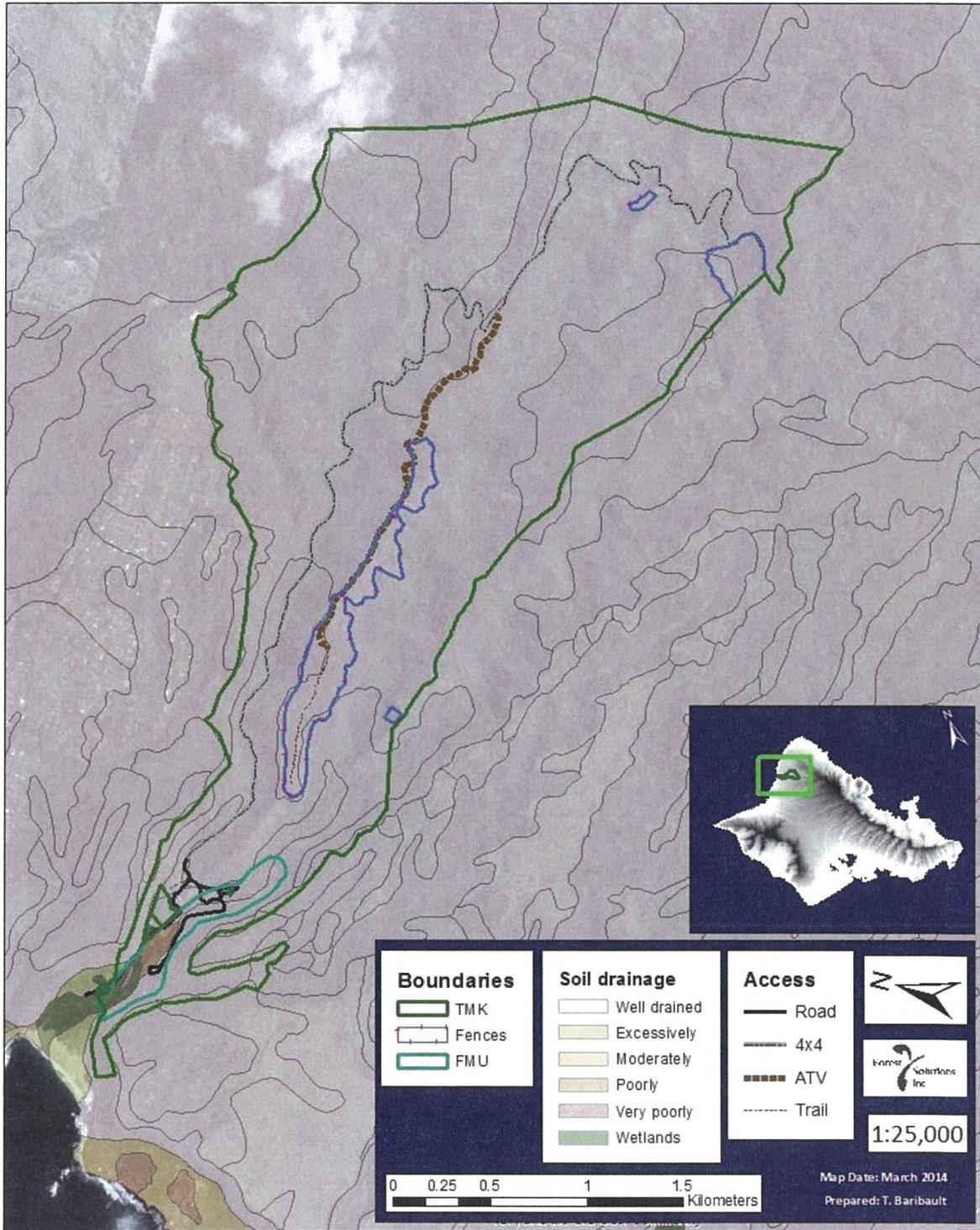


Figure 18. The mauka restoration site, Kalahe'e, lama forest, and *Eugenia* area are situated on well drained soils. The

SMZ and wetland soils are either poorly drained or waterlogged types, but these are constrained to the makai section.

Waimea Valley | Soil Properties

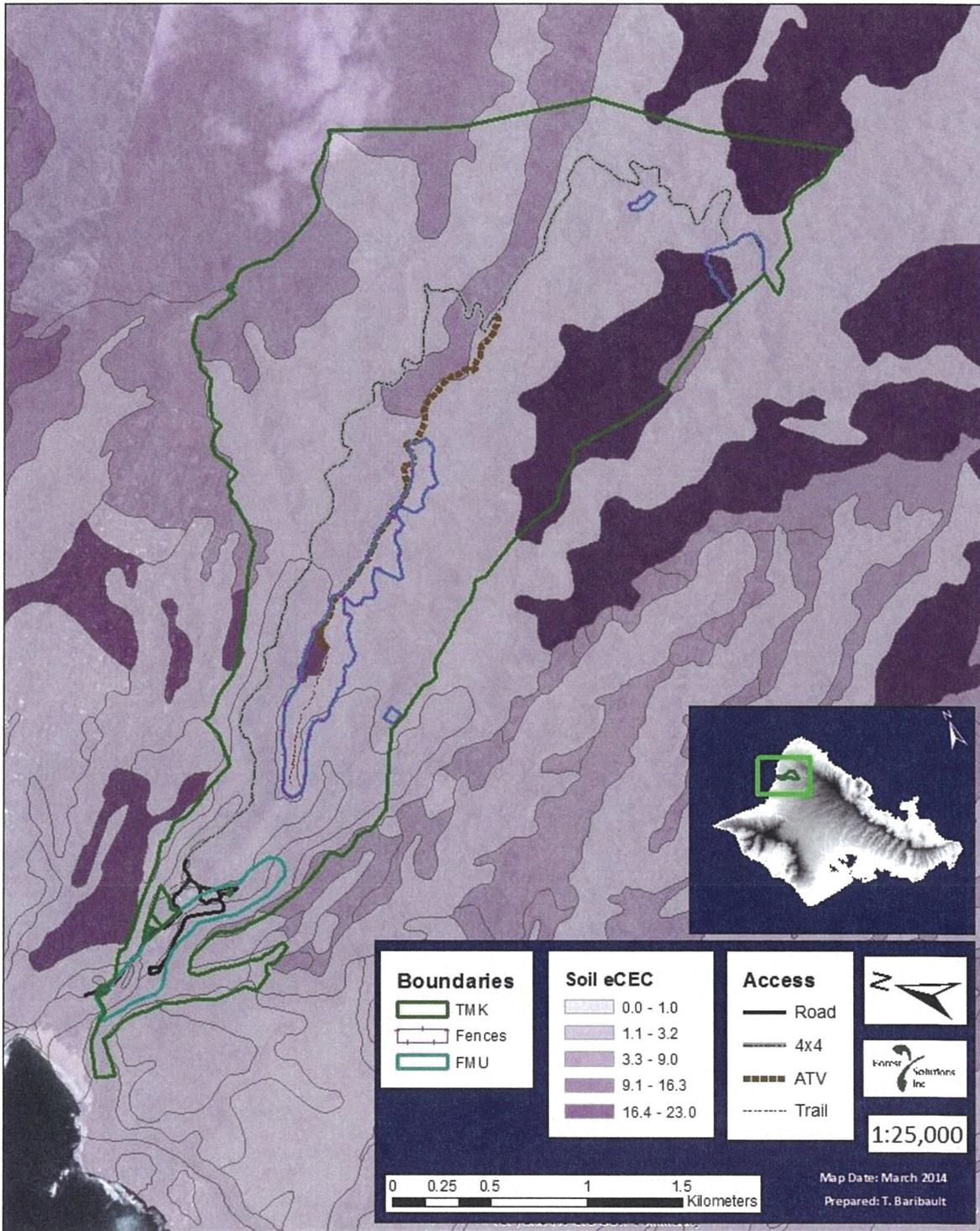


Figure 19. Soil effective cation exchange capacity (eCEC), an integrated measure of soil fertility, is quite low across much of Waimea Valley. Small portions of Kalahe'e and the mauka site have some higher eCEC zones, but fertility is low

overall.

Waimea Valley | Soil Properties

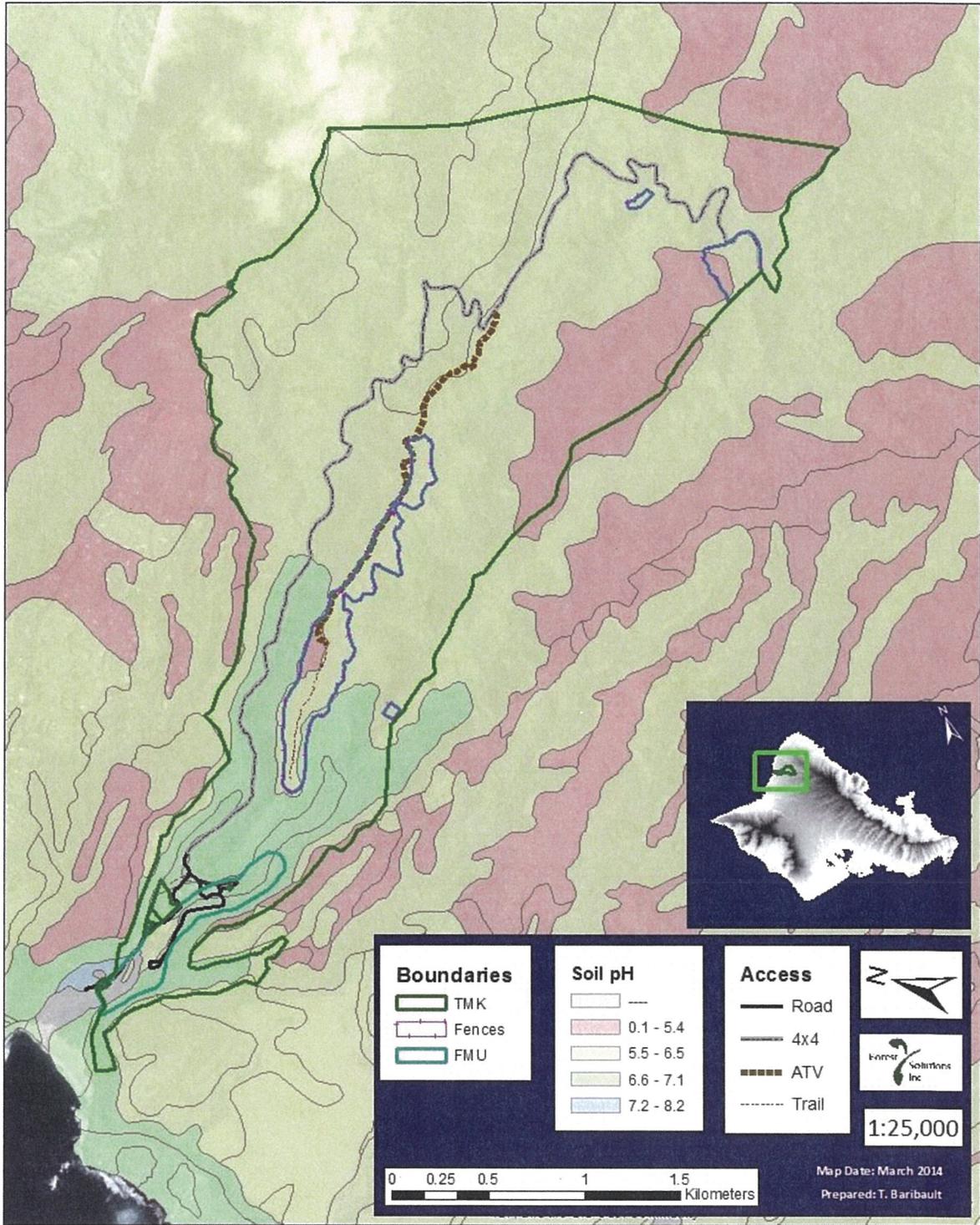


Figure 20. Soil pH across Waimea Valley shows strong variability, from highly acidic soils on the Southern valley walls

near the mauka site to nearly neutral soils toward the makai sections of each stream.

Waimea Valley | Soil Properties

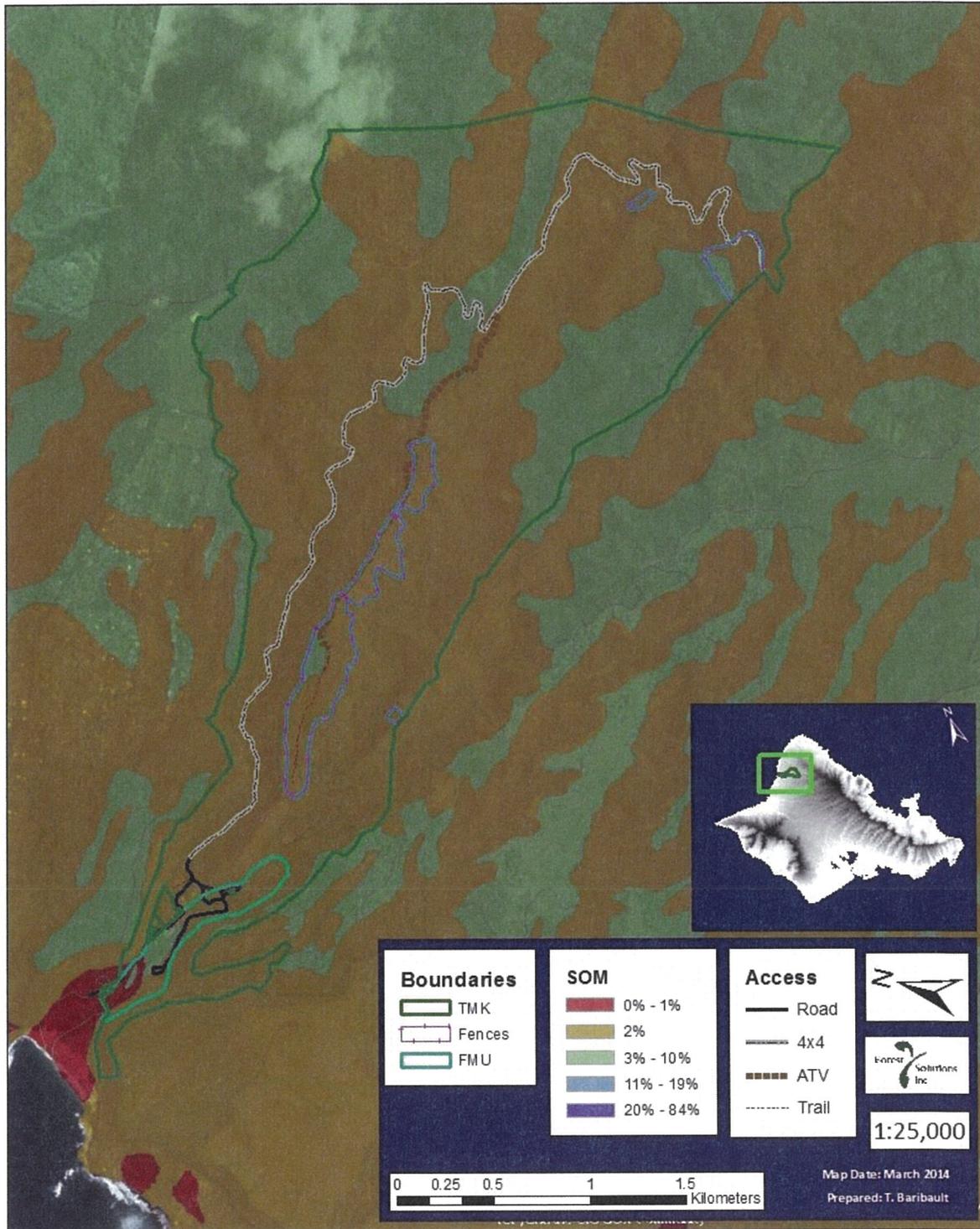


Figure 21. Soil organic matter (SOM) is another integrated soil fertility metric. Most soils in Waimea Valley have very

little SOM, consistent with low fertility as assessed by eCEC.

Waimea Valley | Fire Risk

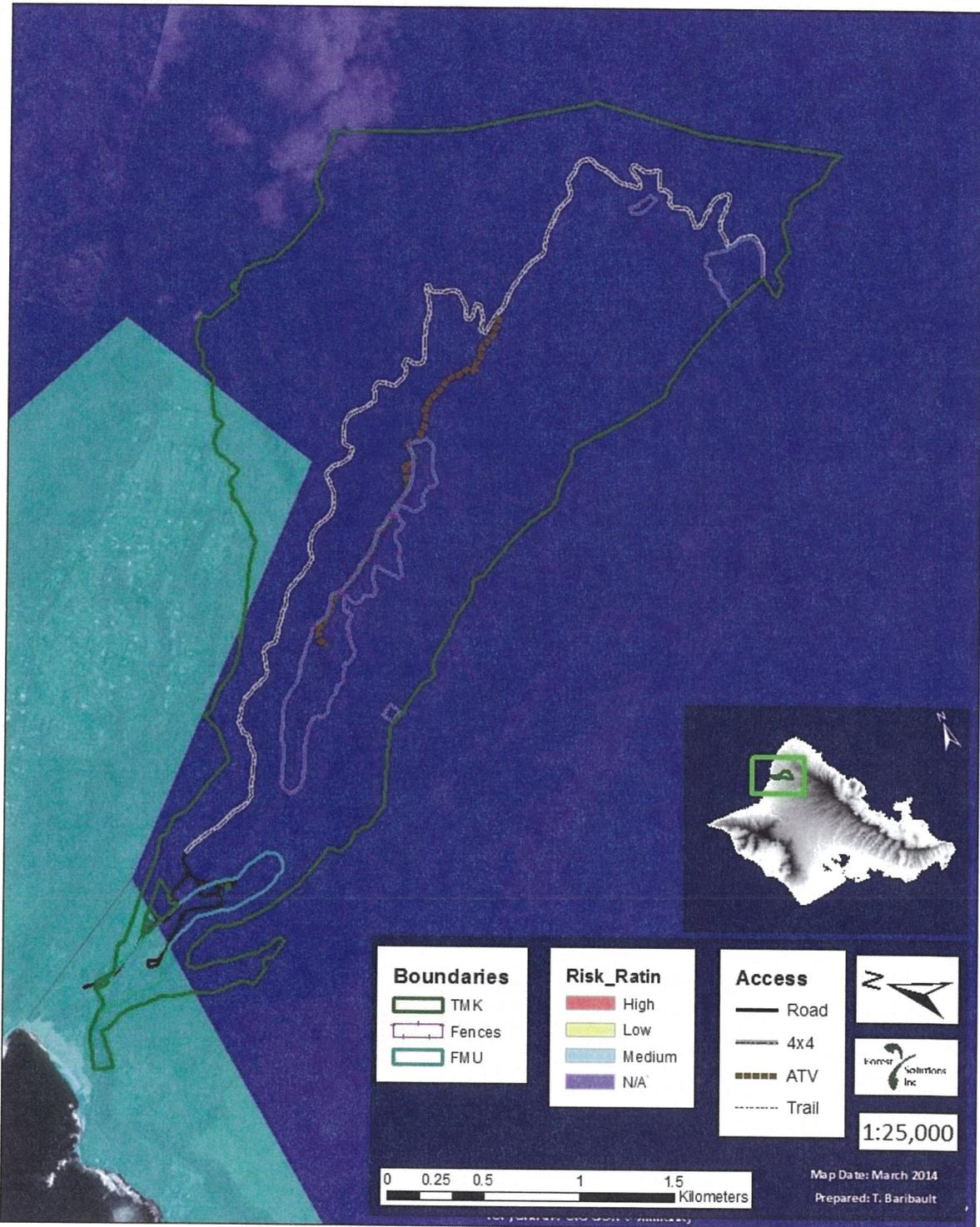


Figure 22. Fire risk zones in Waimea Valley.

Waimea Valley | Slope Map

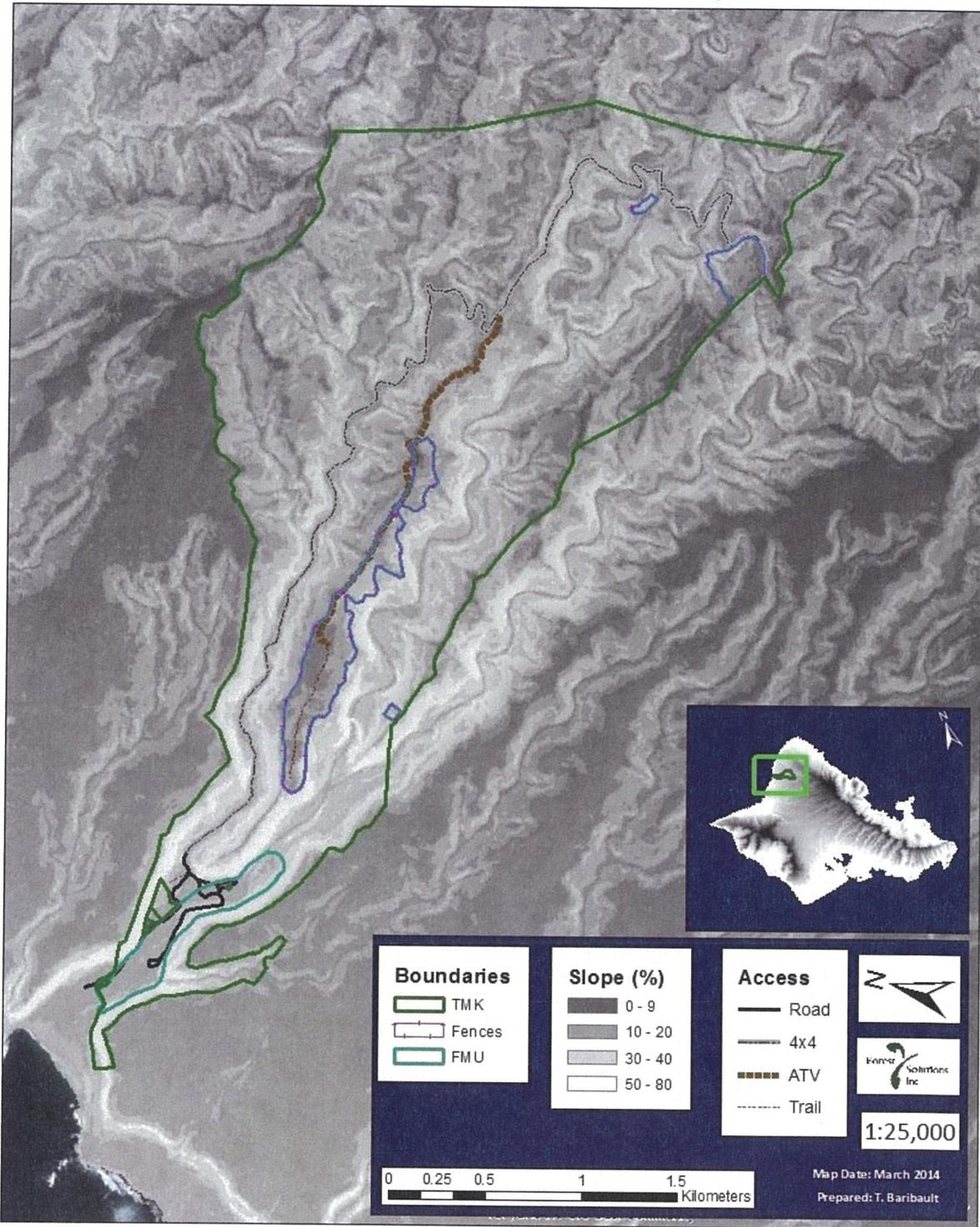


Figure 23. Waimea Valley topography is highly variable, with extremely steep slopes (>80%) on the valley walls and

some flat areas in stream beds and on ridge tops.

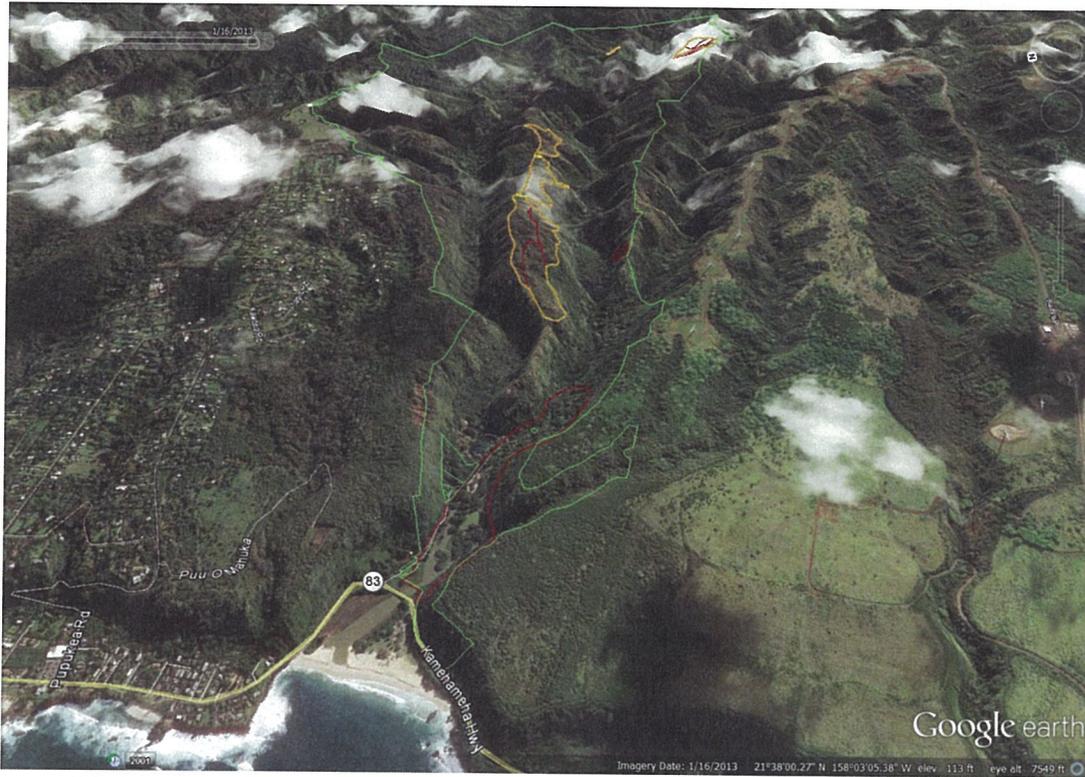


Figure 24. Perspective map of the entire Waimea Valley parcel, view to East.



Figure 25. Perspective map of the mauka restoration site, view to West.