

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

October 11, 2013

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

Land Board Members:

**SUBJECT: REQUEST AMENDMENT FOR BOARD ACTION ITEM C-3 PASSED ON JULY 26, 2013 RELATED TO THE ANNE BROOKE FOREST STEWARDSHIP PROJECT AND COST SHARE SUPPORT.**

**BACKGROUND:**

At its meeting on July 26, 2013, the Board of Land and Natural Resources approved the Anne Brooke Board Submittal (Exhibit A). The Board of Land and Natural Resources reviewed and approved a Forest Stewardship Agreement for the Brooke Forest Stewardship Management Plan and authorized cost-share support in the amount of \$61,156.00 over a 10 year period at its meeting through agenda item C-3 (Exhibit A). The Forest Stewardship Advisory Committee reviewed and recommended for approval the Brooke Forest Stewardship management plan at their meeting on February 15, 2013, and the State Forester approved the management plan on July 3, 2013.

The Brooke Forest Stewardship project proposes to restore approximately nine acres (8.9 acres) from a mixed non-native forest and grassland to a native lowland forest. The larger property, tax map key number (3) 2-6-101:129, 11.44 acres, is designated by the State as Agriculture and as AG-10a by the County of Hawaii in the South Hilo District. The property has been historically, prior to 1990, used for sugarcane production and has been fallow for the past 23 years. Ms. Brooke's goal is to "recreate a lowland native forest appropriate to the Hilo area".

**DISCUSSION:**

Following the Board action on July 26, 2013, the Division discovered discrepancies between the budget in the approved management plan implementation schedule (Table 7, Implementation schedule and estimated costs) and budget summary (Table 8, Budget summary by year) of the management plan (Exhibit B). The Board approved an annual cost-share amount based on the budget summary cost-share amount that did not incorporate the need for additional support for weed control for the maintenance phase of the project. In discussion with the landowner, the additional cost-share support for \$5,175 is need in order for the project to be successful. Thus the

Division request Board approval for \$5,175 additional cost share support for Fiscal Year 2014 to 2024 equaling a total of \$66,331.00 authorized for cost-share support through the authorized Forest Stewardship Program Agreement. The revised budget summary is attached as Exhibit C.

RECOMMENDATIONS:

That the Board:

- A. Amend cost-share support for Brooke Forest Stewardship Program Agreement from \$61,156.00 to \$66,331.00 to reflect corrections to the Implementation Schedule and Budget Summary.

Respectfully submitted,



*for* Roger H. Imoto, Administrator  
Division of Forestry and Wildlife

Attachment: (Exhibit A, B and C)

APPROVED FOR SUBMITTAL:



William J. Aila, Jr., Chairperson

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

July 26, 2013

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

Land Board Members:

**SUBJECT: REQUEST APPROVAL OF A FOREST STEWARDSHIP AGREEMENT WITH ANNE BROOKE TO PARTICIPATE IN THE STATE FOREST STEWARDSHIP PROGRAM, TMK (3) 2-6-010:129, SOUTH HILO DISTRICT, ISLAND OF HAWAII.**

**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 recharge, decreased soil erosion, wildlife habitat, forest products, 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 195 F-6, Hawaii Revised Statutes (HRS). Annual funding is provided by the Conveyance Tax Chapter 247-7, HRS, whereby twenty-five percent of the amount collected from this tax is paid into the Natural Area Reserve Fund. The Department of Land and Natural Resources currently has the authority to use \$500,000 per year to fund approved Forest Stewardship projects in order to provide financial assistance 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 Chapter 109. The program provides cost-share reimbursement for the development of long term forest management plans and for the implementation of approved forest management plans.

To participate in the program, 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 State Forest Stewardship Advisory Committee (FSAC). Landowners interested in

the program submit an application to the FSAC whom recommends the development of a Forest Stewardship management plan based on eligibility requirements and to ensure the project's goals are inline with the program's goals, including conservation, restoration and/or forest production. Landowners then create a forest management plan that is reviewed by DOFAW staff and the FSAC. The committee then recommends the management plan for approval by the Division and Department. The State Forester reviews and approves the management plan.

The award of cost-share support for Forest Stewardship management plan implementation follows a similar process to the development of a management plan. DOFAW staff and landowners discuss the request for cost-share assistance for the implementation of their plan over a ten-year period. This request is taken to the FSAC where they recommend cost-share support for project implementation. The request 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 the Department to enter into the Forest Stewardship Agreement with the landowner. Following authorization by the BLNR the landowner is required to enter into a Forest Stewardship Agreement that commits them to implementing their approved management plan and authorizes state cost-share reimbursement for their project. The Division has previously worked with the Department of the Attorney General to create a Forest Stewardship Agreement template (Exhibit A) to be used in conjunction with the program.

The Brooke Forest Stewardship project proposes to restore approximately nine acres (8.9 acres) from a mixed non-native forest and grassland to a native lowland forest. The larger property, tax map key number (3) 2-6-010:129, 11.44 acres, is designated by the State as agriculture and as AG-10a by the County of Hawaii in the South Hilo District. The property has been historically, prior to 1990, used for sugarcane production and has been sitting fallow for the past 23 years. Ms. Brooke's goal is to "recreate a lowland native forest appropriate to the Hilo area". The Forest Stewardship Advisory Committee approved the Brooke management plan at their meeting on February 15, 2013, and the State Forester approved the management plan on July 8, 2013 (Exhibit B).

#### DISCUSSION:

The Division is requesting approval of a Forest Stewardship Agreement for the implementation of the Anne Brooke Forest Stewardship management plan and project. Over the course of her ten year management plan Ms. Brooke intends to restore a native overstory, supplement the understory by planting sun-intolerant native species, and, once the microclimate is conducive, outplant rarer native species. Ms. Brookes also intends to use her property as a demonstration area for native restoration projects to educate and inform the community.

**Native Species Restoration and Habitat Improvement:** The primary objective of the project is to restore the site to native forest community that can eventually provide habitat for rare native plant species. Ms. Brooke intends to undertake the forest restoration project by initially installing native trees and shrubs followed by establishment of more shade tolerant plants in the later years of the project. The large diversity of plants to be out-planted have been selected based on the Laupahoehoe

planting a variety of native plant species additional habitat for native wildlife and plants will be created. Diversifying the forest will increase the recreational value of the forest by allowing community members to learn about a wider range of native species.

The project proposes establishing a pig proof fence around the property and the removal of non-native ungulates from within the fenced area. The management plan identifies approximately two acres of the property that will be restored each year until the entire site has been reforested. Once the forest canopy has been sufficiently establish, a secondary out-planting will occur of understory trees, shrubs and vine species so that the forest will more closely resembles a native plant community.

**Wildlife Habitat Enhancement:** By improving and restoring the native terrestrial habitat, Ms. Brooke will be increasing habitat for native fauna, including mammals and invertebrates. Additionally, the property is adjacent to two perennial stream systems and the improvement of the vegetation surrounding the stream corridor will improve the stream health and water quality creating a more suitable habitat for native aquatic biota of both freshwater and marine environments.

**Watershed Protection and Improvement:** This project seeks to improve and protect the watershed by minimizing erosion runoff from land sources. The key to lower suspended solids in Hawaii's surface run-off is to reduce the amount of barren exposed soils. Currently the property has many alien trees that limit establishment of understory vegetation leaving a large amount of exposed soil susceptible to erosion. Removing the large alien trees and planting a multi-layer native forest will reduce ground exposure as the forest matures.

**Community Education:** Ms. Brooke has committed to working with Hilo Community College's agriculture program to provide a study site for students to learn about forest management and management of non-native, invasive species. This project will also be used as a demonstration site for experimental disease-resistant native species.

Through this Forest Stewardship Agreement, Anne Brooke is committed to maintaining this project as a healthy, biologically diverse native forest area for restoration and educational purposes through the year 2023. Although the project is relatively small in size, the Forest Stewardship Program encourages projects ranging in size from 5 acres to over 9,000 acres. Additionally, the commitment of the private landowner to restore and manage this site for native species and habitat is significant and provides a number of public benefits including increased groundwater infiltration, public education, decreased soil erosion, and reducing seed sources for alien species.

A total of \$61,156 in State Forest Stewardship funding is requested to provide cost-share support for the Anne Brooke Forest Stewardship project, who will be contributing an additional \$61,156 toward the completion of the project 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 2023.

RECOMMENDATIONS:

That the Board:

1. Approve the Anne Brooke Forest Stewardship project and Forest Stewardship management plan;
2. Approve cost-share support in the amount of \$61,156 for the implementation of the Anne Brooke Forest Stewardship management plan;
3. Authorize the Chairperson to amend, finalize and execute a Forest Stewardship Agreement with Anne Brooke to participate in the State Forest Stewardship Program subject to the following:
  - A. Availability of State Forest Stewardship funds;
  - B. Review and approval as to form of the Forest Stewardship Agreement by the Department of the Attorney General.

Respectfully submitted,



Roger H. Imoto, Administrator  
Division of Forestry and Wildlife

Attachment: (Exhibit A and B)

APPROVED FOR SUBMITTAL:



---

William J. Aila, Jr., Chairperson

# Exhibit A

## 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: \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

### 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:

## Exhibit A

### **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.

## Exhibit A

### **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.

# Exhibit A

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

# Exhibit A

## 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

Exhibit A

**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 \_\_\_\_\_ 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 \_\_\_\_\_ Forest Stewardship project area (“Forest Stewardship project area”) in accordance with the MANAGEMENT PLAN, attached as \_\_\_\_\_ to this AGREEMENT, and all approved amendments thereto, with the intention of \_\_\_\_\_ 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 \_\_\_\_\_ 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.

**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.

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

Exhibit A

Exhibit A Attachment - SI

Hawaii Department of Land and Natural Resources and its authorized employees, agents and representatives.

SECTION 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 \_\_\_\_\_ to this AGREEMENT, the STATE agrees to pay the LANDOWNER a total sum not to exceed \_\_\_\_ 00/100 Dollars (\$XXX.XX) according to the schedule outlined below that includes fiscal year 20XX through 20XX 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 \_\_\_\_\_ 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

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.

**XXXX FOREST STEWARDSHIP  
PROJECT BUDGET/PAYMENT SCHEDULE:**

<b>YEAR</b>	<b>Total Budget</b>	<b>Land Owner share</b>	<b>State Share</b>
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
<b>Total</b>			

**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

annual management activities described in the approved MANAGEMENT PLAN, attached as \_\_\_\_ 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 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.

## 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 Thirteen (13) 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 \_\_\_\_\_; 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

Exhibit A Attachment - S3

into the fund for the next fiscal year. If in any fiscal year the STATE does not 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)

**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 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

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.

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 \_\_, as amend, approved at the Board of Land and Natural Resources \_\_\_ 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

- (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 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 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 -

(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 -

- (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.

**EXHIBIT A**

\_\_\_\_\_ 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 \_\_\_\_\_

**Forestry Stewardship Management Plan  
May 2013**

**I. COVER SHEET**

Anne Brooke  
POB 153238  
Santa Rita  
Guam 96915  
abrookeguam@gmail.com  
Phonc: 671-789-3581

**State and County Zoning:**  
Lot 18 Kaiwiki Homesteads, unit 1  
TMK: (3)2-6-010:129  
AG-10a  
Street address: Honualani Pl, Hilo

Total property acreage: 11.4 acres

Acres of proposed stewardship management arca: 8.9 acres  
General elevation: 1200 ft  
Slope: 0-35%

Plan prepared by:  
Anne Brooke, Ph.D.  
POB 153238  
Santa Rita, GU 96916  
abrookeguam@gmail.com  
Phone: 671-789-3581

## II. SIGNATURE PAGE

### II. Signature Page Forest Stewardship Signature Page

Professional Resource Consultant Certification: I have prepared (revised) this Forest Stewardship Plan. Resource Professional has been consulted and/or approved input as appropriate during the preparation of this plan.

Prepared by:  
Dr. Anne Brooke

Professional Resource Consultants Signature Date

*Brooke Dec 27, 2012*

Professional Resource Consultant's Name  
Dr. Anne Brooke

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:  
Anne Brooke

Applicants Signature Date

*Anne Brooke Dec 27, 2012*

Applicants name  
Anne Brooke

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 Hawaii Forest Stewardship Program guidelines and administrative rules.

Approved by:

*R. H. Imoto 7/19/13*

State Forester's Signature Date

**Roger H. Imoto**

State Forester's Name

TABLE OF CONTENTS

I. COVER SHEET ..... 1

II. SIGNATURE PAGE..... 2

III. INTRODUCTION ..... 5

    Property description..... 5

    Management objectives ..... 7

    Brief history of land uses and present conditions ..... 8

IV. LAND AND RESOURCES DESCRIPTION ..... 8

    Existing forest health and function including disease problems and fire threat ..... 9

    Soil condition, slope and aspect..... 9

    Water resources and their condition ..... 10

    Significant historic and cultural resources ..... 10

    Existing wildlife..... 10

    Existing recreational and aesthetic values ..... 10

V. MANAGEMENT OBJECTIVES AND PRACTICES ..... 10

    Overall plan of action..... 11

    Reforestation species ..... 11

    Fencing and pig removal..... 12

    Species List ..... 12

    Site preparation ..... 14

    Seedling acquisition ..... 15

    Planting ..... 15

    Fertilization and soil amendments ..... 16

    Monitoring ..... 16

    Weed Control and Mulching..... 16

    Streamside management zone (SMZ)..... 16

    Trail construction ..... 17

VI. IMPLEMENTATION SCHEDULE..... 18

VII. BUDGET SUMMARY ..... 20

VIII. ATTACHMENTS..... 20

    Attachment 1: Photographs of property..... 20

    Attachment 2: NRCS soil survey report ..... 20

    Attachment 3: CTAHR soil analysis report ..... 20

    Attachment 4: Fencing proposals..... 20

    Attachment 5: Growers prices and correspondence..... 20

Forestry Stewardship Advisory Committee Recommendations ..... 21

Literature cited and reviewed..... 22

Professionals consulted ..... 23

**FIGURES**

**Figure 1 Property location at Hilo.....6**  
**Figure 2 Property boundary, streams and roads.....6**  
**Figure 3 Management areas .....7**  
**Figure 4 NRCS soils map .....9**

**TABLES**

**Table 1 Native and non-native species present .....8**  
**Table 2 Wildlife species present..... 10**  
**Table 3 Overstory and understory plantings ..... 12**  
**Table 4 Plantings/acre..... 14**  
**Table 5 Seedling cost by year, section, acre..... 14**  
**Table 6 Recommended fertilizer and soil amendments ..... 16**  
**Table 7 Implementation schedule and costs..... 18**  
**Table 8 Budget summary by year..... 20**

### III. INTRODUCTION

The Brooke property is an 11.4 acre parcel on the Island of Hawaii on the eastern slopes of Mauna Kea, 3 miles north of Hilo. The property was purchased in December 2010, and the land is in the Kaiwiki homesteads at 1,200 ft elevation. The property is located 3 miles west of the Belt Road (Route 19) at Wainaku on Honualani Place off of Kopa'a and Kaiwiki Road (Figure. 1 and 2). Survey stakes mark the corner points of the property and midpoints of the western southern boundaries line. The owner currently does not live on the property, however, she and/or family intend to live on the property for at least 10 years. The reforestation efforts described in this proposal will be done on 8.9 acres (ac) of the property. Two areas are excluded from this management plan, a residential site of 0.5 ac and 2 ac of dense strawberry guava on the bank above Awchi stream (Figure 3).

The goal of this reforestation project is to recreate a lowland native forest appropriate to the Hilo area. The property is intended to be used as an educational site for the community, to provide a research and testing site for experimental plantings such as disease-resistant koa, biological control of invasive species and to support native invertebrate fauna that should attract Hawaiian hoary bats and potentially native bird species in the future.

This plan is based on the species found at the lower elevations of the Lapauhoehoe Natural Area Reserve, classified as a closed koa/ohia forest. ([http://www.hetf.us/page/laupahoehoe/pdf/Laupa\\_vege.pdf](http://www.hetf.us/page/laupahoehoe/pdf/Laupa_vege.pdf)). Additional common species appropriate to the lowland Hilo area and recommended by University of Hawaii, Cooperative Extension Service, Tropical Forestry and Hilo Community College Forest TEAM Program are included. Polynesian introductions or other non-native species will not be permanently established. Rare, threatened and endangered species will not be planted until site conditions are suitable for their survival.

The project site will be fenced to exclude pigs in the first year, canopy and sun tolerant trees will be planted in the next four years of the project with koa and ohia making up 70% of the seedlings. Understory and sub-canopy species will be added in years 7-10 after the initial plantings have grown for 5 years in each management section. The reforestation project will be adaptively managed in consultation with the Forest Stewardship Advisory Committee and the Division of Forestry & Wildlife (DOFAW) with advice from University of Hawaii, Cooperative Extension Service Tropical Forestry, and other partners that become involved. Management practices will be evaluated annually and modifications will be made as needed.

#### **Property description**

The property is Subtropical Basal Wet Forest Holdridge life zone, rainfall is between 120-200 inches of rainfall annually (Giambelluca et al 2011).

Boundaries of the 11.4 acre property are largely defined by two streams and Honualani Pl (Figure 2). Maile stream forms the southwestern boundary line, Awehi stream is the northern boundary, and Honualani Place (the driveway extension of Kopa'a road) is the southeastern boundary. A line delineated between the two streams is the northwestern boundary where the neighboring agricultural land is owned by the Kaiwiki Church. The southwestern boundary is marked with flagging from Honualani Place to Maile stream. An old, unimproved dirt access farm 'road' runs through the center of the property. Clumps of bamboo and dying rose apple (*Syzygium jambos*) are along the western boundary. The land slopes from the road at 10-20% inclines to the streams. Both streams courses are deeply cut with steep banks that have lycopodium, ferns, non-native grasses and forbs.

Prior to 1990, the land was used for sugar cane production. The sections for reforestation are dominated by uluhe (*Dicranopteris linearis*) with some areas of non-native grasses. The neighboring properties are residential/agricultural, and on the southwestern side of Maile stream is a Eucalyptus plantation of owned by Bishop Estate.

**Figure 1 Property location at Hilo**



**Figure 2 Property boundary, streams and roads**

**Management objectives**

The management objective is to recreate a closed koa ohia lowland forest that can be used as an educational site for the community, provide a research and testing site for experimental disease-resistant native species, and a location for lowland forest species appropriate to the Hilo area. The forest is intended to support native invertebrate fauna that should attract Hawaiian hoary bats and potentially native bird species in the future. Plants used for reforestation will be limited to native species.

The lack of reference sites for lowland forest in the Hilo area presents a challenge to determine the composition and density of species for reforestation. The Lapauhoehoe Natural Area Reserve was considered as approximations for species that will be planted.

The management actions of this plan are to fence the boundary of the management areas, remove pigs and invasive trees, and plant native forest species in succession.



**Figure 3 Management areas**

Section 1 ~ 3.2 ac, Section 2 ~ 2.8 ac, Section 3 ~ 2.6 ac., Section 4 ~ 0.3 ac. Not included in this management plan are ~2.0 ac of dense strawberry guava and residential area ~ .5 ac. Fence location shown by solid red line, property boundary by dashed orange line.

### Brief history of land uses and present conditions

Kaiwiki is at the lower elevation edge of existing koa forests and within the boundary of the primary koa belt of Hawaii Island (Baker et al, 2009). Overall, the area is described as a mixed koa-ohia forest with understory dominated by hapuu, (*Cibotium glaucum*, *C. mensiesii*), and ieie (*Freycinetia arborea*) (NRCS, 2010, Baker, et al 2009).

It is not known when the native forest was lost from the Kaiwiki area. In the recent past, the property was planted in sugar cane from the late 1800's to 1990. After production stopped, non-native grasses, weedy species and uluhe ferns became dominant. The four sections considered in this plan are dominated by uluhe fern, bushy beardgrass and other non-native grass species are dominant in some patches. Approximately 30 koa, a small number of ohia and hapuu have become established. (See attached photographs of the property in Attachment 1.) Young strawberry guava are coming up in all sections.

Awchi stream has a dense corridor of strawberry guava above the stream bank. Maile stream is bounded by a small amount of kalihi ginger, isolated stands of bamboo, dying rose apple trees and strawberry guava at the northwestern end of the property. A single large albizia (*Falcataria moluccana*) is in section 2.

## IV. LAND AND RESOURCES DESCRIPTION

### Existing vegetation/cover types

Table 1 Native and non-native species present

Native species	
<i>Acacia koa</i>	koa
<i>Metrosideros polymorpha</i>	ohia lehua
<i>Cibotium mensiesii</i>	hapuu
<i>Dicranopteris linearis</i>	uluhe
<i>Lycopodium cernuum</i>	wawaeiole
Non-native species	
<i>Syzygium jambos</i>	rose apple
<i>Bambusa vulgaris</i>	bamboo
<i>Psidium guava</i>	guava
<i>P. cattleianum</i>	strawberry guava
<i>Falcataria moluccana</i>	Moluccan albizia
<i>Heduchium gardnerianum</i>	kalihi ginger
<i>Arundina graminifolia</i>	bamboo orchid
<i>Schizachyrium condensatum</i>	bushy beardgrass
<i>Andropogon virginicus</i>	broom sedge
<i>Themeda villosa</i>	Lyon's grass
<i>Saccharum officinarum</i>	sugar cane
<i>Diplazium esculentum</i>	paca fern
<i>Nephrolepis exaltata</i>	sword fern

**Existing forest health and function including disease problems and fire threat**

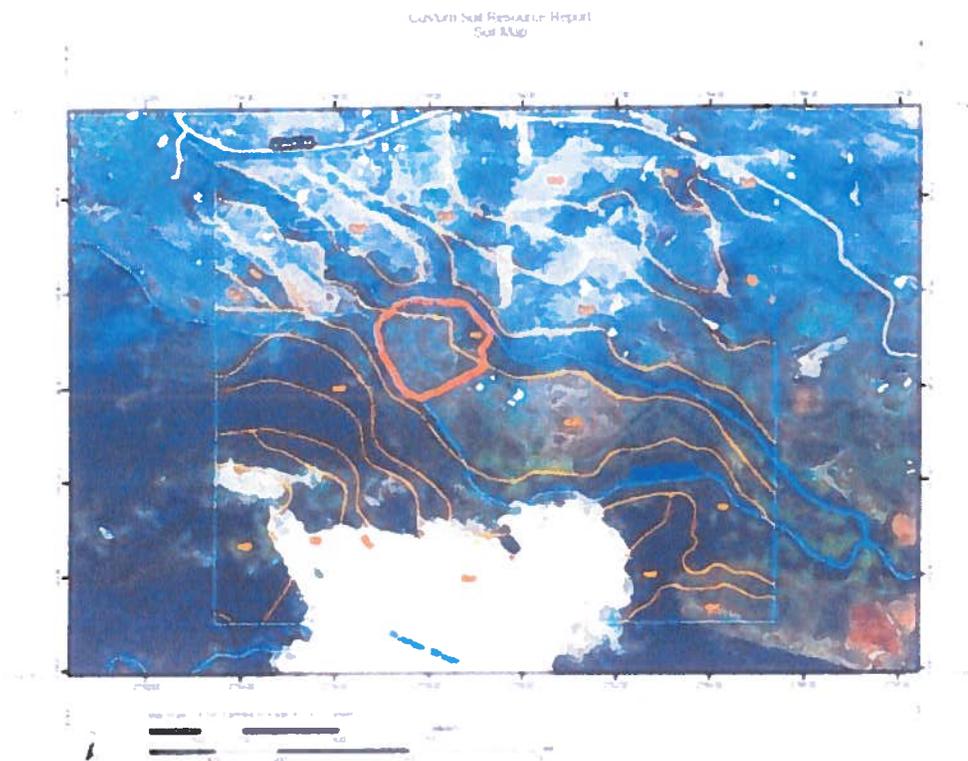
There are scattered plantings of koa in the grasslands. While some trees appear healthy and could be used as a seed source, others have areas of dead branches and appear to have koa wilt (Friday and Dudley; see attached photographs). Kaiwiki is within the area where koa has been most severely infected area with fungal infections (Gardner, 1996).

Stands of rose apple are severely infected with rust (*Puccinia psidii*, Andersen and Yuchida 2008). Trees still alive have few leaves remaining, other trees are starting to fall (see Attachment 1).

Fires are not seen as a significant threat as the Kaiwiki area receives approximately 120-200 inches of rainfall annually (National Climatic Data Center, <http://hurricane.ncdc.noaa.gov/climaps/hip0113.pdf>)

**Soil condition, slope and aspect**

The soils are in the Kaiwiki soil series, approximately 7.4 acres are Kaiwiki silty clay loam (KaD), 0 to 35% slopes; the remaining 4 acres are Rough broken land (RB) (Figure 4). The parent material is volcanic ash. The typical profile 0-60 inches: silty clay loam. Soils are well drained, capacity of the most limiting layer to transmit water: moderately low to moderately high (0.06 to 0.60 in/hr) (NRCS, 2010 Custom Soil Profile included as Attachment 2).



**Figure 4 NRCS soils map**

Property boundaries outlined in red.

An analysis of soil samples by CTAHR found low ph, very low phosphate, potassium, calcium and magnesium (see Attachment 3). Fertilizer and amendments are based on the CTAHR recommendations.

**Water resources and their condition**

Two perennial streams, Maile and Awehi, border the property (Figure 2 & 3 and Attachment 1). Both have steep banks that are dominated by non-native species. Species within the streamside management zone include strawberry guava, bamboo, rose apple, and kalihi ginger.

**Significant historic and cultural resources**

A state archaeological survey has not been done. There are no known historic structures and no visible surface deposits of cultural resources. The land was previously tilled for sugarcane and no cultural sites are expected to be present.

**Existing wildlife**

**Table 2 Wildlife species present**

<i>Buteo solitarius</i>	Hawaiian hawk
<i>Nycticorax nycticorax hoactli</i>	Black-crowned night heron
<i>Zosterops japonicus</i>	Japanese white eye
<i>Acridotheres tristis</i>	Common myna
<i>Cardinalis cardinalis</i>	Northern cardinal
<i>Sus scrofa</i>	wild hog
<i>Herpestes javanicus</i>	Indian mongoose
<i>Rattus exulans</i>	Polynesian rat
<i>Eleutherodactylus coqui</i>	coqui frog

**Threatened and endangered species existing on property**

Hawaiian hawk, io, *Buteo solitarius* are seen daily foraging over the property. Hawaiian hoary bats, *Lasiurus cinereus semotus*, are known from adjacent areas and are likely to be present (Hawaii's CWCC 2005).

**Existing recreational and aesthetic values**

The pool at the base of small waterfall in Maile stream is used by the neighbors for recreation. The property has views of Hilo Bay to the east and Mauna Kea to the west.

**V. MANAGEMENT OBJECTIVES AND PRACTICES**

The objective of the management project is to recreate a native forest that can be used as a demonstration and educational site for the community, provide a research and testing site for experimental disease-resistant native species appropriate to the Hilo area and support native invertebrate fauna that should attract Hawaiian hoary bats and potentially native bird species in the future.

As part of the educational support, Hilo Community College's Dr. Orlo Steele has been invited to use the property in his spring 2013 class Ag 291, Forest Restoration Ecology and Ecosystem Management Practicum. The property can be used as a study site for students to design forest restoration, management of alien species and write a management plan. Additional involvement with

the Community College, other schools and community groups will be explored and encouraged throughout the project.

Pig fencing will be installed in the first year of the project. The initial plantings in years 2-5 will be 70% koa and ohia augmented with other native lowland trees that are sun tolerant (Table 3). Native shrubs and other understory plants will be added 5 years after each section was planted with overstory species (Table 3). Canopy coverage will be evaluated prior to understory species establishment to prevent mortality and the schedule will be adjusted accordingly.

Invasive trees, particularly strawberry guava, will be cut, herbicide applied to cut stem and basal bark to prevent regrowth. Herbicide applications will be used as necessary to remove invasive grasses. Soil amendments and fertilizers will be added to planting sites and monitored annually as per CTAHR recommendations. Success of tree plantings will be monitored throughout the project, the property will be managed adaptively with a long-term goal to develop as close an approximation to a native forest as possible

Temporary plantings of pigeon pea, *Cajenis cajan*, a non-invasive and short-lived shrub may be used to assist in out-competing grasses and other invasives while native plantings are become established. Any plantings will be removed when native species have canopy cover.

#### **Overall plan of action**

Reforestation will be done on 8.9 ac of the property. The four sections to be reforested are defined by landscape features (Figure 3). In the first year of the project, a pig exclusion fence will be constructed (Figure 3). Any pigs remaining within the fence will be removed. The four sections will be site prepped and planted in succession, starting with section 1 in 2014, section 2 in 2015, and section 3 in 2016 (Tables 4 & 5). These three areas are dominated by uluhe with some areas of grasses. Section 4 is dense strawberry guava and dying rose apple with kahili ginger as ground cover. This small 0.3 ac section of invasive plants will be cleared during years 2-5 before planting in year 6. Understory shrubs and non-arborescent species will be planted in years 7-10 giving the earlier plantings time to grow (Tables 4 & 5). Understory species will be planted between koa, ohia and other species.

Approximately 2.0 ac of dense strawberry guava growing on the bank above Awehi stream are not included in this management plan. The landowners ultimate goal is to reforest this section however methods and a time frame for this work have not been set.

The owner put up a cabin on the property in 2012 where Chris Todd, USGS biologist, will be living. Mr. Todd will help control invasive grasses and maintain progress made in removing invasive plants. The owner frequently comes to Hawaii for Navy related projects and is able to spend time working on the property every 2-4 months. She anticipates retiring in 2014 and will reside on the property. In 2013 fencing will be put up by a local contractor, koa seeds will be collected from the property and other trees in the lowland Hilo area and grown in an onsite nursery for planting in 2014. Ohia and other species will be purchased from local Hilo growers (see Attachment 5). Once the owner is living on the land, the majority of work including seedling propagation will be done by the landowner, family and friends. This workforce is dependable and will be available throughout the project.

#### **Reforestation species**

Species used in this management plan (Table 3) are based on the Laupahoehoe Forest Permanent Forest Plot as the most representative of a lowland native forest on the Hamakua coast. The lower

elevations are classified as a closed ohia forest ([http://www.hetf.us/page/laupahoe/ohia/pdf/Laupahoe\\_vege.pdf](http://www.hetf.us/page/laupahoe/ohia/pdf/Laupahoe_vege.pdf)). A larger list of potential species was reviewed by Dr. J.B. Friday, the University of Hawaii Extension forester and Dr. Orlo Steele, Hilo Community College Forest TEAM program, for suitability.

### Fencing and pig removal

Fence will meet NRCS specifications and be similar to fencing used by U.S. Fish and Wildlife Service and the National Park Service for remote pig fencing: 48" high Besinal 1348 Class III Hog wire Fabric (10 horizontal/line wires with spacing from bottom to top at 3"-3.5"-4"-4.5"-5"-5.5"-6"-7"-8'. Vertical/stay wires spaced 6" apart, internal wires 11 gauge, top and bottom wire 9 gauge. All brace wire will be 9-gauge wire. 12.5 gauge Besinal barbed wire will be run at the base of the fence, secured to each T-post and to the ground mid-way between T-posts. Pressure treated wooden line posts spaced every 100', T posts spaced every 10'. H braces at all corners and end points. Three gates will use pig-proof specifications, two 14' vehicle gates and one walking gate.

Estimates were obtained from one licensed and three non-licensed contractors (see Attachment 4). On the Line Fencing (licensed) gave a verbal estimate of approximately \$20,000, a written estimate will be provided if the project is under serious consideration. Three non-licensed contractors provided fencing estimates: KLIK Services Inc. \$19,422.00; Upcountry Modifications \$23,748; Critter Fencing \$40,560.66 (price estimate is by 600 ft. sections). On the Line Fencing, KLIK and Upcountry Modifications proposed clearing the fence line with an excavator, Critter Fencing proposed using a weedeater.

The southern boundary of section 4 (approximately 115 ft) will be cleared of dying rose apple and strawberry guava in a path in prior to fence installation in year 1.

After the fence is installed, pigs will be hunted by family, friends and neighbors as well as trapped by the landowner with box traps until no further sign is detected. Fence lines will be monitored and maintained regularly throughout the project. At any sign that pigs have breached the fence, trapping and/or hunting will be reinstated until no fresh sign is seen.

### Species List

Table 3 lists overstorey and understorey species that will be planted. Additional native species may be considered as the project progresses, DOFAW and Forestry Stewardship Program will be consulted prior to seed collection.

**Table 3 Overstorey and understorey plantings**

Overstorey plantings	
<i>Acacia koa</i>	koa
<i>Metrosideros polymorpha</i>	ohia
<i>Cibotium menziesii</i>	hapuu ii
<i>C. glaucum</i>	hapuu pulu
<i>Coprosma rhynchocarpa</i>	pilo
<i>Dodonea viscosa</i>	aalii
<i>Ilex anomala</i>	kawau
<i>Psychotria hawaiiensis</i>	kopiko
<i>Melicope chusifolia</i>	kakaemoa

<i>Myrsine lessertiana</i>	kolea
<i>Pandanus tectorius</i>	hala
<i>Pritchardia beccariana</i>	loulou
<i>Rhus sandwicensis</i>	neheleau
<i>Cajenis cajan</i>	pigeon pea- temporary
Understory plantings	
<i>Alyxia stellata</i>	maile
<i>Broussaisia arguta</i>	kanawau
<i>Clermontia parviflora</i>	ohia
<i>Cheirodendron trigynum</i>	olapa
<i>Cyanea pilosa, C. floribunda</i>	haha
<i>Cyrtandra hawaiiensis</i>	ilihia
<i>Freycinetia arborea</i>	ieic
<i>Kadua affini</i>	manono
<i>Myrsine sandwicensis</i>	kolea
<i>Perrottetia sandwicensis</i>	olomea
<i>Pipterus albidus</i>	mamaki
<i>Vaccinium calycinum</i>	ohelo

In years 2-5, sections will be planted in sequence with overstorey species, Koa and ohia will comprise 75% of the total plantings, the remaining 25% of seedlings will be a mixture of sun tolerant species (Table 4). The overall density will be 600 seedlings/acre. The goal is to establish a broad mix of species over time with koa and ohia as the dominant overstorey. A mixture of understory trees, shrubs and non-arborescent species will be used as secondary plantings in years 7-10 at a density of 430 seedlings/ac. Species used will depend on availability of seed/seedlings, the goal is to have a good representation of each species planted as seeds and plants are available. For any additional species considered, DOFAW and Forestry Stewardship Program will be consulted. Tables 4 gives planting schedule and breakdown of species numbers by year, section, and acre. Table 5 provides a cost breakdown of the same information.

Overstorey seedlings will be planted in irregular clumpings rather than on 8 x 9 foot spacings as would be done in a commercial forest.

Uluhe ferns will be retained as ground cover and other native ferns encouraged. Access through the uluhe will be maintained by hand pruning for planting and access to young trees. Site preparation, planting and mulching for understory plants will be the same as for overstorey seedling.

Management practices will be evaluated annually and revised as needed. If survival rates are low, the Forestry Stewardship Program, the State Forester and other experts in local forestry will be consulted. If possible, wilt resistant koa will be used for some of the plantings.

**Table 4 Plantings: 600 seedlings/acre overstory, 430 seedlings/acre understory**

Year	Section	Acres	Koa 50%	Ohia 25%	25% Mixed species	Understory species
2	1	3.2	960	480	480	
3	2	2.8	840	420	420	
4	3	2.6	780	390	390	
5	4	0.3	90	45	45	
6						
7	1	3.2				1376
8	2	2.8				1204
9	3	2.6				1118
10	4	0.3				128

**Table 5 Seedling cost by year, section, acre**

Year	Section	Acres	Koa \$2/ea	Ohia \$5.5/ea	Additional overstory species \$5.5	Understory species \$5.5	Cost	Cost/ac
2	1	3.2	1920	2640	2640		7200	2250
3	2	2.8	1680	2310	2310		6300	2250
4	3	2.6	1560	2145	2145		5850	2250
5	4	0.3	102	247	247		596	1987
6								
7	1	3.2				7568	7568	2365
8	2	2.8				6622	6622	2365
9	3	2.6				6149	6149	2365
10	4	0.3				129	129	2367

**Site preparation**

The native tree species that are currently on the land (koa, ohia, hapuu) will be encouraged and cleared of overgrowing uluhe. Extensive areas of uluhe will be left as intact as possible to impede invasive grasses, temporary paths will be made through uluhe to access. All non-native trees within management sections (bamboo, strawberry guava, *Falcataria*, and other species) will be removed. Stands of bamboo will be cut to ground level by hand saw and chain saw then mechanically mowed until there is no re-growth. Herbicide will be used if needed. Strawberry guava will be cut and oil based herbicide applied to cut stem and basal bark (Leary et al 2012, Matooka, et al. 2002). The single *Falcataria moluccana* will have herbicide applied by basal bark and injection (Leary et al 2010). The large tree is not near roads and will be left in place when it falls. Any other invasive

trees encountered will be treated with herbicide in an appropriate manner. Clumps of Lyon's grass *Themeda villosa*, will be cut and regrowth treated with foliar herbicide (Motooka et al 2003) until dead. Kalihi ginger will be cut, herbicide applied to cut roots (Motooka et al 2002). Bamboo will be cut by hand repeatedly until dead, cut stems will be chipped and applied to seedlings as mulch.

Individual planting sites will be cleared to bare mineral earth for both overstory plantings (years 2-5) and understory plantings (years 7-10). Where uluhe is dominant, it will be clipped from the planting site, runners and roots removed. Invasive grasses will be treated with Glyphosate and Imazapyr, dead grasses will be left in place (Motooka, et al. 2002). Use of herbicides will follow DOFAW Best Management Practices (<http://www.state.hi.us/dlnr/dofaw/wmp/bmps.htm>).

Seedlings will be planted in irregular clumpings rather than straight lines used in commercial forests. Tall uluhe that overshadows planting sites will be cut back to allow light to reach the planting site but will not be removed. The majority of work will be done by the landowner, family and friends. This workforce is dependable and will be available throughout the project.

#### **Seedling acquisition**

In the first five years of the project, most seedlings will be purchased from local suppliers. Aileens Nursery, a Hilo based grower of native plants will provide ohia and species other than hapuu and koa. H&S Farms, an antherium grower in Kurtistown, has a large number of young hapuu and ohia seeded naturally in their shade houses.

The only commercially available koa are from the state nursery however seeds are not from Hilo lowland sources. The owner will collect seed from the property and other local sites in the Hilo area, and propagate seedlings on site following methods of Jacobs et al 2011 and Dumroese et al 2009. Koa and ohia will be started in the year prior to scheduled planting for outplanting while species that are slow growing will be started several years prior to the planting schedule to allow time for sufficient growth.

A small on-site nursery will be established by the owner for propagation of understory plants in years 6-10. All plants will be grown from seed; cuttings and root stock will not be used. Seedlings will be outplanted when have at least 6 leaves past the cotyledon as per recommendation of the Volcano Rare Plant Facility.

The price of nursery grown seedlings is used as the cost basis for the owners nursery grown seedlings Price estimates are taken from Aileens Nursery for ohia and other natives and H&S Farms for hapuu at \$5 to 5.5/seedling (see Attachment 5). Koa seedlings are estimated at \$2/ea grown by the owner on site.

#### **Planting**

Planting sites will be spot cultivated and cleared of vegetation within a 3 square foot area. The planting hole for each seedling will be a minimum of adequate diameter to plant the tree seedlings such that the tree root system shall be positioned in a natural arrangement (e.g. not coiled or bent upward in the planting hole). Planting hole size will depend on how the seedling is potted (i.e.: 2" diameter dibble tubes require smaller holes seedlings in 1 gallon pots). The tree seedling will be planted so that the entire root system is below the natural soil line and planting hole filled with soil and firmed around the planted seedling to remove air pockets.

### Fertilization and soil amendments

An analysis of soil samples by CTAHR found low ph, very low phosphate, potassium, calcium and magnesium (see Attachment 3). Recommended soil amendments for each 3 sq. ft planting site are given in Table 6. Dolomite will be worked into each planting site one month prior to planting, other amendments will be worked into the planting site just prior to planting. Slow release fertilizer will be worked into the soil surface and in the mulch around each planting site at planting and at 3 month intervals the first year. Nutrient monitoring will be done annually to adjust amendment levels.

**Table 6 Recommended fertilizer and soil amendments**

	lbs/planting site	lbs/ac	cost/ac
Slow- release 10-20-20	0.4 over 4 applications	216	110
Triple super phosphate	0.2	90	110
Dolomite (lime)	0.4	206	110
Gypsum (calcium)	0.7	361	96
Magnesium-sulfite	0.2	103	103
Estimated cost/ac		976	529

### Monitoring

Seedlings being grown on site will be monitored on a daily basis for pests and diseases. Prior to planting, plants will be checked and selected for vigorous growth and root systems. In the first year after planting, seedling will be monitored at a minimum of every two months for pests, disease, encroaching vegetation and newly emerging invasive plants. In subsequent years, monitoring will be conducted at a minimum of every four months.

An annual census will be made of all plantings to include: height, dbh, dbh of trees that have died since last plot visit, presence of decay, disease, breakage, discoloration of leaves. Nutrients will be monitored annually to adjust amendment levels.

### Weed Control and Mulching

Organic mulch (including chipped trees removed from the site) will be applied at the base of each seedling at least 2" thick where feasible to help control weeds. Mulch will be not be applied directly to stems to help prevent rot. Invasive grasses will be treated with Glyphosate and Imazapyr, dead grasses will be left in place (Matooka, et al. 2002). Use of herbicides will follow DOFAW Best Management Practices. Areas of uluhe will be left as intact as possible to impede invasive grasses and temporary paths will be made through uluhe to access planting sites.

Invasive weeds will be controlled as each section is added cumulatively to the project. Mulching at individual planting sites will be done for each section as it is planted. The number of stems planted will increase from a density of 600 stems/acre for overstory plantings in years 2-6 to 860 stems/acre when understory plantings are added in years 7-10. Costs for weed control and mulching decline by 50% in years 7-10 to maintain understory plantings.

### Streamside management zone (SMZ)

Existing vegetation within 35 feet of the Maile stream includes grasses, kahili ginger, rose apple, guava, bamboo, non-native ferns and grasses. The fence in section 1 will be within the SMZ, approximately 15-25 ft from the stream bank. The area between the fence and stream bank is

included as part of this management plan and will be planted as part of section 1. However, the bank of Maile stream is a vertical cliff in most areas and is not included in this management plan. The stream bank of Awehi stream is a dense stand of guava between section 3 and the stream, it also is not included as part of the plan.

**Trail construction**

No permanent trails are intended for this project. The existing dirt road in the middle of the property will be retained for access but not improved.

## VI. IMPLEMENTATION SCHEDULE

Table 7 Implementation schedule and estimated costs

Practice component	Units (ac)	Cost/Unit	Total Cost	Applicant Share	FSP Share
<b>Year 1</b>					
Management Plan			4000	2000	2000
Site prep- tree removal	8.9 ac	500/ac	4450	2225	2225
Fencing	2,400 ft	8.33/ft	20000	10000	10000
<b>Total Costs Year 1</b>			<b>28450</b>	<b>14225</b>	<b>14225</b>
<b>Year 2 - Section 1</b>					
Site preparation	3.2	500	2000	1000	1000
Soil amendments	3.2	529	1693	846	846
Seedling aquisition	1376	2-5.5/ea	7200	3600	3600
Planting	3.2	500	1600	800	800
Weed control and mulching	3.2	600	1920	960	960
<b>Total Costs Year 2</b>			<b>14413</b>	<b>7206</b>	<b>7206</b>
<b>Year 3 - Section 2</b>					
Site preparation	2.8	500	1400	700	700
Soil amendments	2.8	529	1481	741	741
Seedling aquisition	1204	2-5.5/ea	6300	3150	3150
Planting	2.8	500	1400	700	700
Weed control and mulching	5.6	600	3360	1680	1680
<b>Total Costs Year 3</b>			<b>13941</b>	<b>6971</b>	<b>6971</b>
<b>Year 4 - Section 3</b>					
Site preparation	2.6	500	1300	650	650
Soil amendments	2.6	529	1375	688	688
Seedling aquisition	1118	2-5.5/ea	5850	2925	2925
Planting	2.6	500	1300	650	650
Weed control and mulching	8.2	600	4920	2460	2460
<b>Total Costs Year 4</b>			<b>14745</b>	<b>7373</b>	<b>7373</b>
<b>Year 5 - Section 4</b>					
Site preparation	0.3	500	150	75	75
Soil amendments	0.3	529	159	79	79
Seedling aquisition	129	2-5.5/ea	676	265	338

Planting	0.3	500	150	75	75
Weed control and mulching	8.6	600	5160	2580	2580
<b>Total Costs Year 5</b>			<b>6295</b>	<b>3147</b>	<b>3147</b>
<b>Year 6</b>					
Weed control and mulching	8.6	600	5160	2580	2580
<b>Total Costs Year 6</b>			<b>5160</b>	<b>2580</b>	<b>2580</b>
<b>Year 7</b>					
Site preparation - Sect 1	3.2	500	1600	800	800
Soil amendments - Sect 1	3.2	529	1693	846	846
Seedling aquisition	1376	5.5/ea	10560	5280	5280
Planting	3.2	500	1600	800	800
Weed control and mulching	8.9	300	2670	1335	1335
<b>Total Costs Year 7</b>			<b>18123</b>	<b>9061</b>	<b>9061</b>
<b>Year 8</b>					
Site preparation - Sect 2	2.8	500	1400	700	700
Soil amendments - Sect 2	2.8	529	1481	741	741
Seedling aquisition	1204	5.5/ea	9240	4620	4620
Planting	2.8	500	1400	700	700
Weed control and mulching	8.9	300	2670	1335	1335
<b>Total Costs Year 8</b>			<b>16191</b>	<b>8096</b>	<b>8096</b>
<b>Year 9</b>					
Site preparation - Sect 3	2.6	500	1300	650	650
Soil amendments - Sect 3	2.6	529	1375	688	688
Seedling aquisition	1118	5.5/ea	8580	4290	4290
Planting	2.6	500	1300	650	650
Weed control and mulching	8.9	300	2670	1335	1335
<b>Total Costs Year 9</b>			<b>15225</b>	<b>7613</b>	<b>7613</b>
<b>Year 10</b>					
Site preparation - Sect 4	0.3	500	150	75	75
Soil amendments - Sect 4	0.3	529	159	79	79
Seedling aquisition	129	5.5/ea	990	495	495
Planting	0.3	500	150	75	75
Weed control and mulching	8.9	300	2670	1335	1335
<b>Total Costs Year 10</b>			<b>4119</b>	<b>2059</b>	<b>2059</b>

**VII. BUDGET SUMMARY****Table 8 Budget summary by year**

<b>Year</b>	<b>Total Cost</b>	<b>Applicant Share</b>	<b>FSP Share</b>	<b>Other Funding Source</b>
#1 2013	28450	14225	14225	0
#2 2014	14413	6276	6276	0
#3 2015	13941	6971	6971	0
#4 2016	14745	7373	7373	0
#5 2017	6295	3147	3147	0
#6 2018	5160	2580	2580	0
#7 2019	18123	9061	9061	0
#8 2020	16191	8096	8096	0
#9 2021	15225	7613	7613	0
#10 2022	4119	2059	2059	0
<b>TOTAL</b>	<b>136,662</b>	<b>67400</b>	<b>67400</b>	<b>0</b>

**VIII. ATTACHMENTS****Attachment 1: Photographs of property****Attachment 2: NRCS soil survey report****Attachment 3: CTAHR soil analysis report****Attachment 4: Fencing proposals****Attachment 5: Growers prices and correspondence**

## **Forestry Stewardship Advisory Committee Recommendations**

### **Comments April 29 2013**

1) Minor error on page 7 of the management plan – should be “succession” instead of “successive”?

Corrected

2) In year 7 of your implementation plan you have included site preparation as a practice – is this practice to prepare the site for planting or used more as a weed control practice? If it is the latter, then we should update the name to weed control.

Response: Site preparation costs for years 7-9 are to cut through the dense uluhe root mat to get to bare mineral soil.

3) On your final management plan it should include the county zoning for the property (e.g.: Ag-5 or Ag-1, etc)

Corrected

4) The committee thought you could consider a higher planting density (more than 10ft x 10ft spacing) for the purposes of your project; however, that would result in a high cost. For your consideration...

Response: Planting density has been increased to 600/ac altering the ratio to 50% koa, 25% ohia and 25% mixed other species. The majority of the increase is in koa. Spacing will be irregular, not on a grid pattern.

5) The committee also recommended the use of herbicides in addition to the cutting and mowing for controlling the bamboo on the property.

Response: revised to include herbicides

6) In your management plan, are you intending to clear to bare soil the entire area or just in a radius around each planting site?

Response: Individual planting sites will be cleared to bare mineral earth, not the entire area.

7) The committee recommend using a slow release fertilizer in each of the planting holes instead of broadcasting fertilizer – it would be more cost efficient.

Revised: Slow release fertilizer will be worked into the soil surface and in the mulch around each planting site at planting and 3 month intervals the first year.

**Literature cited and reviewed**

- Anderson, R.C. and J. Uchida, 2008. Disease Index for the Rust *Puccinia psidii* on Rose Apple in Hawai'i, CTAHR Plant Disease publication PD-37.
- Baker, P. J., Scowcroft, P. G., Ewel, J. J. 2009. Koa (*Acacia koa*) ecology and silviculture. Gen. Tech. Rep. PSW-GTR-211. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 129 p.
- Dumroese, K., Jacobs, D.F., and A.S. Davis. 2009. Inoculating *Acacia koa* with *Bradyrhizobium* and Applying Fertilizer in the Nursery: Effects on Nodule Formation and Seedling Growth. *Horticultural Science* 44(2):443–446. 2009.
- Friday, J.B and N. Dudley. Koa wilt. [http://www.ctahr.hawaii.edu/forestry/disease/koa\\_wilt.html](http://www.ctahr.hawaii.edu/forestry/disease/koa_wilt.html)
- Gardner, D.E. 1996. *Acacia koa*: A review of its diseases and associated fungi. University of Hawaii Department of Botany. In: *Koa: A Decade of Growth*. Hawaii Forest Industry Association (HFIA), Hilo.
- Giambelluca TW, Chen Q, Frazier AG, Price JP, Chen Y-L, Chu P-S, Eischeid J., and Delparte, D. 2011. The Rainfall Atlas of Hawai'i. <http://rainfall.geography.hawaii.edu>
- Hawaii's Comprehensive Wildlife Conservation Strategy, 2005. 'Ope'ape'a or Hawaiian hoary bat.
- Jacobs, D.F, Davis, A.S., and K. Dunrosc 2011. Nursery techniques to improve restoration of *Acacia koa* seedlings in competition with kikiyu grass. Talk presented at the Hawaii Conservation Conference.
- Juvik, J and L. Lawrence, 1982. Late holocene vegetation history from Hawaiian peat deposits. In: *Proceedings, Fourth Conference in Natural Sciences, Hawaii Volcanoes National Park*, pp. 100.
- Leary, J., Beachy, J. and A. Hardman 2012. Practitioners guide for effective non-restricted herbicide techniques to control and suppress invasive woody species in Hawai'i. University of Hawaii, College of Tropical Agriculture and Human resources, WC-10.
- Motooka, P., Ching, L. and G. Nagai, 2002. *Herbicidal Weed Control Methods for Pastures and Natural Areas of Hawaii*. Cooperative Extensions Service, College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa, WC-8, pp. 36.
- Motooka, P., Castro, L., Nelson, D., Nagai, G., and L. Ching. 2003. *Weeds of Hawaii's pastures and natural areas; an identification and management guide*. University of Hawaii, Manoa.
- NRCS, 2010 Custom Soil Resources Report for Island of Hawaii Area, Hawaii, Kaiwiki parcel.
- Stemmermann, L. 1981 *A guide to Pacific wetland plants*. US Army Corps of Engineers

**Professionals consulted**

**Dr. J.B. Friday, Univ. of Hawaii Extension Forester**

**Tim Tunison, Hawaii Volcanoes National Park, retired**

**Dr. Orlo Steele, Hilo Community College, Forest TEAM Program**

**Robert Wescom, Licensed forester, Guam**

**Dr. Anne Brooke is the Conservation Program Manager for the US Navy on Guam. She has worked on erosion control, reforestation and plant conservation projects on Navy lands and was the POC for the Cetti Bay reforestation project with Gov. Guam Department of Agriculture. She has lived on Guam since 2003 when she was the USFWS wildlife biologist at the Guam National Wildlife Refuge. Dr. Brooke had been a terrestrial biologist for Department of Marine and Wildlife Resources, Am Samoa 1994-1997.**

**Forestry Stewardship Management Plan  
May 2013**

**I. COVER SHEET**

Anne Brooke  
POB 153238  
Santa Rita  
Guam 96915  
abrookeguam@gmail.com  
Phonc: 671-789-3581

**State and County Zoning:**  
Lot 18 Kaiwiki Homesteads, unit 1  
TMK: (3)2-6-010:129  
AG-10a  
Street address: Honualani Pl, Hilo

Total property acreage: 11.4 acres

Acres of proposed stewardship management area: 8.9 acres  
General elevation: 1200 ft  
Slope: 0-35%

Plan prepared by:  
Anne Brooke, Ph.D.  
POB 153238  
Santa Rita, GU 96916  
abrookeguam@gmail.com  
Phone: 671-789-3581

## II. SIGNATURE PAGE

### II. Signature Page Forest Stewardship Signature Page

Professional Resource Consultant Certification. I have prepared (revised) this Forest Stewardship Plan. Resource Professional has been consulted and or approved input as appropriate during the preparation of this plan.

Prepared by:  
Dr. Anne Brooke

Professional Resource Consultants Signature Date

*Brooke Dec 27, 2012*

Professional Resource Consultant's Name  
Dr. Anne Brooke

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:  
Anne Brooke

Applicants Signature Date

*Anne Brooke Dec 27, 2012*

Applicants name  
Anne Brooke

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 Hawaii Forest Stewardship Program guidelines and administrative rules

Approved by:

*R. H. Imoto 7/9/13*

State Forester's Signature Date

**Roger H. Imoto**

State Forester's Name

TABLE OF CONTENTS

I. COVER SHEET ..... 1

II. SIGNATURE PAGE..... 2

III. INTRODUCTION ..... 5

    Property description ..... 5

    Management objectives ..... 7

    Brief history of land uses and present conditions ..... 8

IV. LAND AND RESOURCES DESCRIPTION ..... 8

    Existing forest health and function including disease problems and fire threat ..... 9

    Soil condition, slope and aspect..... 9

    Water resources and their condition ..... 10

    Significant historic and cultural resources ..... 10

    Existing wildlife..... 10

    Existing recreational and aesthetic values ..... 10

V. MANAGEMENT OBJECTIVES AND PRACTICES ..... 10

    Overall plan of action..... 11

    Reforestation species ..... 11

    Fencing and pig removal..... 12

    Species List ..... 12

    Site preparation ..... 14

    Seedling acquisition..... 15

    Planting ..... 15

    Fertilization and soil amendments ..... 16

    Monitoring ..... 16

    Weed Control and Mulching..... 16

    Streamside management zone (SMZ)..... 16

    Trail construction..... 17

VI. IMPLEMENTATION SCHEDULE..... 18

VII. BUDGET SUMMARY ..... 20

VIII. ATTACHMENTS..... 20

    Attachment 1: Photographs of property ..... 20

    Attachment 2: NRCS soil survey report ..... 20

    Attachment 3: CTAHR soil analysis report ..... 20

    Attachment 4: Fencing proposals..... 20

    Attachment 5: Growers prices and correspondence..... 20

Forestry Stewardship Advisory Committee Recommendations ..... 21

Literature cited and reviewed..... 22

Professionals consulted ..... 23

**FIGURES**

Figure 1 Property location at Hilo.....6  
Figure 2 Property boundary, streams and roads .....6  
Figure 3 Management areas .....7  
Figure 4 NRCS soils map .....9

**TABLES**

Table 1 Native and non-native species present .....8  
Table 2 Wildlife species present.....10  
Table 3 Overstory and understory plantings .....12  
Table 4 Plantings/acre.....14  
Table 5 Seedling cost by year, section, acre.....14  
Table 6 Recommended fertilizer and soil amendments.....16  
Table 7 Implementation schedule and costs.....18  
Table 8 Budget summary by year.....20

### III. INTRODUCTION

The Brooke property is an 11.4 acre parcel on the Island of Hawaii on the eastern slopes of Mauna Koa, 3 miles north of Hilo. The property was purchased in December 2010, and the land is in the Kaiwiki homesteads at 1,200 ft elevation. The property is located 3 miles west of the Belt Road (Route 19) at Wainaku on Honualani Place off of Kopa'a and Kaiwiki Road (Figure 1 and 2). Survey stakes mark the corner points of the property and midpoints of the western southern boundaries line. The owner currently does not live on the property, however, she and/or family intend to live on the property for at least 10 years. The reforestation efforts described in this proposal will be done on 8.9 acres (ac) of the property. Two areas are excluded from this management plan, a residential site of 0.5 ac and 2 ac of dense strawberry guava on the bank above Awchi stream (Figure 3).

The goal of this reforestation project is to recreate a lowland native forest appropriate to the Hilo area. The property is intended to be used as an educational site for the community, to provide a research and testing site for experimental plantings such as disease-resistant koa, biological control of invasive species and to support native invertebrate fauna that should attract Hawaiian hoary bats and potentially native bird species in the future.

This plan is based on the species found at the lower elevations of the Lapauhoehoe Natural Area Reserve, classified as a closed koa/ohia forest.

([http://www.hetf.us/page/laupahoehoe/pdf/Laupa\\_vege.pdf](http://www.hetf.us/page/laupahoehoe/pdf/Laupa_vege.pdf)). Additional common species appropriate to the lowland Hilo area and recommended by University of Hawaii, Cooperative Extension Service, Tropical Forestry and Hilo Community College Forest TEAM Program are included. Polynesian introductions or other non-native species will not be permanently established. Rare, threatened and endangered species will not be planted until site conditions are suitable for their survival.

The project site will be fenced to exclude pigs in the first year, canopy and sun tolerant trees will be planted in the next four years of the project with koa and ohia making up 70% of the seedlings. Understory and sub-canopy species will be added in years 7-10 after the initial plantings have grown for 5 years in each management section. The reforestation project will be adaptively managed in consultation with the Forest Stewardship Advisory Committee and the Division of Forestry & Wildlife (DOFAW) with advice from University of Hawaii, Cooperative Extension Service Tropical Forestry, and other partners that become involved. Management practices will be evaluated annually and modifications will be made as needed.

#### **Property description**

The property is Subtropical Basal Wet Forest Holdridge life zone, rainfall is between 120-200 inches of rainfall annually (Giambelluca et al 2011).

Boundaries of the 11.4 acre property are largely defined by two streams and Honualani Pl (Figure 2). Maile stream forms the southwestern boundary line, Awchi stream is the northern boundary, and Honualani Place (the driveway extension of Kopa'a road) is the southeastern boundary. A line delineated between the two streams is the northwestern boundary where the neighboring agricultural land is owned by the Kaiwiki Church. The southwestern boundary is marked with flagging from Honualani Place to Maile stream. An old, unimproved dirt access farm 'road' runs through the center of the property. Clumps of bamboo and dying rose apple (*Syzygium jambos*) are along the western boundary. The land slopes from the road at 10-20% inclines to the streams. Both streams courses are deeply cut with steep banks that have lycopodium, ferns, non-native grasses and forbs.

Prior to 1990, the land was used for sugar cane production. The sections for reforestation are dominated by uluhe (*Dicranopteris linearis*) with some areas of non-native grasses. The neighboring properties are residential/agricultural, and on the southwestern side of Maile stream is a Eucalyptus plantation of owned by Bishop Estate.

**Figure 1 Property location at Hilo**



**Figure 2 Property boundary, streams and roads**

### Management objectives

The management objective is to recreate a closed koa ohia lowland forest that can be used as an educational site for the community, provide a research and testing site for experimental disease-resistant native species, and a location for lowland forest species appropriate to the Hilo area. The forest is intended to support native invertebrate fauna that should attract Hawaiian hoary bats and potentially native bird species in the future. Plants used for reforestation will be limited to native species.

The lack of reference sites for lowland forest in the Hilo area presents a challenge to determine the composition and density of species for reforestation. The Lapauhoehoe Natural Area Reserve was considered as approximations for species that will be planted.

The management actions of this plan are to fence the boundary of the management areas, remove pigs and invasive trees, and plant native forest species in succession.



**Figure 3 Management areas**

Section 1 ~ 3.2 ac, Section 2 ~ 2.8 ac, Section 3 ~ 2.6 ac., Section 4 ~ 0.3 ac. Not included in this management plan are ~2.0 ac of dense strawberry guava and residential area ~ .5 ac. Fence location shown by solid red line, property boundary by dashed orange line.

### Brief history of land uses and present conditions

Kaiwiki is at the lower elevation edge of existing koa forests and within the boundary of the primary koa belt of Hawaii Island (Baker et al, 2009). Overall, the area is described as a mixed koa–ohia forest with understory dominated by hapuu, (*Cibotium glaucum*, *C. mensiesii*), and ieie (*Freycinetia arborea*) (NRCS, 2010, Baker, et al 2009).

It is not known when the native forest was lost from the Kaiwiki area. In the recent past, the property was planted in sugar cane from the late 1800's to 1990. After production stopped, non-native grasses, weedy species and uluhe ferns became dominant. The four sections considered in this plan are dominated by uluhe fern, bushy beardgrass and other non-native grass species are dominant in some patches. Approximately 30 koa, a small number of ohia and hapuu have become established. (See attached photographs of the property in Attachment 1.) Young strawberry guava are coming up in all sections.

Awehi stream has a dense corridor of strawberry guava above the stream bank. Maile stream is bounded by a small amount of kalihi ginger, isolated stands of bamboo, dying rose apple trees and strawberry guava at the northwestern end of the property. A single large albizia (*Falcataria moluccana*) is in section 2.

## IV. LAND AND RESOURCES DESCRIPTION

### Existing vegetation/cover types

**Table 1 Native and non-native species present**

Native species	
<i>Acacia koa</i>	koa
<i>Metrosideros polymorpha</i>	ohia lehua
<i>Cibotium mensiesii</i>	hapuu
<i>Dicranopteris linearis</i>	uluhe
<i>Lycopodium cernuum</i>	wawaeiole
Non-native species	
<i>Syzygium jambos</i>	rose apple
<i>Bambusa vulgaris</i>	bamboo
<i>Psidium guava</i>	guava
<i>P. cattleianum</i>	strawberry guava
<i>Falcataria moluccana</i>	Moluccan albizia
<i>Heduchium gardnerianum</i>	kalihi ginger
<i>Arundina graminifolia</i>	bamboo orchid
<i>Schizachyrium condensatum</i>	bushy beardgrass
<i>Andropogon virginicus</i>	broom sedge
<i>Themeda villosa</i>	Lyon's grass
<i>Saccharum officinarum</i>	sugar cane
<i>Diplazium esculentum</i>	paca fern
<i>Nephrolepis exaltata</i>	sword fern

**Existing forest health and function including disease problems and fire threat**

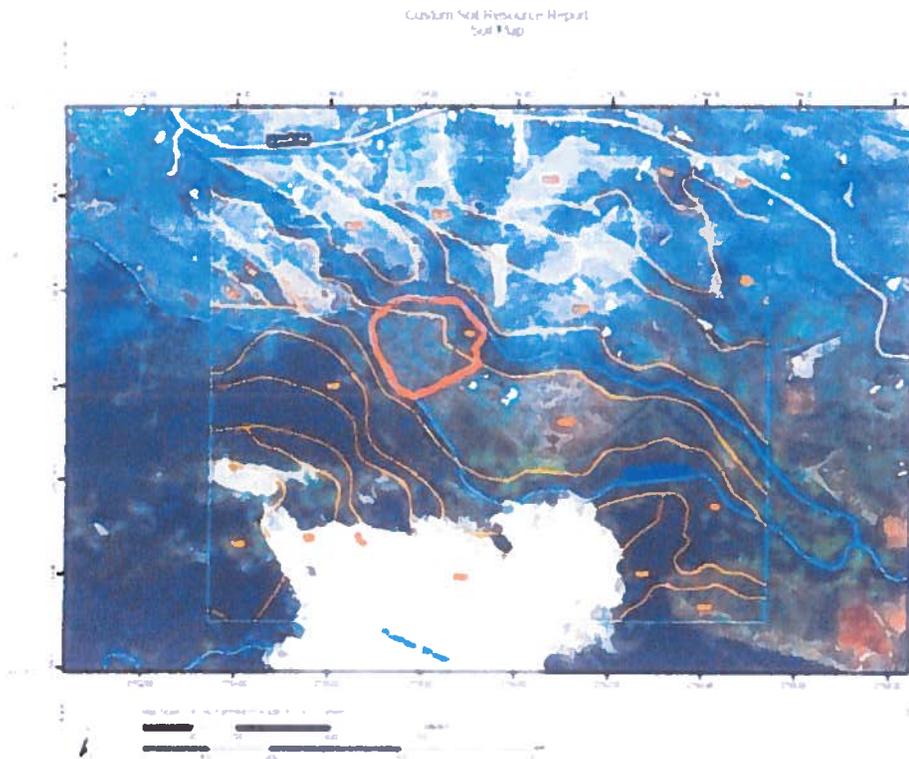
There are scattered plantings of koa in the grasslands. While some trees appear healthy and could be used as a seed source, others have areas of dead branches and appear to have koa wilt (Friday and Dudley; see attached photographs). Kaiwiki is within the area where koa has been most severely infected area with fungal infections (Gardner, 1996).

Stands of rose apple are severely infected with rust (*Puccinia psidii*, Andersen and Yuchida 2008). Trees still alive have few leaves remaining, other trees are starting to fall (see Attachment 1).

Fires are not seen as a significant threat as the Kaiwiki area receives approximately 120-200 inches of rainfall annually (National Climatic Data Center, <http://hurricane.ncdc.noaa.gov/climaps/hip0113.pdf>)

**Soil condition, slope and aspect**

The soils are in the Kaiwiki soil series, approximately 7.4 acres are Kaiwiki silty clay loam (KaD), 0 to 35% slopes; the remaining 4 acres are Rough broken land (RB) (Figure 4). The parent material is volcanic ash. The typical profile 0-60 inches: silty clay loam. Soils are well drained, capacity of the most limiting layer to transmit water: moderately low to moderately high (0.06 to 0.60 in/hr) (NRCS, 2010 Custom Soil Profile included as Attachment 2).



**Figure 4 NRCS soils map**

Property boundaries outlined in red.

An analysis of soil samples by CTAHR found low ph, very low phosphate, potassium, calcium and magnesium (see Attachment 3). Fertilizer and amendments are based on the CTAHR recommendations.

**Water resources and their condition**

Two perennial streams, Maile and Awehi, border the property (Figure 2 & 3 and Attachment 1). Both have steep banks that are dominated by non-native species. Species within the streamside management zone include strawberry guava, bamboo, rose apple, and kalihi ginger.

**Significant historic and cultural resources**

A state archaeological survey has not been done. There are no known historic structures and no visible surface deposits of cultural resources. The land was previously tilled for sugarcane and no cultural sites are expected to be present.

**Existing wildlife**

**Table 2 Wildlife species present**

<i>Buteo solitarius</i>	Hawaiian hawk
<i>Nycticorax nycticorax hoactli</i>	Black-crowned night heron
<i>Zosterops japonicus</i>	Japanese white eye
<i>Acridotheres tristis</i>	Common myna
<i>Cardinalis cardinalis</i>	Northern cardinal
<i>Sus scrofa</i>	wild hog
<i>Herpestes javanicus</i>	Indian mongoose
<i>Rattus exulans</i>	Polynesian rat
<i>Eleutherodactylus coqui</i>	coqui frog

**Threatened and endangered species existing on property**

Hawaiian hawk, io, *Buteo solitarius* are seen daily foraging over the property. Hawaiian hoary bats, *Lasiurus cinereus semotus*, are known from adjacent areas and are likely to be present (Hawaii's CWCC 2005).

**Existing recreational and aesthetic values**

The pool at the base of small waterfall in Maile stream is used by the neighbors for recreation. The property has views of Hilo Bay to the east and Mauna Kea to the west.

**V. MANAGEMENT OBJECTIVES AND PRACTICES**

The objective of the management project is to recreate a native forest that can be used as a demonstration and educational site for the community, provide a research and testing site for experimental disease-resistant native species appropriate to the Hilo area and support native invertebrate fauna that should attract Hawaiian hoary bats and potentially native bird species in the future.

As part of the educational support, Hilo Community College's Dr. Orlo Steele has been invited to use the property in his spring 2013 class Ag 291, Forest Restoration Ecology and Ecosystem Management Practicum. The property can be used as a study site for students to design forest restoration, management of alien species and write a management plan. Additional involvement with

the Community College, other schools and community groups will be explored and encouraged throughout the project.

Pig fencing will be installed in the first year of the project. The initial plantings in years 2-5 will be 70% koa and ohia augmented with other native lowland trees that are sun tolerant (Table 3). Native shrubs and other understory plants will be added 5 years after each section was planted with overstory species (Table 3). Canopy coverage will be evaluated prior to understory species establishment to prevent mortality and the schedule will be adjusted accordingly.

Invasive trees, particularly strawberry guava, will be cut, herbicide applied to cut stem and basal bark to prevent regrowth. Herbicide applications will be used as necessary to remove invasive grasses. Soil amendments and fertilizers will be added to planting sites and monitored annually as per CTAHR recommendations. Success of tree plantings will be monitored throughout the project, the property will be managed adaptively with a long-term goal to develop as close an approximation to a native forest as possible

Temporary plantings of pigeon pea, *Cajenis cajan*, a non-invasive and short-lived shrub may be used to assist in out-competing grasses and other invasives while native plantings are become established. Any plantings will be removed when native species have canopy cover.

#### **Overall plan of action**

Reforestation will be done on 8.9 ac of the property. The four sections to be reforested are defined by landscape features (Figure 3). In the first year of the project, a pig exclusion fence will be constructed (Figure 3). Any pigs remaining within the fence will be removed. The four sections will be site prepped and planted in succession, starting with section 1 in 2014, section 2 in 2015, and section 3 in 2016 (Tables 4 & 5). These three areas are dominated by uluhe with some areas of grasses. Section 4 is dense strawberry guava and dying rose apple with kahili ginger as ground cover. This small 0.3 ac section of invasive plants will be cleared during years 2-5 before planting in year 6. Understory shrubs and non-arborescent species will be planted in years 7-10 giving the earlier plantings time to grow (Tables 4 & 5). Understory species will be planted between koa, ohia and other species.

Approximately 2.0 ac of dense strawberry guava growing on the bank above Awehi stream are not included in this management plan. The landowners ultimate goal is to reforest this section however methods and a time frame for this work have not been set.

The owner put up a cabin on the property in 2012 where Chris Todd, USGS biologist, will be living. Mr. Todd will help control invasive grasses and maintain progress made in removing invasive plants. The owner frequently comes to Hawaii for Navy related projects and is able to spend time working on the property every 2-4 months. She anticipates retiring in 2014 and will reside on the property. In 2013 fencing will be put up by a local contractor, koa seeds will be collected from the property and other trees in the lowland Hilo area and grown in an onsite nursery for planting in 2014. Ohia and other species will be purchased from local Hilo growers (see Attachment 5). Once the owner is living on the land, the majority of work including seedling propagation will be done by the landowner, family and friends. This workforce is dependable and will be available throughout the project.

#### **Reforestation species**

Species used in this management plan (Table 3) are based on the Laupahoehoe Forest Permanent Forest Plot as the most representative of a lowland native forest on the Hamakua coast. The lower

elevations are classified as a closed ohia forest (<http://www.hetf.us/page/laupahoehoe/pdf/Laupavege.pdf>). A larger list of potential species was reviewed by Dr. J.B. Friday, the University of Hawaii Extension forester and Dr. Orlo Steele, Hilo Community College Forest TEAM program, for suitability.

**Fencing and pig removal**

Fence will meet NRCS specifications and be similar to fencing used by U.S. Fish and Wildlife Service and the National Park Service for remote pig fencing: 48" high Besinal 1348 Class III Hog wire Fabric (10 horizontal/line wires with spacing from bottom to top at 3"-3.5"-4"-4.5"-5"-5.5"-6" 7"-8'. Vertical/stay wires spaced 6" apart, internal wires 11 gauge, top and bottom wire 9 gauge. All brace wire will be 9-gauge wire. 12.5 gauge Besinal barbed wire will be run at the base of the fence, secured to each T-post and to the ground mid-way between T-posts. Pressure treated wooden line posts spaced every 100', T posts spaced every 10'. H braces at all corners and end points. Three gates will use pig-proof specifications, two 14' vehicle gates and one walking gate.

Estimates were obtained from one licensed and three non-licensed contractors (see Attachment 4). On the Line Fencing (licensed) gave a verbal estimate of approximately \$20,000, a written estimate will be provided if the project is under serious consideration. Three non-licensed contractors provided fencing estimates: KIIK Services Inc. \$19,422.00; Upcountry Modifications \$23,748; Critter Fencing \$40,560.66 (price estimate is by 600 ft. sections). On the Line Fencing, KIIK and Upcountry Modifications proposed clearing the fence line with an excavator, Critter Fencing proposed using a weedeater.

The southern boundary of section 4 (approximately 115 ft) will be cleared of dying rose apple and strawberry guava in a path in prior to fence installation in year 1.

After the fence is installed, pigs will be hunted by family, friends and neighbors as well as trapped by the landowner with box traps until no further sign is detected. Fence lines will be monitored and maintained regularly throughout the project. At any sign that pigs have breached the fence, trapping and/or hunting will be reinstated until no fresh sign is seen.

**Species List**

Table 3 lists overstorey and understorey species that will be planted. Additional native species may be considered as the project progresses, DOFAW and Forestry Stewardship Program will be consulted prior to seed collection.

**Table 3 Overstorey and understorey plantings**

Overstorey plantings	
<i>Acacia koa</i>	koa
<i>Metrosideros polymorpha</i>	ohia
<i>Cibotium menziesii</i>	hapuu ii
<i>C. glaucum</i>	hapuu pulu
<i>Coprosma rhynchocarpa</i>	pilo
<i>Dodonea viscosa</i>	aalii
<i>Ilex anomala</i>	kawau
<i>Psychotria hawaiiensis</i>	kopiko
<i>Melicope clusiifolia</i>	kakaemoa

<i>Myrsine lessertiana</i>	kolea
<i>Pandanus tectorius</i>	hala
<i>Pritchardia beccariana</i>	loulou
<i>Rhus sandwicensis</i>	neheleau
<i>Cajenis cajan</i>	pigeon pea- temporary
Understory plantings	
<i>Alyxia stellata</i>	maile
<i>Broussaisia arguta</i>	kanawau
<i>Clermontia parviflora</i>	oha
<i>Cheirodendron trigynum</i>	olapa
<i>Cyanea pilosa, C. floribunda</i>	haha
<i>Cyrtandra hawaiiensis</i>	ilihia
<i>Freycinetia arborea</i>	icic
<i>Kadua affini</i>	manono
<i>Myrsine sandwicensis</i>	kolea
<i>Perrottetia sandwicensis</i>	olomea
<i>Pipterus albidus</i>	mamaki
<i>Vaccinium calycinum</i>	ohelo

In years 2-5, sections will be planted in sequence with overstorey species, Koa and ohia will comprise 75% of the total plantings, the remaining 25% of seedlings will be a mixture of sun tolerant species (Table 4). The overall density will be 600 seedlings/acre. The goal is to establish a broad mix of species over time with koa and ohia as the dominant overstorey. A mixture of understory trees, shrubs and non-arborescent species will be used as secondary plantings in years 7-10 at a density of 430 seedlings/ac. Species used will depend on availability of seed/seedlings, the goal is to have a good representation of each species planted as seeds and plants are available. For any additional species considered, DOFAW and Forestry Stewardship Program will be consulted. Tables 4 gives planting schedule and breakdown of species numbers by year, section, and acre. Table 5 provides a cost breakdown of the same information.

Overstorey seedlings will be planted in irregular clumpings rather than on 8 x 9 foot spacings as would be done in a commercial forest.

Uluhe ferns will be retained as ground cover and other native ferns encouraged. Access through the uluhe will be maintained by hand pruning for planting and access to young trees. Site preparation, planting and mulching for understory plants will be the same as for overstorey seedling.

Management practices will be evaluated annually and revised as needed. If survival rates are low, the Forestry Stewardship Program, the State Forester and other experts in local forestry will be consulted. If possible, wilt resistant koa will be used for some of the plantings.

**Table 4 Plantings: 600 seedlings/acre overstory, 430 seedlings/acre understory**

Year	Section	Acres	Koa 50%	Ohia 25%	25% Mixed species	Understory species
2	1	3.2	960	480	480	
3	2	2.8	840	420	420	
4	3	2.6	780	390	390	
5	4	0.3	90	45	45	
6						
7	1	3.2				1376
8	2	2.8				1204
9	3	2.6				1118
10	4	0.3				128

**Table 5 Seedling cost by year, section, acre**

Year	Section	Acres	Koa \$2/ca	Ohia \$5.5/ca	Additional overstory species \$5.5	Understory species \$5.5	Cost	Cost/ac
2	1	3.2	1920	2640	2640		7200	2250
3	2	2.8	1680	2310	2310		6300	2250
4	3	2.6	1560	2145	2145		5850	2250
5	4	0.3	102	247	247		596	1987
6								
7	1	3.2				7568	7568	2365
8	2	2.8				6622	6622	2365
9	3	2.6				6149	6149	2365
10	4	0.3				129	129	2367

**Site preparation**

The native tree species that are currently on the land (koa, ohia, hapuu) will be encouraged and cleared of overgrowing uluhe. Extensive areas of uluhe will be left as intact as possible to impede invasive grasses, temporary paths will be made through uluhe to access. All non-native trees within management sections (bamboo, strawberry guava, *Falcataria*, and other species) will be removed. Stands of bamboo will be cut to ground level by hand saw and chain saw then mechanically mowed until there is no re-growth. Herbicide will be used if needed. Strawberry guava will be cut and oil based herbicide applied to cut stem and basal bark (Leary et al 2012, Matooka, et al. 2002). The single *Falcataria moluccana* will be have herbicide applied by basal bark and injection (Leary et al 2010). The large tree is not near roads and will be left in place when it falls. Any other invasive

trees encountered will be treated with herbicide in an appropriate manner. Clumps of Lyon's grass *Themeda villosa*, will be cut and regrowth treated with foliar herbicide (Motooka et al 2003) until dead. Kalihi ginger will be cut, herbicide applied to cut roots (Motooka et al 2002). Bamboo will be cut by hand repeatedly until dead, cut stems will be chipped and applied to seedlings as mulch.

Individual planting sites will be cleared to bare mineral earth for both overstory plantings (years 2-5) and understory plantings (years 7-10). Where uluhe is dominant, it will be clipped from the planting site, runners and roots removed. Invasive grasses will be treated with Glyphosate and Imazapyr, dead grasses will be left in place (Motooka, et al. 2002). Use of herbicides will follow DOFAW Best Management Practices (<http://www.state.hi.us/dlnr/dofaw/wmp/bmps.htm>).

Seedlings will be planted in irregular clumpings rather than straight lines used in commercial forests. Tall uluhe that overshadows planting sites will be cut back to allow light to reach the planting site but will not be removed. The majority of work will be done by the landowner, family and friends. This workforce is dependable and will be available throughout the project.

#### **Seedling acquisition**

In the first five years of the project, most seedlings will be purchased from local suppliers. Aileens Nursery, a Hilo based grower of native plants will provide ohia and species other than hapuu and koa. H&S Farms, an antherium grower in Kurtistown, has a large number of young hapuu and ohia seeded naturally in their shade houses.

The only commercially available koa are from the state nursery however seeds are not from Hilo lowland sources. The owner will collect seed from the property and other local sites in the Hilo area, and propagate seedlings on site following methods of Jacobs et al 2011 and Dumroese et al 2009. Koa and ohia will be started in the year prior to scheduled planting for outplanting while species that are slow growing will be started several years prior to the planting schedule to allow time for sufficient growth.

A small on-site nursery will be established by the owner for propagation of understory plants in years 6-10. All plants will be grown from seed; cuttings and root stock will not be used. Seedlings will be outplanted when have at least 6 leaves past the cotyledon as per recommendation of the Volcano Rare Plant Facility.

The price of nursery grown seedlings is used as the cost basis for the owners nursery grown seedlings Price estimates are taken from Aileens Nursery for ohia and other natives and H&S Farms for hapuu at \$5 to 5.5/seedling (see Attachment 5). Koa seedlings are estimated at \$2/ea grown by the owner on site.

#### **Planting**

Planting sites will be spot cultivated and cleared of vegetation within a 3 square foot area. The planting hole for each seedling will be a minimum of adequate diameter to plant the tree seedlings such that the tree root system shall be positioned in a natural arrangement (e.g. not coiled or bent upward in the planting hole). Planting hole size will depend on how the seedling is potted (i.e.: 2" diameter dibble tubes require smaller holes seedlings in 1 gallon pots). The tree seedling will be planted so that the entire root system is below the natural soil line and planting hole filled with soil and firmed around the planted seedling to remove air pockets.

### Fertilization and soil amendments

An analysis of soil samples by CTAHR found low ph, very low phosphate, potassium, calcium and magnesium (see Attachment 3). Recommended soil amendments for each 3 sq. ft planting site are given in Table 6. Dolomite will be worked into each planting site one month prior to planting, other amendments will be worked into the planting site just prior to planting. Slow release fertilizer will be worked into the soil surface and in the mulch around each planting site at planting and at 3 month intervals the first year. Nutrient monitoring will be done annually to adjust amendment levels.

**Table 6 Recommended fertilizer and soil amendments**

	lbs/planting site	lbs/ac	cost/ac
Slow- release 10-20-20	0.4 over 4 applications	216	110
Triple super phosphate	0.2	90	110
Dolomite (lime)	0.4	206	110
Gypsum (calcium)	0.7	361	96
Magnesium-sulfite	0.2	103	103
Estimated cost/ac		976	529

### Monitoring

Seedlings being grown on site will be monitored on a daily basis for pests and diseases. Prior to planting, plants will be checked and selected for vigorous growth and root systems. In the first year after planting, seedling will be monitored at a minimum of every two months for pests, disease, encroaching vegetation and newly emerging invasive plants. In subsequent years, monitoring will be conducted at a minimum of every four months.

An annual census will be made of all plantings to include: height, dbh, dbh of trees that have died since last plot visit, presence of decay, disease, breakage, discoloration of leaves. Nutrients will be monitored annually to adjust amendment levels.

### Weed Control and Mulching

Organic mulch (including chipped trees removed from the site) will be applied at the base of each seedling at least 2" thick where feasible to help control weeds. Mulch will be not be applied directly to stems to help prevent rot. Invasive grasses will be treated with Glyphosate and Imazapyr, dead grasses will be left in place (Matooka, et al. 2002). Use of herbicides will follow DOFAW Best Management Practices. Areas of uluhe will be left as intact as possible to impede invasive grasses and temporary paths will be made through uluhe to access planting sites.

Invasive weeds will be controlled as each section is added cumulatively to the project. Mulching at individual planting sites will be done for each section as it is planted. The number of stems planted will increase from a density of 600 stems/acre for overstory plantings in years 2-6 to 860 stems/acre when understory plantings are added in years 7-10. Costs for weed control and mulching decline by 50% in years 7-10 to maintain understory plantings.

### Streamside management zone (SMZ)

Existing vegetation within 35 feet of the Maile stream includes grasses, kahili ginger, rose apple, guava, bamboo, non-native ferns and grasses. The fence in section 1 will be within the SMZ, approximately 15-25 ft from the stream bank. The area between the fence and stream bank is

included as part of this management plan and will be planted as part of section 1. However, the bank of Maile stream is a vertical cliff in most areas and is not included in this management plan. The stream bank of Awehi stream is a dense stand of guava between section 3 and the stream, it also is not included as part of the plan.

**Trail construction**

No permanent trails are intended for this project. The existing dirt road in the middle of the property will be retained for access but not improved.

## VI. IMPLEMENTATION SCHEDULE

Table 7 Implementation schedule and estimated costs

Practice component	Units (ac)	Cost/Unit	Total Cost	Applicant Share	FSP Share
<b>Year 1</b>					
Management Plan			4000	2000	2000
Site prep- tree removal	8.9 ac	500/ac	4450	2225	2225
Fencing	2,400 ft	8.33/ft	20000	10000	10000
<b>Total Costs Year 1</b>			<b>28450</b>	<b>14225</b>	<b>14225</b>
<b>Year 2 - Section 1</b>					
Site preparation	3.2	500	2000	1000	1000
Soil amendments	3.2	529	1693	846	846
Seedling aquisition	1376	2-5.5/ea	7200	3600	3600
Planting	3.2	500	1600	800	800
Weed control and mulching	3.2	600	1920	960	960
<b>Total Costs Year 2</b>			<b>14413</b>	<b>7206</b>	<b>7206</b>
<b>Year 3 - Section 2</b>					
Site preparation	2.8	500	1400	700	700
Soil amendments	2.8	529	1481	741	741
Seedling aquisition	1204	2-5.5/ea	6300	3150	3150
Planting	2.8	500	1400	700	700
Weed control and mulching	5.6	600	3360	1680	1680
<b>Total Costs Year 3</b>			<b>13941</b>	<b>6971</b>	<b>6971</b>
<b>Year 4 - Section 3</b>					
Site preparation	2.6	500	1300	650	650
Soil amendments	2.6	529	1375	688	688
Seedling aquisition	1118	2-5.5/ea	5850	2925	2925
Planting	2.6	500	1300	650	650
Weed control and mulching	8.2	600	4920	2460	2460
<b>Total Costs Year 4</b>			<b>14745</b>	<b>7373</b>	<b>7373</b>
<b>Year 5 - Section 4</b>					
Site preparation	0.3	500	150	75	75
Soil amendments	0.3	529	159	79	79
Seedling aquisition	129	2-5.5/ea	676	265	338

Planting	0.3	500	150	75	75
Weed control and mulching	8.6	600	5160	2580	2580
<b>Total Costs Year 5</b>			<b>6295</b>	<b>3147</b>	<b>3147</b>
<b>Year 6</b>					
Weed control and mulching	8.6	600	5160	2580	2580
<b>Total Costs Year 6</b>			<b>5160</b>	<b>2580</b>	<b>2580</b>
<b>Year 7</b>					
Site preparation - Sect 1	3.2	500	1600	800	800
Soil amendments - Sect 1	3.2	529	1693	846	846
Seedling aquisition	1376	5.5/ea	10560	5280	5280
Planting	3.2	500	1600	800	800
Weed control and mulching	8.9	300	2670	1335	1335
<b>Total Costs Year 7</b>			<b>18123</b>	<b>9061</b>	<b>9061</b>
<b>Year 8</b>					
Site preparation – Sect 2	2.8	500	1400	700	700
Soil amendments - Sect 2	2.8	529	1481	741	741
Seedling aquisition	1204	5.5/ea	9240	4620	4620
Planting	2.8	500	1400	700	700
Weed control and mulching	8.9	300	2670	1335	1335
<b>Total Costs Year 8</b>			<b>16191</b>	<b>8096</b>	<b>8096</b>
<b>Year 9</b>					
Site preparation - Sect 3	2.6	500	1300	650	650
Soil amendments - Sect 3	2.6	529	1375	688	688
Seedling aquisition	1118	5.5/ea	8580	4290	4290
Planting	2.6	500	1300	650	650
Weed control and mulching	8.9	300	2670	1335	1335
<b>Total Costs Year 9</b>			<b>15225</b>	<b>7613</b>	<b>7613</b>
<b>Year 10</b>					
Site preparation - Sect 4	0.3	500	150	75	75
Soil amendments - Sect 4	0.3	529	159	79	79
Seedling aquisition	129	5.5/ea	990	495	495
Planting	0.3	500	150	75	75
Weed control and mulching	8.9	300	2670	1335	1335
<b>Total Costs Year 10</b>			<b>4119</b>	<b>2059</b>	<b>2059</b>

## VII. BUDGET SUMMARY

**Table 8 Budget summary by year**

<b>Year</b>	<b>Total Cost</b>	<b>Applicant Share</b>	<b>FSP Share</b>	<b>Other Funding Source</b>
#1 2013	28450	14225	14225	0
#2 2014	14413	6276	6276	0
#3 2015	13941	6971	6971	0
#4 2016	14745	7373	7373	0
#5 2017	6295	3147	3147	0
#6 2018	5160	2580	2580	0
#7 2019	18123	9061	9061	0
#8 2020	16191	8096	8096	0
#9 2021	15225	7613	7613	0
#10 2022	4119	2059	2059	0
<b>TOTAL</b>	<b>136,662</b>	<b>67400</b>	<b>67400</b>	<b>0</b>

## VIII. ATTACHMENTS

**Attachment 1: Photographs of property**

**Attachment 2: NRCS soil survey report**

**Attachment 3: CTAHR soil analysis report**

**Attachment 4: Fencing proposals**

**Attachment 5: Growers prices and correspondence**

## **Forestry Stewardship Advisory Committee Recommendations**

### **Comments April 29 2013**

1) Minor error on page 7 of the management plan - should be "succession" instead of "successive"?

Corrected

2) In year 7 of your implementation plan you have included site preparation as a practice – is this practice to prepare the site for planting or used more as a weed control practice? If it is the latter, then we should update the name to weed control.

Response: Site preparation costs for years 7-9 are to cut through the dense uluhe root mat to get to bare mineral soil.

3) On your final management plan it should include the county zoning for the property (e.g.: Ag-5 or Ag-1, etc)

Corrected

4) The committee thought you could consider a higher planting density (more than 10ft x 10ft spacing) for the purposes of your project; however, that would result in a high cost. For your consideration...

Response: Planting density has been increased to 600/ac altering the ratio to 50% koa, 25% ohia and 25% mixed other species. The majority of the increase is in koa. Spacing will be irregular, not on a grid pattern.

5) The committee also recommended the use of herbicides in addition to the cutting and mowing for controlling the bamboo on the property.

Response: revised to include herbicides

6) In your management plan, are you intending to clear to bare soil the entire area or just in a radius around each planting site?

Response: Individual planting sites will be cleared to bare mineral earth, not the entire area.

7) The committee recommend using a slow release fertilizer in each of the planting holes instead of broadcasting fertilizer – it would be more cost efficient.

Revised: Slow release fertilizer will be worked into the soil surface and in the mulch around each planting site at planting and 3 month intervals the first year.

**Literature cited and reviewed**

- Anderson, R.C. and J. Uchida, 2008. Disease Index for the Rust *Puccinia psidii* on Rose Apple in Hawai'i, CTAHR Plant Disease publication PD-37.
- Baker, P. J., Scowcroft, P. G., Ewel, J. J. 2009. Koa (*Acacia koa*) ecology and silviculture. Gen. Tech. Rep. PSW-GTR-211. Albany, CA: U.S. Department of Agriculture, Forest Service, Pacific Southwest Research Station. 129 p.
- Dumroese, K., Jacobs, D.F., and A.S. Davis. 2009. Inoculating *Acacia koa* with *Bradyrhizobium* and Applying Fertilizer in the Nursery: Effects on Nodule Formation and Seedling Growth. *Horticultural Science* 44(2):443–446. 2009.
- Friday, J.B and N. Dudley. Koa wilt. [http://www.ctahr.hawaii.edu/forestry/disease/koa\\_wilt.html](http://www.ctahr.hawaii.edu/forestry/disease/koa_wilt.html)
- Gardner, D.E. 1996. *Acacia koa*: A review of its diseases and associated fungi. University of Hawaii Department of Botany. In: *Koa: A Decade of Growth*. Hawaii Forest Industry Association (HFIA), Hilo.
- Giambelluca TW, Chen Q, Frazier AG, Price JP, Chen Y-L, Chu P-S, Eischeid J., and Delparte, D. 2011. The Rainfall Atlas of Hawai'i. <http://rainfall.geography.hawaii.edu>
- Hawaii's Comprehensive Wildlife Conservation Strategy, 2005. 'Ope'ape'a or Hawaiian hoary bat.
- Jacobs, D.F, Davis, A.S., and K. Dunrosc 2011. Nursery techniques to improve restoration of *Acacia koa* seedlings in competition with kikiyu grass. Talk presented at the Hawaii Conservation Conference.
- Juvik, J and L. Lawrence, 1982. Late holocene vegetation history from Hawaiian peat deposits. In: *Proceedings, Fourth Conference in Natural Sciences, Hawaii Volcanoes National Park*, pp. 100.
- Leary, J., Beachy, J. and A. Hardman 2012. Practitioners guide for effective non-restricted herbicide techniques to control and suppress invasive woody species in Hawai'i. University of Hawaii, College of Tropical Agriculture and Human resources, WC-10.
- Motooka, P., Ching, L. and G. Nagai, 2002. *Herbicidal Weed Control Methods for Pastures and Natural Areas of Hawaii*. Cooperative Extensions Service, College of Tropical Agriculture and Human Resources, University of Hawaii at Manoa, WC-8, pp. 36.
- Motooka, P., Castro, L., Nelson, D., Nagai, G., and L. Ching. 2003. *Weeds of Hawaii's pastures and natural areas; an identification and management guide*. University of Hawaii, Manoa.
- NRCS, 2010 Custom Soil Resources Report for Island of Hawaii Area, Hawaii, Kaiwiki parcel.
- Stemmermann, L. 1981 *A guide to Pacific wetland plants*. US Army Corps of Engineers

**Professionals consulted**

Dr. J.B. Friday, Univ. of Hawaii Extension Forester

Tim Tunison, Hawaii Volcanoes National Park, retired

Dr. Orlo Steele, Hilo Community College, Forest TEAM Program

Robert Wescom, Licensed forester, Guam

Dr. Anne Brooke is the Conservation Program Manager for the US Navy on Guam. She has worked on erosion control, reforestation and plant conservation projects on Navy lands and was the POC for the Cetti Bay reforestation project with Gov. Guam Department of Agriculture. She has lived on Guam since 2003 when she was the USFWS wildlife biologist at the Guam National Wildlife Refuge. Dr. Brooke had been a terrestrial biologist for Department of Marine and Wildlife Resources, Am Samoa 1994-1997.

**Exhibit B**

## VI. IMPLEMENTATION SCHEDULE

Table 1 Implementation schedule and estimated costs

Practice component	Units (ac)	Cost/Unit	Total Cost	Applicant Share	FSP Share
<b>Year 1</b>					
Management Plan			\$4,000.00	\$2,000.00	\$2,000.00
Site prep- tree removal	8.9 ac	500/ac	\$4,450.00	\$2,225.00	\$2,225.00
Fencing	2,400 ft	8.33/ft	\$20,000.00	\$10,000.00	\$10,000.00
<b>Total Costs Year 1</b>			<b>\$24,450.00*</b>	<b>\$12,225.00*</b>	<b>\$12,225.00*</b>
<i>*Minus the Management Plan Development Cost</i>					
<b>Year 2 - Section 1</b>					
Site preparation	3.2	500	\$2,000.00	\$1,000.00	\$1,000.00
Soil amendments	3.2	529	\$1,693.00	\$846.00	\$846.00
Seedling acquisition	1376	2-5.5/ea	\$7,200.00	\$3,600.00	\$3,600.00
Planting	3.2	500	\$1,600.00	\$800.00	\$800.00
Weed control and mulching	3.2	600	\$1,920.00	\$960.00	\$960.00
<b>Total Costs Year 2</b>			<b>\$14,413.00</b>	<b>\$7,206.00</b>	<b>\$7,206.00</b>
<b>Year 3 - Section 2</b>					
Site preparation	2.8	500	\$1,400.00	\$700.00	\$700.00
Soil amendments	2.8	529	\$1,481.00	\$741.00	\$741.00
Seedling acquisition	1204	2-5.5/ea	\$6,300.00	\$3,150.00	\$3,150.00
Planting	2.8	500	\$1,400.00	\$700.00	\$700.00
Weed control and mulching	5.6	600	\$3,360.00	\$1,680.00	\$1,680.00
<b>Total Costs Year 3</b>			<b>\$13,941.00</b>	<b>\$6,971.00</b>	<b>\$6,971.00</b>
<b>Year 4 - Section 3</b>					
Site preparation	2.6	500	\$1,300.00	\$650.00	\$650.00
Soil amendments	2.6	529	\$1,375.00	\$688.00	\$688.00
Seedling acquisition	1118	2-5.5/ea	\$5,850.00	\$2,925.00	\$2,925.00
Planting	2.6	500	\$1,300.00	\$650.00	\$650.00
Weed control and mulching	8.2	600	\$4,920.00	\$2,460.00	\$2,460.00
<b>Total Costs Year 4</b>			<b>\$14,745.00</b>	<b>\$7,373.00</b>	<b>\$7,373.00</b>
<b>Year 5 - Section 4</b>					

Exhibit C

Site preparation	0.3	500	\$150.00	\$75.00	\$75.00
Soil amendments	0.3	529	\$159.00	\$79.00	\$79.00
Seedling acquisition	129	2-5.5/ea	\$676.00	\$265.00	\$338.00
Planting	0.3	500	\$150.00	\$75.00	\$75.00
Weed control and mulching	8.6	600	\$5,160.00	\$2,580.00	\$2,580.00
<b>Total Costs Year 5</b>			<b>\$6,295.00</b>	<b>\$3,147.00</b>	<b>\$3,147.00</b>
<b>Year 6</b>					
Weed control and mulching	8.6	600	\$5,160.00	\$2,580.00	\$2,580.00
<b>Total Costs Year 6</b>			<b>\$5,160.00</b>	<b>\$2,580.00</b>	<b>\$2,580.00</b>
<b>Year 7</b>					
Site preparation - Sect 1	3.2	500	\$1,600.00	\$800.00	\$800.00
Soil amendments - Sect 1	3.2	529	\$1,693.00	\$846.00	\$846.00
Seedling acquisition	1376	5.5/ea	\$10,560.00	\$5,280.00	\$5,280.00
Planting	3.2	500	\$1,600.00	\$800.00	\$800.00
Weed control and mulching	8.9	300	\$2,670.00	\$1,335.00	\$1,335.00
<b>Total Costs Year 7</b>			<b>\$18,123.00</b>	<b>\$9,061.00</b>	<b>\$9,061.00</b>
<b>Year 8</b>					
Site preparation - Sect 2	2.8	500	\$1,400.00	\$700.00	\$700.00
Soil amendments - Sect 2	2.8	529	\$1,481.00	\$741.00	\$741.00
Seedling acquisition	1204	5.5/ea	\$9,240.00	\$4,620.00	\$4,620.00
Planting	2.8	500	\$1,400.00	\$700.00	\$700.00
Weed control and mulching	8.9	300	\$2,670.00	\$1,335.00	\$1,335.00
<b>Total Costs Year 8</b>			<b>\$16,191.00</b>	<b>\$8,096.00</b>	<b>\$8,096.00</b>
<b>Year 9</b>					
Site preparation - Sect 3	2.6	500	\$1,300.00	\$650.00	\$650.00
Soil amendments - Sect 3	2.6	529	\$1,375.00	\$688.00	\$688.00
Seedling acquisition	1118	5.5/ea	\$8,580.00	\$4,290.00	\$4,290.00
Planting	2.6	500	\$1,300.00	\$650.00	\$650.00
Weed control and mulching	8.9	300	\$2,670.00	\$1,335.00	\$1,335.00
<b>Total Costs Year 9</b>			<b>\$15,225.00</b>	<b>\$7,613.00</b>	<b>\$7,613.00</b>
<b>Year 10</b>					
Site preparation - Sect 4	0.3	500	\$150.00	\$75.00	\$75.00
Soil amendments - Sect 4	0.3	529	\$159.00	\$79.00	\$79.00

## Exhibit C

Seedling acquisition	129	5.5/ea	\$990.00	\$495.00	\$495.00
Planting	0.3	500	\$150.00	\$75.00	\$75.00
Weed control and mulching	8.9	300	\$2,670.00	\$1,335.00	\$1,335.00
<b>Total Costs Year 10</b>			<b>\$4,119.00</b>	<b>\$2,059.00</b>	<b>\$2,059.00</b>

### VII. BUDGET SUMMARY

**Table 2 Budget summary by year**

<b>Year</b>	<b>Total Cost</b>	<b>Applicant Share</b>	<b>FSP Share</b>
#1 2013	\$24,450.00	\$12,225.00	\$12,225.00
#2 2014	\$14,413.00	\$7,206.00	\$7,206.00
#3 2015	\$13,941.00	\$6,971.00	\$6,971.00
#4 2016	\$14,745.00	\$7,373.00	\$7,373.00
#5 2017	\$6,295.00	\$3,147.00	\$3,147.00
#6 2018	\$5,160.00	\$2,580.00	\$2,580.00
#7 2019	\$18,123.00	\$9,061.00	\$9,061.00
#8 2020	\$16,191.00	\$8,096.00	\$8,096.00
#9 2021	\$15,225.00	\$7,613.00	\$7,613.00
#10 2022	\$4,119.00	\$2,059.00	\$2,059.00
<b>TOTAL</b>	<b>\$132,662.00</b>	<b>\$66,331.00</b>	<b>\$66,331.00</b>