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Director Jessica Wooley
Office of Environmental Quality Control
Department of Health, State of Hawai'i
235 S. Beretania Street, Room 702
Honolulu, Hawai'i 96813

Dear Director:
With this letter, the Division of Forestry and Wildlife hereby transmits the draft environmental assessment and anticipated finding of no significant impact (DEA-AFONSI) for the Waiākea Timber Management Area Sustainable Commercial Harvest of Timber situated at (3) 1-8-012:001 (3) 2-4-008:001, (3) 2-4-008:006, (3) 2-4-008:010, and (3) 2-4-008:022, in the South Hilo and Puna Districts on the island of Hawaii for publication in the February 8, 2015 edition of the Environmental Notice.

Enclosed is a completed OEQC Publication Form, one copy of the DEA-AFONSI, an Adobe Acrobat PDF file of the same, and an electronic copy of the publication form in MS Word. Simultaneous with this letter, we have submitted the summary of the action in a text file by electronic mail to your office.

If there are any questions, please contact Sheri Mann at (808) 587-4172.

Sincerely,

Lisa J. Hadway, Administrator
Division of Forestry and Wildlife

AGENCY ACTIONS
SECTION 343-5(B), HRS
PUBLICATION FORM (FEBRUARY 2013 REVISION)

Project Name: Waiākea Timber Management Area Sustainable Commercial Harvest of Timber
Island: Hawaii
District: South Hilo and Puna Districts
TMK: (3) 1-8-012:001 (3) 2-4-008:001, (3) 2-4-008:006, (3) 2-4-008:010, and (3) 2-4-008:022
Permits: BLNR approval
Proposing/Determination Agency: Department of Land and Natural Resources, Division of Forestry and Wildlife, 1151 Punchbowl St. Rm 325, Honolulu, HI 96813, Sheri S. Mann, (808) 587-4172
(*Address, Contact Person, Telephone*)
Accepting Authority:
(for EIS submittals only)
Consultant: Anden Consulting, 2812-B Kalihi Street Honolulu, HI 96819, Christen Mitchell, (808)222-7877
Status (check one only):

X_DEA-AFNSI	Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of DEA, a completed OEQC publication form, along with an electronic word processing summary and a PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov); a 30-day comment period ensues upon publication in the periodic bulletin.
__FEA-FONSI	Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and a PDF copy (send both summary and PDF to oeqchawaii@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.
__FEA-EISPN	Submit the proposing agency notice of determination/transmittal on agency letterhead, a hard copy of the FEA, an OEQC publication form, along with an electronic word processing summary and PDF copy (you may send both summary and PDF to oeqchawaii@doh.hawaii.gov); a 30-day consultation period ensues upon publication in the periodic bulletin.
__Act 172-12 EISPN	Submit the proposing agency notice of determination on agency letterhead, an OEQC publication form, and an electronic word processing summary (you may send the summary to oeqchawaii@doh.hawaii.gov). NO environmental assessment is required and a 30-day consultation period upon publication in the periodic bulletin.
__DEIS	The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the DEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the DEIS (you may send both the summary and PDF to oeqchawaii@doh.hawaii.gov); a 45-day comment period ensues upon publication in the periodic bulletin.
__FEIS	The proposing agency simultaneously transmits to both the OEQC and the accepting authority, a hard copy of the FEIS, a completed OEQC publication form, a distribution list, along with an electronic word processing summary and PDF copy of the FEIS (you may send both the summary and PDF to oeqchawaii@doh.hawaii.gov); no comment period ensues upon publication in the periodic bulletin.
__ Section 11-200-23 Determination	The accepting authority simultaneously transmits its determination of acceptance or nonacceptance (pursuant to Section 11-200-23, HAR) of the FEIS to both OEQC and the proposing agency. No comment period ensues upon publication in the periodic bulletin.
__Section 11-200-27 Determination	The accepting authority simultaneously transmits its notice to both the proposing agency and the OEQC that it has reviewed (pursuant to Section 11-200-27, HAR) the previously accepted FEIS and determines that a supplemental EIS is not required. No EA is required and no comment period ensues upon publication in the periodic bulletin.
__Withdrawal (explain)	

Summary (Provide proposed action and purpose/need in less than 200 words. Please keep the summary brief and on this one page)**:**

The Division of Forestry and Wildlife (DOFAW) proposes to commercially harvest timber from the Waiākea Timber Management Area (WTMA) through a Request for Proposal process and subsequent issuance of a timber land license. The proposed action involves the use of State land, including those within the Conservation District. As such, the proposed action requires an environmental assessment pursuant to Hawai‘i Revised Statutes (HRS) Chapter 343. An environmental assessment was previously prepared in 1999 for similar activities, resulting in a finding of no significant impact. The intent of this environmental assessment is to update the analysis to reflect changes in the surrounding environment over the past fifteen years.

Project activities will include road maintenance, timber harvesting, site preparation, reforestation and other forest management practices for timber stand improvement. Strict adherence to the State’s Best Management Practices for Maintaining Water Quality in Hawaii (BMPs) and to the management objective of sustainable, long-term forest plantation productivity will minimize impacts to the physical environment.

DRAFT
ENVIRONMENTAL ASSESSMENT

Waiākea Timber Management Area

Sustainable Commercial Harvest of Timber

JANUARY 2015

Prepared by:
Department of Land and Natural Resources
Division of Forestry and Wildlife
1151 Punchbowl Street, Room 325
Honolulu, HI 96813

with assistance from
Anden Consulting
2812-B Kalihi Street
Honolulu, HI 96819

In accordance with
Chapter 343, Hawai‘i Revised Statutes

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I. SUMMARY

Project Name	Sustainable Commercial Harvest of Timber
Project Location	Waiākea Timber Management Area Island of Hawai‘i South Hilo and Puna Districts Upper Waiākea, Waiākea and ‘Ōla‘a Forest Reserves
Land Use	Forest Reserve

TMKs	State land use	County zoning
(3) 1-8-012:001	Conservation	none
(3) 2-4-008:001	Conservation	none
(3) 2-4-008:006	Conservation	none
(3) 2-4-008:010	Conservation	A-3(a)
(3) 2-4-008:022	Conservation	none

Proposing Agency	Department of Land and Natural Resources Division of Forestry and Wildlife
Anticipated Determination	Finding of No Significant Impact

<u>Summary of Action</u>

The Division of Forestry and Wildlife (DOFAW) proposes to commercially harvest timber from the Waiākea Timber Management Area (WTMA) through a Request for Proposal process and subsequent issuance of a timber land license. The proposed action involves the use of State land, including those within the Conservation District. As such, the proposed action requires an environmental assessment pursuant to Hawai‘i Revised Statutes (HRS) Chapter 343. An environmental assessment was previously prepared in 1999 for similar activities, resulting in a finding of no significant impact. The intent of this environmental assessment is to update the analysis to reflect changes in the surrounding environment over the past fifteen years.

The project area is located in the Upper Waiākea, Waiākea and ‘Ōla‘a Forest Reserves. The WTMA was established to create a forest resource base that could provide a consistent wood and forest products supply to stimulate the forest product industry in Hawai‘i. Major planting efforts began in 1959; timber inventory data indicates that the WTMA in its current configuration contains approximately 16,000,000 cubic feet of gross merchantable timber, primarily composed of Queensland maple (*Flindersia brayleyana*), *Eucalyptus saligna* and *grandis*, Australian toon (*Toona ciliata*), and

tropical ash (*Fraxinus uhdei*).

Project activities will include road maintenance, timber harvesting, site preparation, reforestation and other forest management practices for timber stand improvement. Strict adherence to the State's *Best Management Practices for Maintaining Water Quality in Hawaii* (BMPs) and to the management objective of sustainable, long-term forest plantation productivity will minimize impacts to the physical environment.

The benefits of guiding public timber and forest product assets into local processing facilities include immediate economic gain to the local economy, creation of high quality jobs for the local community, and establishment of a more productive forest product industry in the State of Hawaiʻi. It also provides a more consistent source of revenue to DOFAW to improve forest management throughout Hawaiʻi island. Primary anticipated impacts of project activities include the potential spread of invasive species, temporary disruption of existing recreational activities within the WTMA, and impacts on local traffic.

II. PROJECT PURPOSE AND NEED

The Waiākea Timber Management Area was established for commercial forest products harvesting – to provide a consistent wood supply to support the development of a forest products industry. In 1956, the Waiākea Arboretum was created to test adaptability and growth potential of 84 introduced timber species, clearing of the WTMA by bulldozer occurred between 1959 and 1968, and major planting efforts began in 1959. These efforts continued into the mid-1970s, planting an estimated 2.3 million trees. Another 330 acres formerly leased to the Puna Sugar Company was planted in the early 1980s.

In 1997, a forest timber survey was conducted to determine timber species volume and to obtain data on tree species size and density. The timber survey data revealed a gross volume of over 17 million cubic feet of merchantable timber resources for trees with diameters greater than four inches in diameter at breast height. Based on the timber survey, the WTMA has an estimated economic stumpage value of several million dollars; actual revenue depends on the markets currently available for the timber resources. The value-added economic gain to the local economy is estimated to be greater than the actual stumpage value, by providing primary and secondary employment, by providing a local source of wood for wood products, and by contributing to energy security as a biofuel source.

DOFAW has received previous requests from the private sector for access to the timber within the WTMA, from those interested in wood chips, veneer, plywood, lumber, biofuel, and other higher value wood products, such as molding, paneling, flooring, furniture, and turning stock (e.g., for bowls). From 1985 to 1988, the State and the Puna Sugar Company entered into a timber harvest agreement for approximately 1,500 acres of Eucalyptus. The harvested trees were converted to wood chips and used to produce power at a local electrical generator plant, and the harvested area was replanted with Eucalyptus. From 2001 to 2011, most of the WTMA (approximately 68%) was under a timber land license agreement with Tradewinds Forest Products. Tradewinds intended to harvest approximately 500 acres per year to provide raw materials for a mill that was never constructed. Due to a myriad of start-up problems, very little timber was harvested from WTMA. As of July 2014, approximately 1,000

acres of WTMA remain under a timber land license. To date, little to no harvesting of planted hardwoods has occurred with the exception of small-scale timber salvage operations, where commercial value did not exceed $1,000. The timber resources of WTMA continue to mature.

Sustainable commercial harvest of the WTMA is proposed to effectively utilize existing aging timber resources and enhance the long-term health of the forest in this area. The proposed commercial harvest of WTMA implements the original purpose of the WTMA as it incorporates sustainable forestry techniques to provide a consistent wood supply. A sustainable commercial harvest operation in the WTMA will provide a model for developing and utilizing timber management areas on other islands and support the growth of a sustainable forest products industry in Hawaiʻi. The island of Hawaiʻi is arguably the best location in the State to stimulate a local forest products industry because of the good site conditions (soil, precipitation, etc.), higher unemployment rates, thousands of acres of forest and potential forest land, and a modest existing commercial forest resource base that can support a range of value-added forest processing options.

Historically, the economics of forestry operations in Hawaiʻi have been variable. Some planted species have not succeeded, most timber plantations have not been effectively managed to maximize timber value, local processing opportunities have been limited, and the remote location and relatively small (compared to mainland forests) timber resource base increases costs of harvest. However, DOFAW believes that guiding public timber assets into capable local processing operations/facilities can support jobs for the local community and supplement local energy needs. DOFAW further believes that WTMA can be economically profitable, while accommodating recreational uses and supporting a healthy forest. All revenues received by the State will be deposited into the Forest Stewardship special fund to be used for future forest management, pursuant to HRS §195F-4.

As required by Hawaiʻi Revised Statutes §183-16.5, the Board of Land and Natural Resources (Board) must approve a Forest Management Plan before a single tree can be harvested on state-owned land. In 1999, both a management plan and an environmental assessment were completed by DOFAW for the purpose of commercial harvest and reforestation of the WTMA, and a timber license was issued in 2001. As DOFAW prepares to conduct an RFP to issue a new timber land license or licenses, the previous management plan has been revised (and is attached as Appendix B) and this Draft Environmental Assessment (DEA) has been prepared to reflect changes that have occurred in the environment and communities in this area.

III. SCOPING AND PUBLIC PARTICIPATION

A formal scoping letter was sent to a variety of Federal, State, and Hawaiʻi county agencies, community groups, non-profits, and interested individuals in March 2012 by postal mail and by email. The list of consulted parties is included as Appendix A. Oral comments were received from three individuals; written comments were received from Hawaiʻi Volcanoes National Park, DLNR-State Historic Preservation Division, DLNR-Office of Conservation and Coastal Lands, the State Department of Hawaiian Home Lands, the State Department of Health, the State Department of Transportation, the County of Hawaiʻi Planning Department, County of Hawaiʻi Department of Research and

Development, County of Hawai‘i Fire Department, Mauna Kea Recreational Users Group, Big Island Mountain Bike Association, and an individual. Copies of the letters are included as Appendix H. Overall, initial public response to the project has been generally positive.

Issues raised during the scoping process and addressed in this DEA include:

- recommendation for an archaeological inventory survey within the lower elevations of the project area;
- potential impacts on State highways of transporting oversized and/or overweight materials;
- potential impact on traffic;
- impact of timber management on native species;
- concern regarding access to timber for local woodworkers;
- potential impact to existing recreational uses in WTMA;
- the potential for introduction or spread of invasive plant species;
- potential impacts on bats; and
- the need for reforestation after harvest.

Issues raised in the 1999 Forest Management Plan providing for commercial harvest included:

- possibility of watershed degradation;
- past military dumping of chemical agent canisters;
- replanting the site with nitrogen fixing plants or bamboo and rattan;
- availability of job opportunities for local people; and
- availability of area for hunting, recreation, and non-wood forest product gathering.

IV. PROJECT DESCRIPTION

A. Overview

DOFAW proposes to sustainably harvest timber from WTMA through the issuance of a Request for Proposals resulting in a timber land license agreement or agreements. As outlined in the WTMA Draft Forest Management Plan, commercial harvest within the WTMA will be guided by the following 8 principles:

1. The State should utilize its land and timber within the WTMA to maximize local processing where feasible, create jobs, and encourage development of *integrated processing facilities* that provide suitable outlets for the range of species and grades of wood that currently exist. The availability of plantation forest resources within the WTMA could allow for development of a variety of wood processing plants (e.g., lumber and veneer), and biomass power or biofuels facilities. This will provide *immediate employment opportunities*. It will also encourage other investors and landowners to become involved in plantation forestry at the onset, stimulating additional employment opportunities. DOFAW should also look at current market and future demand projections, to help decide what will be the most valuable and in-demand timber to replant.

2. Effective soil erosion control practices, including harvesting methods and replanting, safe use of herbicides, and visual buffers along major transportation corridors will be required for all commercial forest operations within the WTMA as outlined in the State's Best Management Practices.

3. The State will evaluate all non-native species proposed for planting for potential invasiveness utilizing the Hawai‘i Weed Risk Assessment and other relevant information.

4. The need to *involve the public* in project planning and development is important to account for the appropriate use of the resources, especially when it affects the local communities. Careful integration of timber management with *hunting, recreational, and gathering activities* will aid in developing community support for growing and processing timber resources.

5. A portion of the timber within WTMA should be reserved to *supply local entrepreneurs and small businesses*, thus increasing community recognition regarding the economic opportunities offered by sustainable forest management. This reservation percentage will be based on the amount of local demand. The *higher value timber* within the WTMA can provide wood needed to take advantage of new forest marketing programs to stimulate the creation of *niche market for locally grown woods*. Portions of the WTMA should also be used for the development of non-timber forest products.

6. The public forest estate in Hawai‘i has a *low level of public investment* (e.g., one forester per 150,000 acres of public forest reserve on the island of Hawai‘i); in order to manage the WTMA sustainably, a portion of the timber proceeds should be reinvested back into the forest.

7. Timber management and research activities in the WTMA can provide a valuable educational role in extension and training, contributing practical information to both government and private sectors, while helping create a professional forestry work force.

8. There will be no timber harvesting, forest clearing, or other commercial timber operations within designated native forest sections of the WTMA.

Sustainable timber harvest in WTMA will involve the following activities:

1) repair and maintenance of existing forest road infrastructure,
2) harvesting of timber,
3) replanting of harvested areas,
4) management of planted areas, and
5) transport of harvested timber and other forest products from WTMA.

Implementation of a timber license agreement will also require DOFAW staff time for monitoring compliance with DOFAW's conditions by the licensee.

DOFAW will require all bids received for harvesting within WTMA to include at minimum:

- identification of areas and species to be harvested,
- anticipated markets for harvested timber,
- detailed information about harvest methods,
- site preparation methods for replanting,
- replanting plans (including species selection variations),
- timber stand improvement methods,
- transportation plan,
- timeline for proposed activities,
- sanitation and invasive species protocols, equipment staging locations, equipment cleaning, and other related activities, and
- any planned mitigation measures.

In addition, DOFAW will require that all harvest activities comply with the measures listed in the State's *Best Management Practices for Maintaining Water Quality in Hawaii* (BMPs) (attached as Appendix C). Developed in 1996, these practices can be used to minimize the impact of forestry practices on water quality and cover the following topics: roads, timber harvesting, chemical management, streamside management, fencing, wildlife damage control, fireline construction, prescribed burn, and reforestation. Finally, DOFAW will require that all harvest activities comply with the mitigation measures outlined in the Final EA.

Within the WTMA, approximately 779 acres of native forest (defined as areas containing 50 percent or more native forest cover) remain. Commercial timber harvest will not occur in these areas. The primary goal in these areas will be forest protection and they will remain accessible for traditional gathering of forest resources, research, hunting, and recreation.

B. Repair and maintenance of existing forest road infrastructure

Approximately 130 miles of unimproved access roads grid the WTMA into 245 40-acre blocks. These roads can be utilized for timber harvest purposes, and with this network of roads in place, no new permanent roads need to be constructed. Improvements to the existing road, such as clearing, grading, or reconstruction of water bars, dips, culverts and cross drainages, may be required to accommodate harvesting activities and to repair or restore the existing roads after harvesting activities are complete. Temporary skid trails, used to move logs from the forest to the landing area, and landings, where logs are loaded into trucks for transportation, will be permitted, with locations determined in advance after collaboration with DOFAW. Temporary trails and landings will be allowed to revegetate naturally or artificially revegetated after harvesting activities are complete. All roads, skid trails, and landing sites utilized within the WTMA must be mapped and approved by DOFAW prior to any harvest activities.

Because forest roads have the potential to create more erosion than any other forestry activity, all improvements and maintenance of the existing access roads and all work related to temporary skid trails will conform to the BMPs reprinted in Appendix C. Maintenance of active and inactive roads will

be sufficient to maintain a stable surface and keep the drainage system operating. The following practices are to be incorporated:

1) maintenance will include cleaning dips and crossdrains, repairing ditches, marking culverts inlets to aid in location, and clearing debris from culverts;
2) keep culverts, flumes and ditches functional before and during the rainy season to diminish the danger of clogging and the possibility of washouts;
3) conduct road surface maintenance as necessary to minimize erosion of the surface and subgrade;
4) during operations, keep the road surface crowned or outsloped and keep the downhill side of the road free from berms except those intentionally constructed for protection of fill;
5) avoid using roads during wet periods if such use would likely damage the road drainage features; and
6) water bars will be inspected after major rain storms and damage should be promptly corrected.

In addition, the following practices are to be incorporated during establishment and use of skid trails and landings:

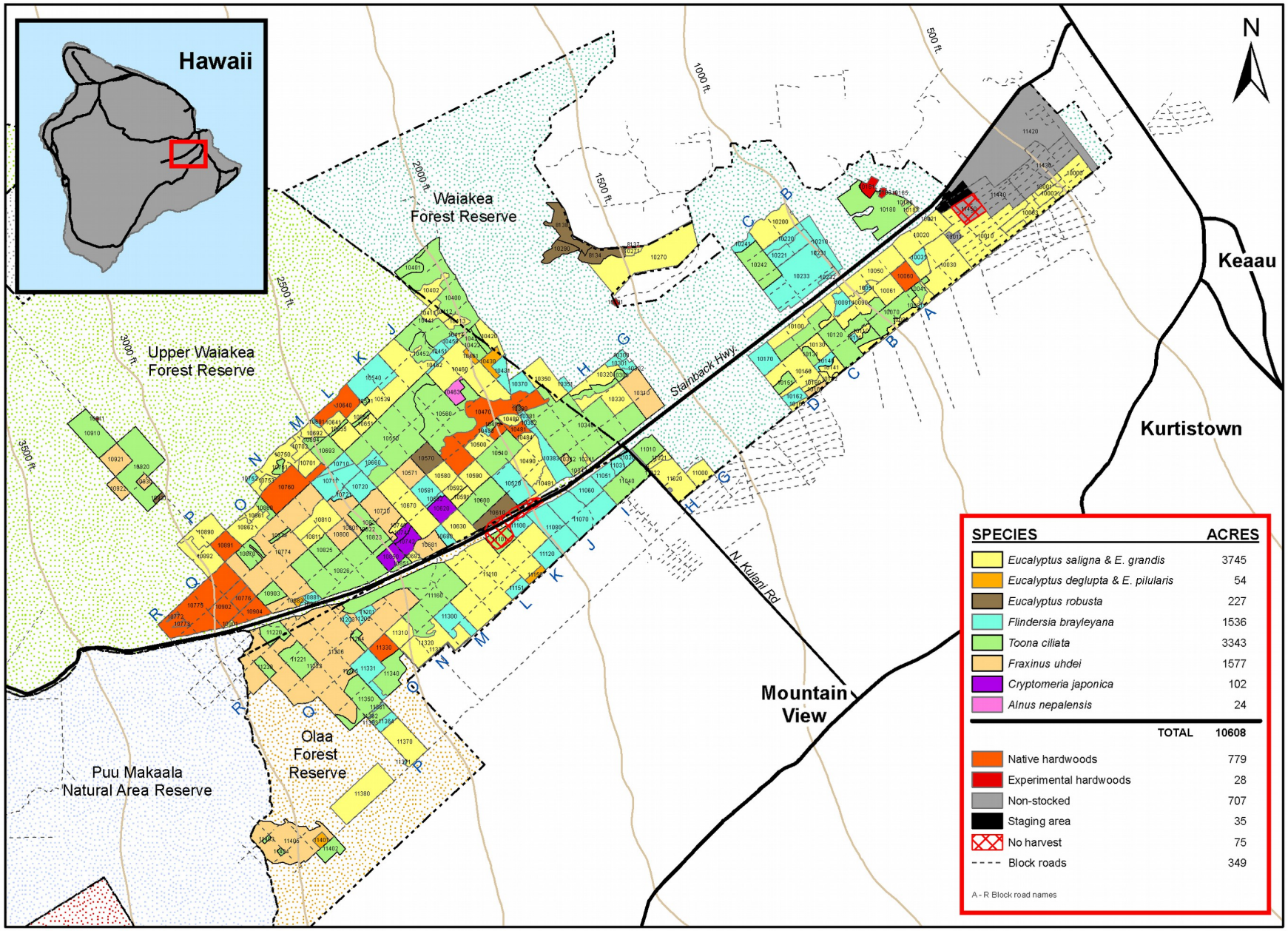
1) location of temporary access roads will be planned before operations begin;
2) road construction will be kept to a minimum;
3) landings will be located to minimize the adverse impact of skidding on the natural drainage pattern;
4) logging roads and landings will be located on firm ground;
5) landings will be kept as small an area as possible;
6) when operations are completed, provisions will be made to divert water run-off from the landings and roads.

C. Harvest of timber

Timber inventory data from 1997 indicated that the WTMA in its current configuration contains over 17 million cubic feet of timber on a gross merchantable basis. This timber is not uniform; as noted earlier, DOFAW planted different species throughout the WTMA in 40-acre blocks. There are approximately 4,026 acres of *Eucalyptus* species, 3,343 acres of Australian toon, 1,577 acres of tropical ash, and 1,536 acres of Queensland maple (see Figure 1). The remaining acreage is generally composed of other introduced timber species (including Sugi pine (*Cryptomeria japonica*) and Nepal alder (*Alnus nepalensis*)), native forest (approximately 779 acres), or is considered non-stocked (generally former sugar land that has not yet been planted with timber species).

The timber species have different potential uses and vary in their potential economic value, due to differences in physiology and their suitability for site conditions.

Figure 1. Waiakea Timber Management Map
Primary Tree Species - Based on 1997 Timber Inventory



State of Hawaii
Department of Land and Natural Resources
Division of Forestry and Wildlife
October 2013

0 0.5 1 2 3 4 Miles

HAWAII STATEWIDE GIS PROGRAM

Table IV-1: Timber Species of WTMA

Tree species (common name)	**Scientific name**	**Likely Use; Other uses**	**Acreage in WTMA**	**Estimated volume (ft3)**	**Estimated board foot (BF)**
Sydney bluegum and grand eucalyptus	*Eucalyptus saligna & E. grandis*	Biofuel; paper production, saw timber, veneer	3,745	8,176,042	37,132,760
Swamp mahogany	*E. robusta*	Wood products; biofuel	227	1,007,433	4,816,112
Rainbow eucalyptus and Blackbutt eucalyptus	*E. deglupta & E. pilularis*	Biofuel; saw timber	54	88,711	401,217
Australian toon	*Toona ciliata*	Wood products; biofuel	3,343	2,588,887	9,504,944
Tropical ash	*Fraxinus uhdei*	Biofuel	1,577	863,971	3,324,086
Queensland maple	*Flindersia brayleyana*	Wood products; biofuel	1,536	2,539,213	10,287,031

Most commercial species of *Eucalyptus* are well suited to the growing conditions found in the WTMA. Rapid growth rates, high yields, and straight form of these trees make some of them desirable for a wide variety of processing opportunities including lumber, veneer, plywood, and biofuel. Rapid growth though, can cause processing issues for some species, such as *E. saligna*, but use of newer hybrids may reduce this issue. *Eucalyptus robusta* is currently considered more valuable than *E. grandis*, *E. saligna*, *E. deglupta*, or *E. pilularis* due to its site adaptability, high wood quality, and local and regional markets for this wood. Although *Eucalyptus* species have the potential, in general, to spread into adjacent areas under certain conditions, the planted species of *Eucalyptus* have not done so in the 45-plus years since the establishment of the WTMA plantations. Most *Eucalyptus* stands are mature and ready for harvest.

Queensland maple has also proven to be well adapted to the growing conditions in the WTMA. This species produces a high quality, light colored wood with potential use for finish grade lumber, veneer, plywood, and for value added operations such as flooring, paneling, molding, furniture, and cabinet making. As with the *Eucalyptus*, a range of stand ages and tree sizes are present, allowing

for both immediate harvest opportunities and new plantings. At present, the size and value of the commercial market for Queensland maple is unknown.

Large areas of WTMA were also planted with Australian toon and tropical ash. Australian toon grew well only on the best quality sites, but poorly elsewhere, and tropical ash was poorly adapted to local site conditions. After 45-plus years' growth, most of these species' stands only contain scattered pole sized trees and some areas have regenerated into native forest. The commercial value of the Australian toon and tropical ash is unknown, and these timber species are most likely to be utilized for biomass or biofuel purposes. Other timber species in the WTMA include Sugi pine (102 acres), Nepal alder (24 acres), and other introduced timber species covering small areas.

Timber harvest begins with the preliminary actions required before any cutting takes place. Preliminary actions include identification of harvest areas, on-site surveys for endangered species and archaeological features, development of a harvest plan that identifies access routes, skid trails, and landing areas, expected timing of actions, and site-specific best management practices to be incorporated, and mobilization of heavy equipment to the site.

Actual harvest involves several steps: 1) felling, or cutting, the trees; 2) bucking the cut tree, which involves removing the branches and if necessary, cutting the tree into logs; 3) extracting the logs from the felling site in the forest to a landing area, using ground-based mechanical systems; and 4) loading the cut logs onto trucks for transportation off-site for processing.

Best management practices to be incorporated during harvesting include

1) careful felling of trees to minimize damage to the tree, adjacent timber, and native forest adjacent to but outside the WTMA;
2) avoiding use of existing road ditches as skid trails;
3) use of water bars for skid trails on steep slopes;
4) servicing equipment involving fuel, lubricants, or coolants in places where the materials cannot enter streams; and collecting used oil and other liquids for proper disposal (not poured on the ground); and
5) mulching or seeding erosion-prone areas upon completion of logging.

DOFAW will not prescribe a specific management regime for harvesting timber with the WTMA (e.g., regeneration harvest vs. selective harvest of specific trees). Due to the age of the trees, efficiency considerations related to mobilizing equipment and labor, and replanting considerations, DOFAW recognizes that cutting entire stands will be necessary. At the same time, DOFAW acknowledges the public perception and visual impacts related to regeneration harvest of large areas. Therefore, to address these concerns, harvesting restrictions for the WTMA include:

- Regeneration harvest, where previously planted trees and other vegetation are cleared, is limited to 40-acre blocks,
- Adjacent 40-acre blocks may not be harvested simultaneously,
- Harvested blocks must be replanted within six months, and new growth must reach 15 to 20 feet

tall, before adjacent blocks may be harvested,
- Up to 600 acres of regeneration harvest may be done annually,
- Thinning and selective tree removal may occur in other units (in addition to the 600 acres), and
- DOFAW may identify specific tree(s) to be left standing for visual buffers, wildlife habitat, or other reasons.

Restricting harvest of entire stands to 600 acres a year provides a secondary benefit of facilitating a sustained supply of timber from the WTMA over time. The proposed annual harvest of 600 acres or less is approximately 6% of the total area shown in Table IV-1, page 12.

In addition, timber felling will not be allowed between June 1 and September 15 due to potential impacts to the Hawaiian hoary bat, or ʻōpeʻapeʻa (*Lasiurus cinereus semotus*). However, this restriction may be lifted upon additional surveys and the development and implementation of additional mitigation actions, if DOFAW Wildlife staff and the US Fish and Wildlife Service (USFWS) concur that the proposed mitigation actions will adequately protect the bat from take during ongoing harvesting activities. Other project activities, including loading and transporting timber, road maintenance, site preparation, and replanting may still occur within the WTMA during the "no-harvest" period.

D. Treatment of site post-harvest and replanting of harvested areas

Timber harvesting creates woody debris, called slash, composed of treetops and branches left behind after the cut logs are removed. Slash may be used in areas of soft-ground to create a pad for vehicles and to skid logs to mitigate erosion and reduce soil disturbance. Given the historic high precipitation in the area, most of the slash is expected to decompose and compost in place, which will enhance soil productivity by introducing more organic material into geologically young soil parent material. It may also be chipped or masticated with equipment, and incorporated into site planting preparation as mulch to reduce competition from grasses and introduced woody shrubs. In general, if too much slash is left behind, it may increase fire hazards at the harvest site. However, due to the wet conditions within WTMA, decomposition is expected to be accelerated and in most cases, what slash is left will be required to be scattered and under 36 inches in height, and also may be crushed further with a dozer. This material may be available to local markets should there be interest.

The harvest plan prepared before any harvesting activities will outline the specific methods to address slash for each 40-acre block. In general, the following options are recommended, listed in preferential order:
1) lop all logging debris such that it lies within 36 inches of the ground surface and away from stumps;
2) scatter and crush logging debris with a bulldozer;
3) where necessary, pile logging debris in designated windrows or piles.

After harvest, regrowth from stumps and roots (coppicing) and from seed fall may interfere with replanting activities. Herbicides may be utilized, following all applicable state and federal regulations

and label restrictions, to reduce competition. *Use of fire for site preparation for replanting will not be permitted.* Mechanical crushing, mastication, or manual clearance of vegetation may be used where necessary to provide sufficient access to ground surface to permit tree planting.

The harvest plan prepared before any harvesting activities will outline replanting specifications for each 40-acre block, including planned species, density, planting method, seedling protection, source of seed or seedling stock, and minimum survival expectations, as specifications will vary depending on the micro-conditions (elevation, rainfall, etc.) at the individual site. In general, planting of seedlings will occur within six months of the harvest to minimize establishment of invasive weed species in the area.

In general, species selection will depend largely on what species was harvested, growth potential for a given site, specific qualities of a species (e.g., growth rate, disease resistance, wood characteristics, ease of removal, tolerance to volcanic emissions), seedling availability, available or future markets for the specific species, and goals for that unit. Site productivity for tree growth in the WTMA can be broadly linked to lava flow type and age. Older flows are more productive sites than younger; ‘a‘ā sites are more productive then pāhoehoe. In addition, depressions in the landscape and drainage areas seem to provide the highest growth potential, due to higher accumulation of geologically recent ash deposits and perhaps soil scraped from higher ground when the area was leveled in the 1960s and 1970s. A wide range of species will be considered for replanting, including *Eucalyptus* species and native timber species such as koa (*Acacia koa*), with the understanding that all species are being planted specifically for future harvest. Tropical ash and Australian toon will not be replanted due to poor performance. All non-native species proposed for planting will be evaluated for potential invasiveness using the Hawai‘i Weed Risk Assessment and other relevant information and will be subject to approval by DOFAW. Native species will be selected for wildlife habitat value, watershed health, and value as a future wood source for local woodworkers.

Best management practices to be incorporated during site preparation and replanting include:

1) avoiding excessive soil compaction during harvest and mechanical site preparation,
2) utilizing the minimum preparation necessary to control competing vegetation and establish a desirable timber stand,
3) ensuring that windrows, disking, bedding, and planting with furrow type mechanical planters follow contours, and
4) planting trees on contour.

E. Management of planted areas

After seedlings are planted, timber stand management is necessary to enhance and ensure planting success. Timber stand management includes manual application of commercial fertilizers, to encourage seedling survival and growth, weed control to reduce competition, side branch pruning of young tree stands, and thinning of young stands to improve stand health and vigor as the trees age. In addition, insect and disease monitoring may be conducted for known problems to tree seedlings, such as *Phytophthora cinnamomi* (root rot disease) and for insect damage such as by the black twig borer

(*Xylosandrus compactus*).

Best management practices to be incorporated during timber stand management include:

1) choosing pesticides or herbicides suitable for use on the target species and registered for the intended use by the EPA,
2) following all label directions,
3) considering site factors, application conditions and techniques, and products available, in addition to cost and effectiveness when selecting pesticide or herbicide options, and
4) incorporation of protocols for transportation, storage, use, and disposal of chemicals, to minimize opportunities for spills or contamination.

F. Transport of timber from WTMA

Timber will be yarded to landings using a variety of ground-based, mechanical means, including skidding, use of log loaders or excavators to forward logs, or possibly forwarders. Trucks would then be loaded at the log landing or within units where access and conditions permit, and would leave the WTMA, likely via Stainback Highway or North Kūlani Road, to Highway 11 and then proceed to their destination. Truck traffic volume will depend largely on harvesting activity and what timber species is being harvested. Specific truck routes will depend upon the market for the harvested timber, the size of the truck and load, and relevant state and county transportation regulations. On average, DOFAW estimates that a maximum of twenty-eight trucks per day, regularly spaced throughout the day, would leave the WTMA. This is equivalent to about one truck every 15 minutes during a normal work day.

The above estimate is based on current truck traffic associated with an existing forestry operation on the Hamakua Coast and input from other professional loggers. The Hamakua Coast operation harvests approximately 3 acres a day of high-volume Eucalyptus stands, and rarely has over 25 trucks depart in a day. If WTMA contains lower volume stands or harvesting occurs at a lower capacity, truck traffic would be expected to be reduced.

The graveling of landing areas and the pullouts onto Stainback Road will be required as necessary to minimize the amount of mud tracked onto the paved road, and the roadway condition will be monitored and swept as necessary to minimize any roadway hazards created by mud or gravelly conditions.

G. Timing

Timber harvest is expected to occur in a patchwork fashion rather than from one side of the WTMA to the other because of the conditions placed on harvest (e.g., regeneration harvest limited to 40-acre non-adjacent blocks), the patchwork nature of WTMA (different species in 40-acre blocks), logistical issues involving access and movement of equipment, and increased growth rates of potential replanted species (e.g., some Eucalyptus species are ready for harvest within five to seven years of planting). If fully implemented, the commercial harvest of the entire WTMA would be spread over the next fifteen years. The timing of harvest of specific 40-acre blocks, and of specific timber species, will be dependent on market interest.

The State anticipates releasing its RFP, selecting a contractor or contractors, and awarding a license or licenses within one year of acceptance of the Final EA for this project. Harvesting activities could begin as early as two months after award of the license, depending on the time of year and the ability of the selected contractor to complete required pre-harvest planning and obtaining any additional permits or permissions. Licenses are anticipated to have terms of 10 years, with an option to extend for another 10-year period if performance is satisfactory, with clear milestones, so that the State can terminate a license for inaction or violations of the license terms in a timely manner. DOFAW's goal is to provide sufficient long-term assurances for potential contractors to obtain loans and make the necessary investments required to start-up a commercial harvest operation in Hawai‘i, yet at the same time, prevent bidders from tying up valuable wood resources for anti-competitive purposes. The key purpose at first will be to get mature trees harvested and replant seedlings to establish the next generation of forest, while creating local jobs and possibly providing raw materials for renewable energy production.

V. ALTERNATIVES CONSIDERED

A. Actions Considered but Eliminated

This DEA evaluates the proposed action and a no-action alternative. Several other management alternatives have been considered and were eliminated from further consideration for the following reasons:

Commercial harvest of existing native forest. Due to the value of native forest for watershed and habitat purposes, commercial harvest of existing native forest stands was not seriously considered, despite the commercial value of native species for specialized woodworking.

Non-commercial removal of non-native timber. Widespread removal of *Eucalyptus*, Queensland maple, tropical ash, and Australian toon on a non-commercial basis is not feasible due to extremely high cost and difficulty. Moreover, implementation of this alternative would result in the waste of valuable timber resources that could contribute to energy production or be utilized for a variety of wood products such as saw timber or veneer and would increase hazardous fuel loading and create open spaces likely to be colonized by invasive plant species.

One-time harvest of entire WTMA. Regeneration harvest of all the timber trees within WTMA over a short period of time would result in immediate financial gain, increase the potential for short-term employment, and streamline replanting efforts. Large trees could be used as timber; smaller trees for chips or pulp. This alternative was eliminated due to the significant disruption to public use and enjoyment of WTMA, increased potential for soil erosion and water quality degradation, loss of wildlife and game habitat, visual impacts of approximately 10,000 cleared acres, impact on roads and traffic of moving that volume of timber over a short period, and inability of this method to support the development and growth of a forest products industry due to its failure to provide a consistent stream of timber resources.

B. No Action Alternative

The No-Action Alternative would entail a continuation of the current management activities, without any commercial harvesting. Current management of the WTMA includes basic maintenance of roads for recreational access and use, oversight of the ATV park, rubbish removal, sign maintenance, and removing hazard trees in areas of high use. More intensive forest management would not be anticipated to occur because funding for forest management is limited and dependent on government appropriations, and DOFAW has limited staff and equipment on-hand.

The positive impacts include no disruption to the public use of the WTMA, no disruption to existing traffic patterns, and a higher aesthetic quality of the environment for those who oppose any commercial timber operations. The negative impacts of this alternative are increasing natural mortality due to increased susceptibility to insects and disease, continued expansion of invasive plant species, loss of economic return to the community and the state, loss of a potential revenue stream that would support forest health management, and reduced likelihood of establishing a sustainable forest products industry due to limited availability of raw material.

C. Proposed Action

The proposed action is to sustainably harvest the Waiākea Timber Management Area and reforest the harvested areas with appropriate timber species for future harvests and markets. The project area was established for commercial timber production, while accommodating other forest uses such as recreation, research, and wildlife habitat. Timber growth in much of the project area is minimal and harvest would present the opportunity to replant with more valuable and faster growing species.

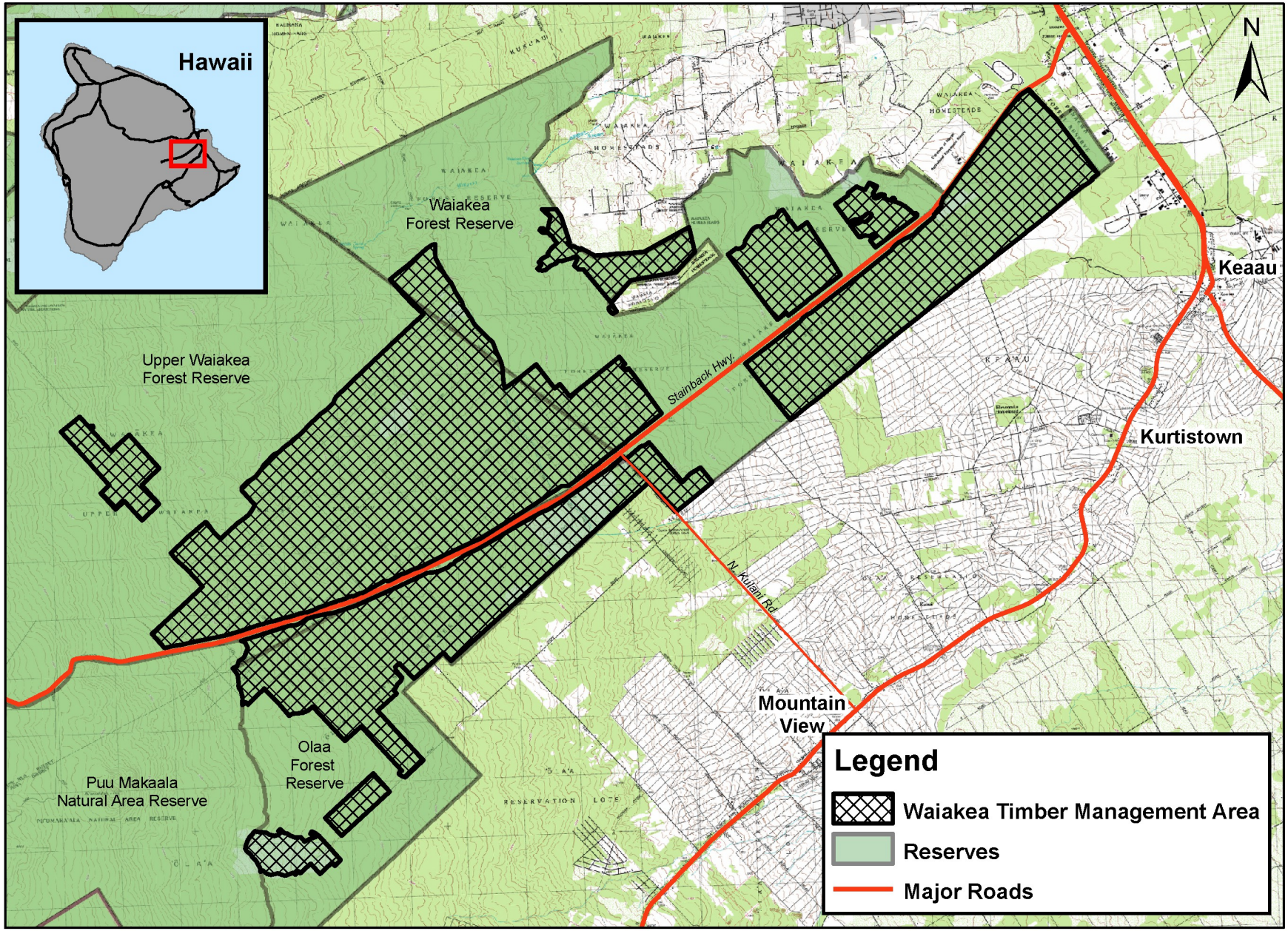
Positive impacts of this alternative include enhancement of the productivity and health of Hawaii's forests, creation of local jobs and increased economic value through local processing, continued public use of the area, and improvement of the local and state economy. Potential negative impacts include the potential spread of invasive species within and outside the WTMA, temporary disruption to recreational users, increased truck traffic on rural roads during harvest, and temporary decline of visual quality in harvested areas.

VI. SUMMARY DESCRIPTION OF AFFECTED ENVIRONMENT

A. Physical Environment

<u>Location</u>
The WTMA is located on the slopes of Mauna Loa volcano, approximately five miles southwest of Hilo town along the Stainback Highway, within the South Hilo and Puna Districts (Figures 2, 3) The 12,506 acre WTMA is comprised of 5 discrete parcels within the Waiākea (WFR), Upper Waiākea (UWFR), and ʻŌlaʻa Forest Reserves (OFR) where timber species were deliberately planted.

Figure 2. Current extent of Waiakea Timber Management Area



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February 2013

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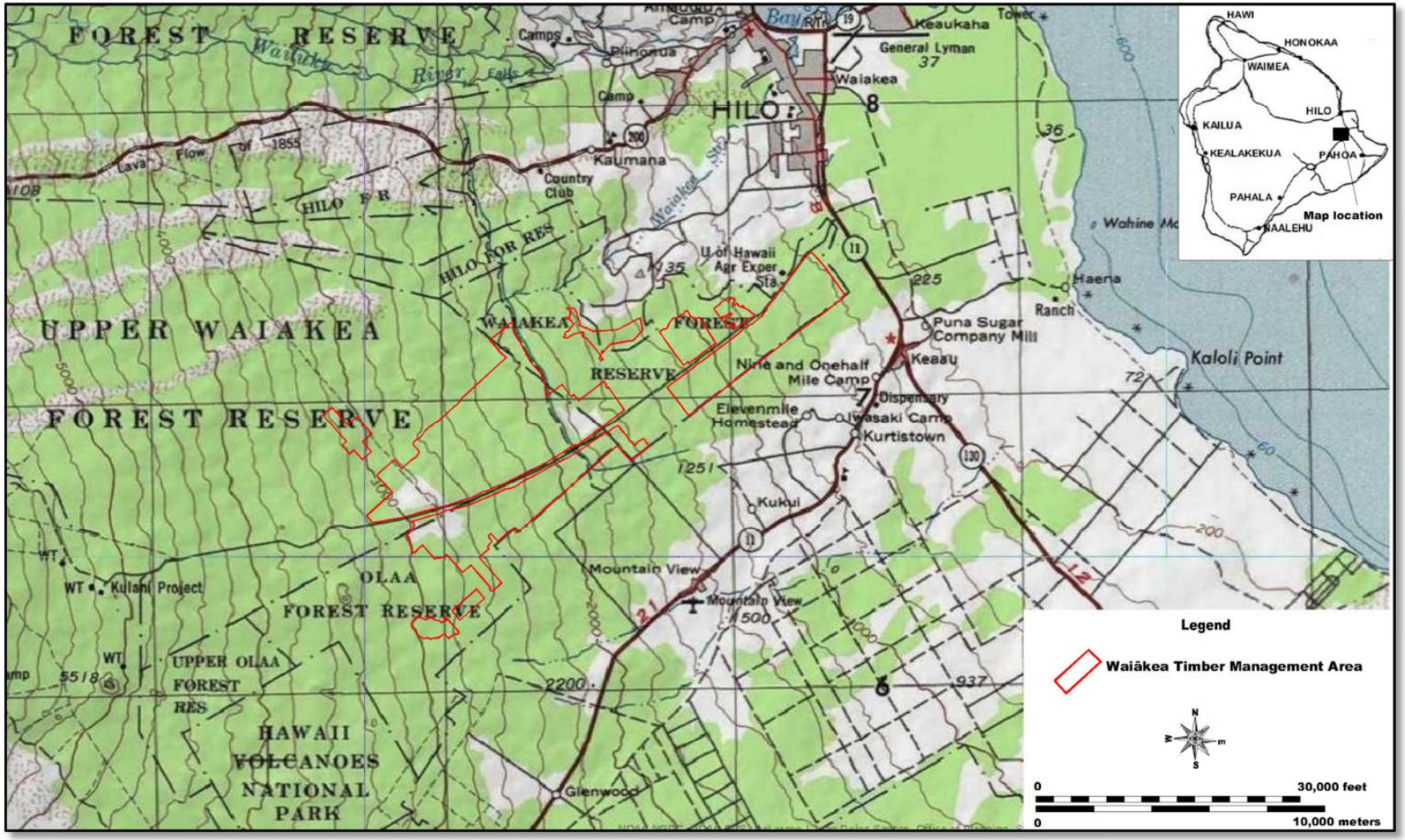


Figure 3. **Portion of USGS 7.5' Hilo (1995), Mountain View (1981) and Puu Makaala (1981) quadrangles showing the Waiākea Timber Management Area**

The WTMA occupies lands in the ahupuaʻa of Waiākea and ʻŌlaʻa, extending from approximately 400 to 3,200 feet in elevation (Figure 4). It is situated on relatively young, shallow ʻaʻā and pāhoehoe lava flows ranging in age from 150 to 9,000 years old, with the majority of the WTMA (71%) on lava flows dating between 750 to 1,500 years ago. Slopes within the WTMA are constant, averaging six percent (except in ravines where the slopes can exceed 45 percent).

The WTMA is bisected by the Stainback Highway that extends inland from Highway 11 and North Kūlani Road, which runs from Highway 11 near Mountain View towards Mauna Loa. Approximately 130 miles of unimproved access roads (with varying degrees of overgrowth) grid the WTMA into 245 40-acre blocks. Stainback Highway terminates at the newly reopened Kūlani Correctional Facility, a minimum security facility for approximately 200 inmates. Other land uses in the surrounding area include Waiākea Forest Reserve, Upper Waiākea Forest Reserve, ʻŌlaʻa Forest Reserve, Puʻu Makaʻala Natural Area Reserve, and rural residences.

Soils

Soils in the WTMA are thin, extremely stony (stones between 10 and 24 inches in diameter comprise at least 60 percent of the volume), and have formed over ʻaʻā and pāhoehoe lava. The soils are made up of "muck," which is well-decomposed organic soil material. The soils are well drained, with rapid permeability, slight erosion potential, and slow to medium runoff. Where the soil overlies ʻaʻā lava, the substrata is also rapidly permeable. Although the pāhoehoe lava is slowly permeable, water moves rapidly through cracks in the lava. In some low-lying areas, swampy conditions may occur.

Water

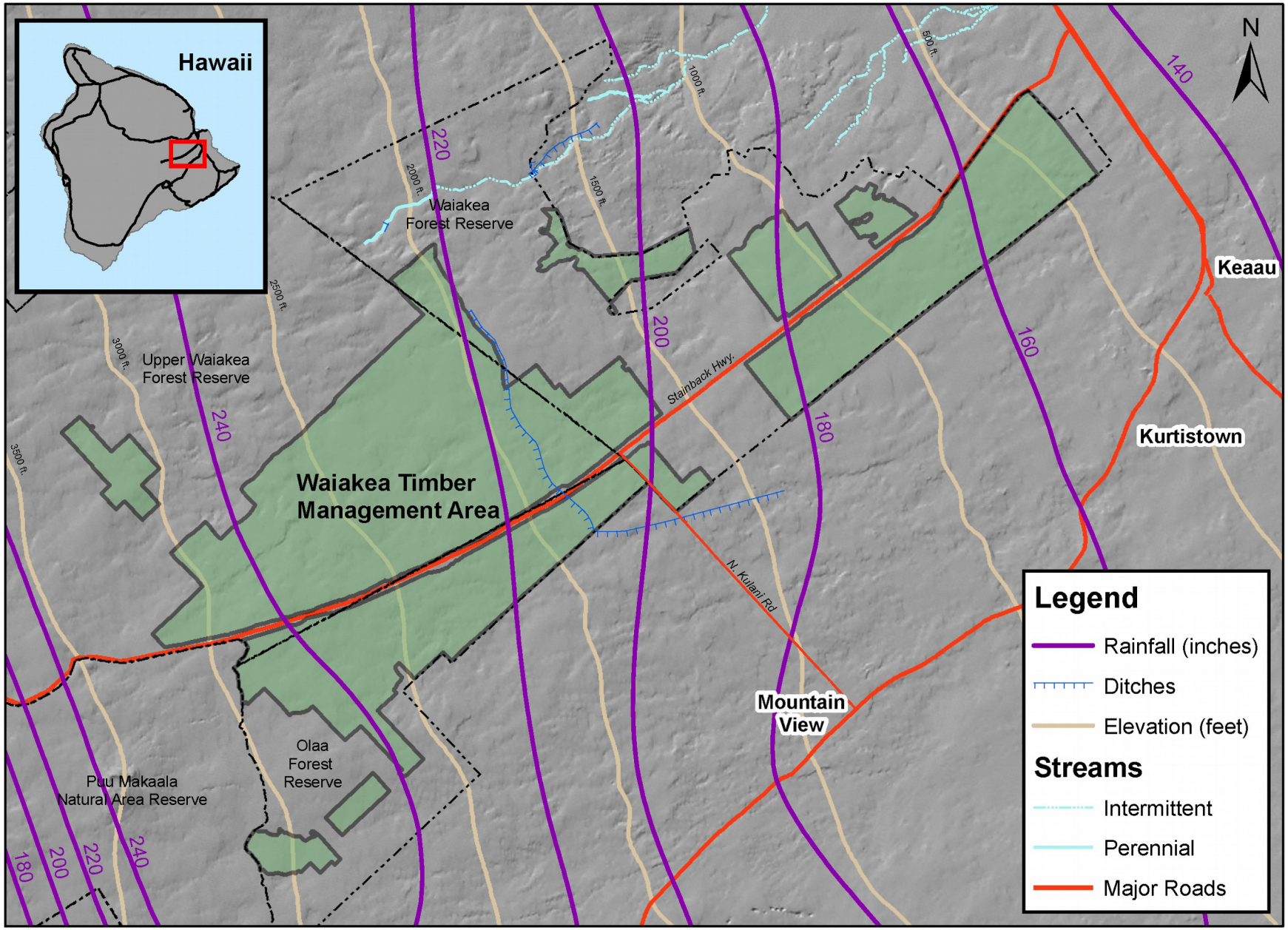
The WTMA has extensive tree and ground cover making the area a functional watershed. Spring-fed Waiākea stream is perennial in its upper reaches, and there are flumes that retain water much of the year. There is no known surface water sources used for domestic or agricultural purposes.

Median annual rainfall in the WTMA varies with elevation, with approximately 240 inches annually at 3,200 ft. elevation, and gradually decreasing to 150 inches at 400 ft. elevation (Figure 4). Most of the WTMA (73%) receives more than 200 inches of rain per year. Rainfall is distributed throughout the year; occasionally drought conditions occur for several months at a time. Overcast conditions are common, and humidity is high throughout the year.

Air

There is no data on ambient air quality specific to the WTMA, but there is a stationary monitoring station right outside WTMA in Mountain View collecting data on sulfur dioxide and fine particulate matter (PM 2.5). Data is reported on a website http://emdweb.doh.hawaii.gov/air-quality/ in near real-time on a continuous basis. In general, air quality in the genera area of WTMA is considered "good."

Figure 4. Hydrological features and elevation of Waiakea Timber Management Area (WTMA)



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B. Biological Resources

Threatened and endangered species: ‘ōpe‘ape‘a

The Hawaiian hoary bat, or ‘ōpe‘ape‘a, is a medium-sized member of the vesper bat family (Vespertillionidae) which consists of nocturnal, mostly insect-eating bats. It is an endemic and endangered subspecies of the North American hoary bat, a solitary tree-rooster. The ‘ōpe‘ape‘a is Hawaii's only native terrestrial mammal and can be found from sea level to 14,000 feet in elevation. Males and females have a wingspan of about 1 foot, and females are typically larger than males. Both sexes have brown and gray fur. Individual hairs are tipped or frosted with white; “hoary” means frosted. The Hawaiian name refers to a half taro leaf or canoe sail shape; these being similar to the shape of the bat. Fur color, frosted or reddish, may be related to location or age.

The ‘ōpe‘ape‘a is primarily solitary, nocturnal and insectivorous. It is a major predator of night-flying insects such as moths, beetles, and termites. Bats forage in open and wooded landscapes and linear habitats such windbreaks and riparian zones, and roost in both native and non-native trees with dense foliage and with open access for launching into flight. Females are believed to give birth to twins May – August and rear pups May – September. Pups fledge from about July – September, which is a critical time in the reproductive cycle (Menard 2001, Bonaccorso et al. 2008). The population size is unknown. Resident populations occur on Kaua‘i, Maui, and Hawai‘i and possibly other main islands, with the highest abundance on Kaua‘i and Hawai‘i. Threats are largely unknown but may include roost disturbance, introduced predators, obstacles to flight (e.g., barbed wire fences, vehicles), and pesticides (USFWS 1998).

Because warm temperatures are strongly associated with reproductive success in this and other bat species, it has been suggested that key breeding habitat is likely to occur at sites where the average July minimum temperature is above 52ºF, which would occur on the island of Hawai‘i below 4,200 ft. elevation. ‘Ōpe‘ape‘a have been found roosting in ‘ōhi‘a, *Eucalyptus*, and Sugi pine, among other species.

‘Ōpe‘ape‘a have been detected in the WTMA as recently as 2008, but the extent of their distribution and density is unknown. Auditory surveys were conducted by United States Geological Service (USGS) in May 2008 and January 2009 at 12 stations along Tree Planting Road in the WTMA. Bats were detected in May 2008 at only three of the twelve stations, and activity levels were low at each station with 16 or less passes per night (in comparison a station approximately 10 miles northwest of WTMA detected 131 passes in one night). No bats were detected in January 2009. Additionally, a total of 14 bats were captured in mist nests for data collection on Tree Planting Road, Flume Road and Quarry Road, between 2004 and 2008.

Threatened and endangered species: ‘io

The endangered Hawaiian hawk, or ‘io (*Buteo solitarius*), is the only broad-winged hawk known to have colonized Hawai‘i and only occurs on the island of Hawai‘i from sea level to about 5,600 feet in elevation. The most recent analysis of the abundance and distribution of the ‘io population estimate that there are approximately 3,000 individuals island wide (Gorreson et al. 2008). These birds of prey feed

on rodents, insects, and small birds, including young game birds. Breeding pairs typically nest in ‘ōhi‘a trees (81%, n= 113), but non-native trees are also used (16%). The most frequently used non-native trees were *Eucalyptus* spp. at 5% (Klavitter et. al 2003). Nest construction is protracted, beginning up to two months before the first egg is laid, and continuing into the nestling period. Fledglings remain dependent on adults for up to nine months. The ‘io appears to be resistant to avian diseases, and has been able to shift to prey upon non-native food items that have increased in density and diversity. In February 2014, the United States Fish and Wildlife Service (USFWS) re-published a proposed rule to remove the Hawaiian Hawk from the Federal List of Endangered and Threatened Wildlife. The proposed delisting was based on several studies that had shown the range-wide population estimates to be stable for at least 20 years and concluding that the species was not threatened with becoming extinct throughout all or a significant portion of its range in the foreseeable future. To date, the USFWS has not published a determination on the proposed rule.

‘Io are regularly observed in the WTMA and adjacent forest reserves. In 2007, the extrapolated density of ‘io in forestry plantations located in Puna was 0.5105 hawks/km (Gorreson et al. 2008). Island wide surveys in 2007 showed that Puna supported lower hawk numbers generally for all habitats compared to the other regions (Hamakua, Ka‘ū, and Kona). ‘Io densities are relatively low in non-native timber, and there have been no recorded nesting sites in the WTMA. The nearest known nesting sites were located below the project area in the vicinity of Pana‘ewa Zoo. The WTMA appears to be occupied primarily by juvenile hawks that have been ejected from prime nesting territories in adjacent native forests.

Threatened and endangered species: *Drosophila mulli*

*Drosophila (*picture-wing flies) are true flies (Order: Diptera). Numerous adaptive shifts and unusual evolutionary developments characterize the species found in Hawai‘i. *Drosophila* are specialized microbivores that rely on over 40 families of native plants, and recent declines in the genus are associated with the loss of these host plants. In 2006, twelve species of *Drosophila* were listed as threatened and critical habitat was designated for these twelve species in 2008.

The WTMA is historically known to contain one of the listed species, *Drosophila mulli*. Found only on the island of Hawai‘i from three locations, *Drosophila mulli* is restricted to the natural distribution of its host plant, the endemic Hawaiian fan palm *Pritchardia beccariana*. Adult flies of *Drosophila mulli* are found only on the undersides of the leaves of this long-lived (approximately 100 years) species. The larval host for *D. mulli* is still unknown, as rearing attempts with various decaying plant material from *P. beccariana* were unsuccessful (USFWS 2012).

Drosophila mulli was discovered within ‘Ōla‘a Forest Reserve at a site that has been surveyed at least 63 times between 1965 and 2001. Fewer than 10 individuals were observed on 4 different dates, with the last sighting being in 2001. *Drosophila mulli* was discovered at a second and third location in the Upper Waiākea Forest Reserve and along Stainback Highway in 1999 and 2000. No records of observations have been reported since 2001, but recent surveys have been limited. Bait can be used to survey for Hawaiian *Drosophila* but only to indicate presence or absence of taxa. Moreover, Hawaiian *Drosophila* life cycles are influenced by rainfall and other environmental variables, making survey

results difficult to compare over time and across sites. Because even the very common species of *Drosophila* fluctuate widely seasonally and daily, population estimates are difficult.

Threats to *Drosophila mulli* include threats to its host plant *P. beccariana*. Non-native scolytid beetles bore into the plant and feed on the nuts, and as a result, little natural regeneration of *P. beccariana* has been observed in the wild since the arrival of the beetle. In addition, the seeds, bark, and flowers of the palm are susceptible to herbivory by rats.

Threatened and endangered species: *Cyrtandra giffardii*

Only one species of endangered plant is currently known to occur within the WTMA. *Cyrtandra giffardii* (ha‘iwale) was listed in 1994 as endangered, with critical habitat of 15,617 acres designated in 2003. It is a short-lived perennial, a small shrubby tree from the African violet family (Gesneriaceae). *Cyrtandra giffardii* is known historically in wet montane forest or lowland wet forest dominated by tree fern of the genus *Cibotium*, from 2,146 to 4,723 ft. elevation. Threats include degradation of habitat by feral ungulates and invasive plant species, human disturbance (due to proximity of recreational trails and roads), low numbers, and climate change.

Cyrtandra giffardii has been collected in four general areas, including Laupāhoehoe Natural Area Reserve (NAR), Upper Waiākea Forest Reserve, the Kūlani/Stainback Highway area, and Pu‘u Maka‘ala NAR. At the time of its listing, the species was known from less than 100 individuals. Additional populations were observed from surveys conducted prior to the completion of the 1996 recovery plan, reporting a total of eleven populations and over 1,000 individuals. At the time critical habitat was proposed in 2002, the species was known from seven populations with less than 500 total individuals. The most current reported information indicated that only two populations totaling less than 112 individuals remain, in Laupāhoehoe NAR and Hawai‘i Volcanoes National Park (USFWS 2012). However, *Cyrtandra giffardii* was found during vegetation survey in June 2012 within timber stands along the western boundary, in an area regenerating into native forest.

Other rare and endangered plant species historically found in the WTMA (prior to the establishment of the timber plantations) or in the forest adjacent to the WTMA include *Cyanea platyphylla*, *Sicyos alba*, *Cyanea tritomantha*, *Gardenia remyi*, *Joinvillea ascendens* ssp. *ascendens*, *Phyllostegia floribunda*, *Phyllostegia vestita*, *Stenogyne scrophularioides*, *Trematolobelia grandiflora*. While only *Gardenia remyi* has been observed within WTMA recently, the presence of others is possible, especially in areas dominated by native species, and may be found upon additional survey.

Vegetation

Introduced timber species and other non-native plant species are the dominant vegetation of the WTMA. In general, intentionally planted timber species dominate the canopy of the WTMA. Timber species were planted in 40-acre blocks: in total, there are approximately 4,026 acres of with *Eucalyptus* species, 3,343 acres of Australian toon, 1,577 acres of tropical ash, 1,536 acres of Queensland maple, and smaller acreages of various other introduced timber species such as Sugi pine and Nepal alder. In addition, there are portions of native forest within the WTMA that were not bulldozed and remain relatively undisturbed and portions where planted timber species did poorly and the area has

regenerated into native dominated forest (779 acres).

During initial land clearing operations (1959-1968) in the WTMA, large native trees such as ʻōhiʻa lehua (*Metrosideros polymorpha*), koa (*Acacia koa*), and loulu (*Pritchardia* spp.) were left undisturbed. Today, these plants are intermixed with non-native timber species. There are other non-native tree species scattered throughout the WTMA and they include ironwood (*Casuarina equisetifolia*), blackwood acacia (*Acacia melanoxylon*), silk oak (*Grevillea robusta*), gunpowder tree (*Trema orientalis*), paperbark (*Melaleuca quinquenervia*), and African tulip (*Spathodea campanulata*). A species list of the plants and wildlife found in WTMA is included in Appendix D.

The majority of the understory of the WTMA is generally composed of non-native plants. Many of these are invasive weeds that occur in thick and fast-growing patches throughout the WTMA, including strawberry guava *(Psidium cattleianum*), palm grass *(Setaria palmifolia*), koster's curse (*Clidemia hirta* var. *hirta*), *Melastoma candidum*, glorybush (*Tibouchina* spp.) and *Melochia umbellata*. In large areas on the east and southern portion of the WTMA these invasive species have formed dense, almost monotypic stands. Emerging invasive weed problems include Australian tree fern (*Cyathea cooperi*), miconia (*Miconia calvescens*), yellow Himalyan raspberry (*Rubus ellipticus* var. *obcordatus*), and gunpowder tree.

While the majority of the understory is non-native, several native understory plants are present, including hāpuʻu (*Cibotium* spp.), uluhe (*Dicranopteris linearis*), olomea (*Perrottetia sandwicensis*), kōpiko (*Psychotria* spp.), moa (*Psilotum nudum*), pilo (*Coprosma* spp.), māmaki (*Pipturus albidus*), and manono (*Hedyotis* spp.).

Approximately 779 acres have been identified as native forest that will not be subject to harvesting. This acreage includes relatively undisturbed native forest classified as native ʻōhiʻa and ʻōhiʻa-hāpuʻu wet forest, or koa-ʻōhiʻa wet forest. These vegetation types have scattered to closed canopies (up to 75 feet tall in places) and contain a variety of native and non-native tree and shrub species. This acreage also includes some areas planted with Australian toon and tropical ash, where the timber species did poorly and the area has regenerated into native-dominated forest. The canopy in this area is a mix of non-native timber and the native ʻōhiʻa lehua. The understory is more than 90% native.

Birds

Forest birds are the dominant native wildlife in the WTMA. Endemic species inhabiting these forests are ʻapapane (*Himatione sanguinea*), ʻamakihi (*Hemignathus virens*), ʻōmaʻo (*Myadestes obscurus*), ʻelepaio (*Chasiempis sandwichensis sandwichensis*), and pueo (*Asio flammeus sandwichensis*). These birds are most frequently observed above 3,000 feet elevation, which is the upper extreme of the WTMA.

Other rare native bird species are found in native forests above the WTMA. These include the endangered ʻōʻū (*Psittirostra psittacea*), endangered ʻakiapōlāʻau (*Hemignathus munroi*), the endangered Hawaiʻi ʻākepa (*Loxops coccineus coccineus*), and the ʻiʻiwi (*Vestiaria coccinea*). It is unlikely that any of these rare bird species inhabit the WTMA, because these species are highly

susceptible to avian diseases transmitted by mosquitoes, and as such, are generally restricted to native forests above 4,000 ft in elevation.

Non-native bird species such as northern cardinal (*Cardinalis cardinalis*), Japanese white-eye (*Zosterops japonicus*), melodious laughing thrush (*Garrulax canorus*), house finch (*Carpodacus mexicanus*), and house sparrow (*Passer domesticus*) utilize the area for feeding, roosting, and nesting.

Game animals

Feral pigs (*Sus scrofa*) are the most common big game species found in the area, but goats (*Capra hircus*) may occasionally be present. Mouflon sheep (*Ovis aries*) has not been seen to date. No pig population studies have been conducted in the area, but the overall number of pigs in the area likely fluctuates depending on food and water availability, hunting pressure, and fencing of nearby conservation areas.

Kalij pheasants (*Lophura leucomelanos*) are the most plentiful game bird in WTMA. Other game birds such as wild turkey (*Meleagris gallopavo*) and Japanese quail (*Coturnix japonica*) are present, but are usually restricted to forest edges or along roadways and lava flows.

Invertebrates

Endemic Hawaiian invertebrates are sensitive to environmental changes such as forest clearing and invasion of alien plant and animal species, although research on direct impacts of timber harvesting in Hawaiʻi still needs to be conducted. Many arthropods have evolved to specific habitats and require one or more native plants to complete their life cycle. Land clearing activities, including the bulldozing that occurred in the 1950s and 1960s, likely contributed to a loss of arthropod communities that are known to be associated with native flora. Recent invasions of non-native yellow jacket wasps (*Vespula pennsylvanica*) into WTMA are also likely to have negatively affected native insect populations.

Detailed invertebrate survey information for the WTMA is not currently available, but due to the previous disturbances and the prevalence of non-native plant species in the canopy and understory, native invertebrate composition in the WTMA is presumed to be lower than it would be in a native-dominated forest. A few native invertebrate species, such as native Lepidoptera (moths), have been documented inside the WTMA and are relatively abundant and exhibit some species diversity. Formal surveys for mollusks have not been conducted in WTMA, but the endemic snail *Succinea* is relatively common throughout Hawaiʻi and are known to be present in the general area.

Significant and Sensitive Habitats

Approximately 48 acres of *D. mulli* critical habitat Unit 2 and Unit 3 are located within the WTMA. The primary constituent elements composing critical habitat, or those physical and biological features that are essential to the conservation of the species and may require special management or protection, are (1) wet montane ʻōhiʻa forest between 1,955 ft and 3,585 ft, and (2) the host plant *P. beccariana*. *Pritchardia beccariana* is also known to be scattered throughout the timber plantations outside of the designated critical habitat.

The project area is not located in or near any of the following types of sensitive areas: flood plains, tsunami zones, beaches, rivers, oceans, estuaries, anchialine ponds, fresh or coastal waters, erosion prone areas, or geologically hazardous land.

C. Social and Economic Conditions

Although established for commercial timber management, the WTMA supports a range of public uses, including hunting, recreation, and passive enjoyment (Figure 5).

Hunting

The timber plantations of WTMA and the surrounding native forests are used extensively for feral pig hunting. The WTMA is located within hunting unit B; unit B is open for hunting game animals daily year-round. Bag limits are two pigs, one sheep and one goat per hunter per day. In the portion of WTMA between Tree Planting Road and Powerline Road, hunting by all means of take is permitted, with use of dogs allowed only between July and December; in the remaining portion of WTMA, dogs may be used year-round. Unit B is also open for game bird hunting on weekends and holidays from the first Saturday in November through the third Sunday in January. Hunters are required to check in and out at established checking stations and to report game harvests on official field forms. Refer to Chapter 123 “Rules Regulating Game Mammal Hunting” for specifics about this area.

Table VI-1. Reported hunter activity, 2011-2013, Waiākea Forest Reserve and Upper Waiākea Forest Reserve.

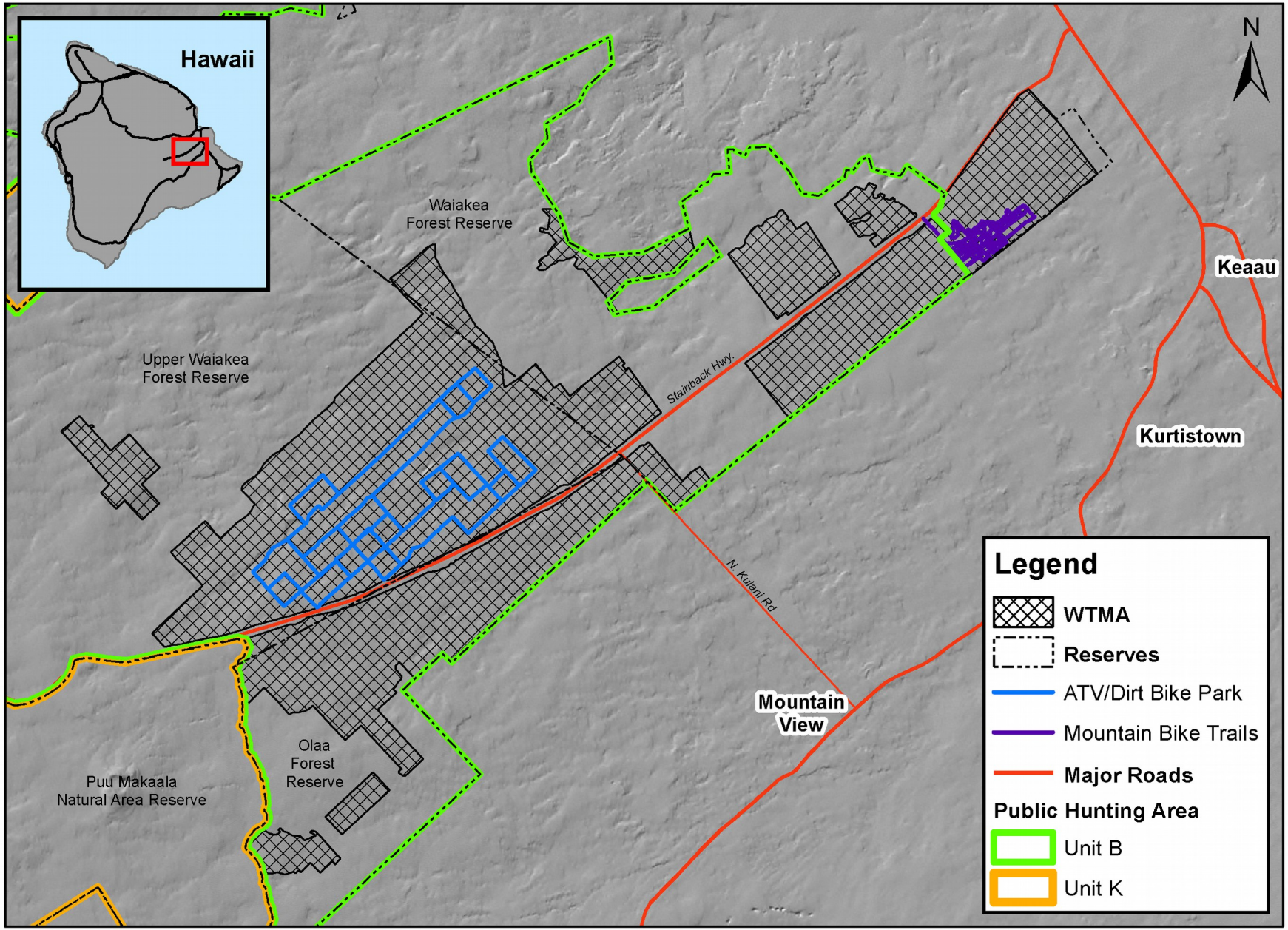
	Waiākea FR 2011	Upper Waiākea FR 2011	Waiākea FR 2012	Upper Waiākea FR 2013	Waiākea FR 2013	Upper Waiākea FR 2013
Hunter Trips	182	161	254	193	259	232
Pigs	98	62	74	62	70	85
Goats	0	0	0	1	0	0
Sheep	0	11	0	9	0	6

Recreational use

Motorcycle and all-terrain vehicle (ATV) riders use the well-developed road network within the area. Other recreational activities include mountain biking, horseback riding, bird watching, botanical exploration and hiking.

DOFAW's Nā Ala Hele Trails and Access program manages the Upper Waiākea ATV/ Dirt Bike Park which is located within the WTMA between Flume and Tree Planting Roads. It has been in operation since July 4, 2004, and offers 28 miles of trails that can be ridden in both directions. In order to use the park, permits and waivers must be obtained from the DOFAW office in advance.

Figure 5. Waiakea Timber Management Area Recreation and Access.



State of Hawaii
Department of Land and Natural Resources
Division of Forestry and Wildlife
February 2013

0 0.5 1 2 3 4 Miles

HAWAII STATEWIDE GIS PROGRAM

The Mauna Kea 200 motorcycle event (MK200), held nearly every year since 1976, utilizes the area for course mileage, and the Rock Island Riders (who implement the MK200) have volunteered time to keep many of the grid roads within WTMA open and identifiable.

There are also established mountain bike trails in the lower portion of WTMA, primarily in the area below Quarry Road in the former sugar plantation lands. There are approximately 11 miles of single track and 15 miles of double track mountain bike trails that traverse through approximately 230 acres of *Eucalyptus saligna* and *E. grandis* plantation timber. In order to use these mountain bike trails, permits and waivers must be obtained from the DOFAW office in advance. Permits have been issued to mountain bike clubs that sponsor riding events.

Equestrian use is common along the Puna boundary of the forest reserve. Bird watching, botanical exploration, and hiking occur less frequently; no trails or destinations within WTMA are regularly documented on social media sites.

Gathering

Tree fern harvesting occurs regularly, with approximately 500 linear feet of logs removed and sold for use in the flower and landscape industry each year. The tree fern market is relatively small, and the work to remove logs difficult.

The WTMA is accessible for traditional gathering of forest resources, which occurs primarily in native forest stands near Stainback Highway. Non-timber forest products most commonly collected within the WTMA include ferns, maile, hāpuʻu fronds, ti leaves, and flowers.

Gathering of material from plant species that are not on Federal or State threatened and endangered species lists is permitted and regulated by DOFAW through standard Forest Reserve System permit procedures as described in HAR §13-104. Gathering for personal use is regulated through issuance of a free collection permit; gathering in quantities determined to represent commercial use is regulated through issuance of a commercial harvest permit for a fee.

Research

Forest plantations in the WTMA provide opportunities for individuals, organizations, and institutions to study both native and introduced forest communities. From the 1960s to the 1970s, the State Department of Health conducted studies on the population dynamics of rodents in the Waiākea Forest Reserve. In the 1970s, the U.S. Fish and Wildlife Service conducted native forest bird surveys on the island of Hawaiʻi and several of the survey transects extended through the WTMA. During the Vietnam war, the U.S. Army conducted several research projects in the WFR, UWFR, and OFR including chemical gases, defoliants, and phosphate explosive devices. The USDA Forest Service, Institute of Pacific Island Forestry, has been monitoring forestry research projects in the WTMA since the late 1950s to the present. Some of the research projects have included nutrient cycling, watershed quality of various native forest plant communities, wood properties of commercial native tree species, and the occurrence of ʻōhiʻa lehua decline. Forestry instructors at the University of Hawaiʻi, Hilo campus use the WTMA for field laboratory exercises.

Visual resources
The project area itself is not visible from any public viewing area or public highway, due to its location on the island. The WTMA is visible from the air by helicopter tours departing from Hilo.

Economic use
The WTMA has an estimated economic stumpage value (the price paid for the right to harvest trees) of several million dollars. The actual stumpage value will depend on the market and the planned use of the timber resources, such as whether the timber will be used for biomass, minimally processed wood products, or value-added products like furniture, and whether the timber will be used locally or transported to another state or country for processing.

Traffic patterns
WTMA is accessed primarily through Stainback Highway, which is located off State Highway 11 (Mamalahoa Highway), about 5 miles southwest of Hilo. The single-lane paved road (no shoulder) provides east-to-west access to WTMA. North Kūlani Road provides a second access to State Highway 11 (Volcano Road) from WTMA, crossing north-south from approximately the middle of WTMA. Both Stainback Highway and North Kūlani Road are narrow roads designed for rural use, and users of these roads are regularly observed to drive faster than the posted speed limit.

Log trucks and possibly chip vans or similar transport will be used to haul logs and chips to and from the WTMA. Low-boy trailers will be used to haul equipment when moving from one site to another. Transporting forest products from the WTMA will increase the use of Stainback Highway, Highway 11, and to a lesser extent North Kūlani Road. The current traffic counts for these roadways are presented in Tables VI-2 – VI-5. Transportation on public roadways is expected to occur up to seven days a week, with regularly spaced hauling trips occurring throughout the day, during active harvest times, probably averaging one every 15 minutes during peak harvest periods for 8 to 10 hours per day.

Table VI-2: Traffic survey information for Stainback Hwy (DOT, 2012)

Location	**Date of Survey**	**Info Type**	**AM Peak**		**PM Peak**		**24 Hour Total Both Directions**
			West-bound	**East-bound**	**West-bound**	**East-bound**	
Stainback Highway between N. Kulani Road to Road to Panaewa Zoo	5/3/2011	Time	6:45-7:45	7:45-8:45	3:00-4:00	4:45-5:45	--------
		Volume	135	30	41	68	1173
	5/4/2011	Time	6:45-7:45	8:00-9:00	3:30-4:30	4:30-5:30	--------
		Volume	116	28	35	80	1003

Table VI-3: Traffic survey information for Route 11 (DOT, 2012)

Location	Date of Survey	Info Type	AM Peak		PM Peak		24 Hour Total Both Directions
			North-bound	South-bound	North-bound	South-bound	
Route 11: Kilauea Avenue to Macadamia Road - 377	4/11/2012	Time	6:30-7:30	7:00-8:00	3:00-4:00	4:30-5:30	--------
		Volume	2568	1009	1494	2407	41562
	4/12/2012	Time	6:45-7:45	6:45-7:45	3:00-4:00	4:30-5:30	--------
		Volume	2993	1042	1487	2356	43566
Volcano Road: between Old Keaau-Pahoa Rd (Rte 139) and Old Volcano Road - 666	4/10/2012	Time	6:45-7:45	6:45-7:45	3:00-4:00	4:45-5:45	--------
		Volume	1351	615	711	956	17595
	4/11/2012	Time	6:45-7:45	6:45-7:45	3:00-4:00	4:45-5:45	--------
		Volume	1335	631	720	1006	18217

Table VI-4: Traffic survey information for North Kūlani Road (DOT, 2012)

Location	Date of Survey	Info Type	AM Peak		PM Peak		24 Hour Total Both Directions
			North-bound	South-bound	North-bound	South-bound	
North Kulani Rd. between Ana Rd. and Volcano Road	2/3/2010	Time	6:30-7:30	7:00-8:00	3:30-4:30	5:00-6:00	--------
		Volume	159	82	78	112	2168
	2/4/2010	Time	6:15-7:15	7:00-8:00	5:15-6:15	5:00-6:00	--------
		Volume	151	90	77	106	2083

Table VI-5: Annual Average Daily Traffic (AADT) and 24-hour truck volume for Stainback Hwy and Route 11 (DOT, 2012)

Location	AADT	24 hour truck volume	
		Single unit trucks (Type 4-7)	Combination (Type 8-13)
Stainback Highway between N. Kulani Road to Road to Panaewa Zoo	1100	2	1
Volcano Road: Kilauea Avenue to Macadamia Road - 377	37300	988	2647
Volcano Road: between Old Keaau-Pahoa Rd (Rte 139) and Old Volcano Road - 666	17200	676	107

D. Cultural, Historic, and Archaeological Resources

The following steps were taken to determine the cultural, historical, and archaeological significance of the project area and impacts of proposed actions: (1) general literature review of reports or studies with relevant information related to this project area; (2) review of a cultural study prepared by Kumu Pono Associates in 2004 for the adjacent Puʻu Makaʻala NAR, providing a detailed overview of the natural and cultural landscape and history of land use in the vicinity of Puʻu Makaʻala NAR, and adjoining lands of Waiākea, in the District of Hilo, and ʻŌlaʻa, in the District of Puna (included as Appendix E); (3) pre-consultation with Native Hawaiian organizations, agencies, adjacent landowners, and individuals through the scoping process outlined earlier in section III; and (4) the preparation of an Archaeological Inventory Survey plan, followed by an Archaeological Inventory Survey (AIS), for the WTMA by Haun and Associates (included as Appendix F and G).

<u>Summary of Archaeological Inventory Survey (2014)</u>
Haun and Associates conducted an archaeological inventory survey of 556 acres in WTMA. The surveyed areas consisted of 550 acres identified in the sampling strategy proposed in the archaeological inventory survey plan for the project and an additional 6.5 acres surveyed during efforts to re-locate a previously identified burial cave. Two-thirds of the sample blocks were located below the 2,500 ft elevation. Predicted site types in the WTMA included temporary habitations, trails, shrines, and minor agricultural features.

The AIS concluded that the WTMA was certainly utilized prehistorically as evidenced by the previously identified burial cave, but that the majority of traditional land use in this area was likely for the procuring of natural resources (e.g., timber, medicinal plants, olona, and birds) and temporary habitation associated with this activity. As such, the physical evidence of these activities would have been ephemeral and left little if any surviving physical evidence.

The survey did identify nine subterranean features in the sample blocks, which were often wet due to high rainfall in the area. As such, the survey concluded that they would not have made suitable habitations locations, even temporarily. None of the features contained cultural remains or evidence of use, consistent with negative findings of previous archaeological work in and adjacent to WTMA. The AIS further noted that the absence of prehistoric sites in the survey blocks was not unexpected due to "the extensive ground disturbance that has occurred in the area since the early 1960s and the expected low site density predicted by McEldowney's (1979) settlement pattern model."

The 20 sample block survey revealed that all of the survey areas have been disturbed to varying degrees. The survey identified a badly disturbed remnant of the historic ʻŌlaʻa Flume associated with the sugarcane industry (site 50-10-34-20870) and documented a historic road (ʻŌlaʻa Back Road) that is currently in use by local residents as Ihope Road) (site 50-10-43-30088). The flume site and historic road were assessed as significant for their information content. These sites have yielded important information for understanding historic land use in the project area. The flume site is also assessed as significant for its association with the broad pattern of sugar cane plantation agriculture in Hawaiʻi. The

AIS concluded that documentation of these sites adequately documents them and that no further work or preservation is recommended.

Documentary research indicated the existence of a burial cave identified in WTMA in 1985 (site 50-10-35-18697). Efforts to re-locate the cave were unsuccessful during the 2014 survey. It is possible the entrance to the cave is obscured behind a large sheered-off section of ridge adjacent to Quarry Road or that the cave was inaccurately plotted in 1985. The AIS recommended that archaeological monitoring of any future land modification be conducted in a 500-square meter (61.7 acre) area centered on the reported location of the burial cave and oriented parallel to the Stainback Highway.

Summary of previous archaeological work

Haun and Associates summarized the previous archaeological research in the Final Plan for the Archaeological Survey (attached as Appendix F), noting that more than 40 archaeological projects have been conducted in the Waiākea and ʻŌlaʻa ahupuaʻa, with most in the seaward portion of Waiākea below 200 ft elevation. Three studies were conducted within or immediately adjacent to WTMA. A field inspection in 1985 by State staff archaeologist Wendall Kam, examined a cave discovered by a county official while conducting a review of a planned agricultural area. The cave was assigned a State Inventory of Historic Places Site No. 50-10-35-18697. In 1999, Cultural Surveys Hawaiʻi conducted an archaeological inventory survey of Stainback Highway in conjunction with proposed improvements to the road. No archaeological sites were found. In 1999, Cultural Surveys Hawaiʻi also conducted an inventory survey of an approximately 280-acre site proposed for a new correctional facility, located along the northern side of Stainback Highway, within the boundaries of WTMA. Three lava tubes were identified, but none had cultural remains or evidence of use. The remainder of the area was noted as extensively impacted by bulldozer activity associated with reforestation efforts. Overall, the previous archaeological studies conducted in the general vicinity of WTMA only identified a single possible agricultural mound and a lava tube used for burial, a low density attributed to the extensive ground-altering disturbance associated with sugarcane cultivation seaward of the project area and with clearing within the WTMA for reforestation, and the rugged nature of the terrain and abundance of rainfall.

Summary of historical documentary research: Haun and Associates

Haun and Associates provided a summary of the historical documentary research for the WTMA in the Final Plan for the AIS (attached as Appendix F), which is largely reproduced below:

> Waiākea Ahupuaʻa is one of the largest in the district of South Hilo covering over 95,000 acres and extending along the coast from the west side of Hilo Bay to the Puna District boundary and inland to approximately 6,000 ft elevation. Similarly, ʻŌlaʻa Ahupuaʻa is one of the largest land divisions in the Puna District (approximately 57,000 acres), second only to the Land of Keaau. ʻŌlaʻa is atypical of Hawaiian ahupuaʻa, in that it is land-locked with no ocean frontage. According to Maly and Maly, "the land of ʻŌlaʻa stood alone, almost independent of the other lands adjoining it in Puna, though it had no ocean frontage — being cut off by Keaʻau and Waiākea" (2004:6).
>
> The project area ahupuaʻa contained a variety of valuable resources that made Waiākea and

‘Ōla‘a important locales. Waiākea served as the seat of chiefly residences as early as the mid-1500s with chiefly associations continuing out traditional times. Waiākea was retained by Kamehameha at the time of his death he, “...held Hilo lands including Pi'ihonua, Punahoa, and Waiākea, descended to Liholiho, his son and heir to the kingdom” (Kelly et al. 1981:11). According to Maly and Maly, the name ‘Ōla‘a, “connotes sacredness and sanctity; the root of the name being “*la‘a*.” ‘Ōla‘a is famed in native tradition for its sacred lands, forest, native birds, and olonā resources” (2004:6).

Much of the following is summarized from *Hilo Bay: A Chronological History*, an extensive and thorough compendium of historical information about the Hilo area by Kelly et al. (1981) and from *He Mo‘olelo ‘Āina: A Cultural Study of the Pu‘u Maka‘ala Natural Area Reserve* by Maly and Maly (2004). Hawaiian traditional and legendary accounts attest to the longstanding importance of the area. The chief of the Hilo region, Kulukulu‘a, who resided in Waiākea, was the first conquest of ‘Umi-a-Liloa in his campaign to unify the districts of Hawai‘i Island. Hilo with its large bay, fishponds, wet taro fields, and abundant freshwater was a population center for commoners and royalty. Kamehameha I and his court resided in Hilo in the 1790s. In preparation for his planned invasion of Kauai in 1802, Kamehameha built a canoe fleet at Hilo, reportedly consisting of 800 vessels. Kamehameha gave his favorite wife, Ka‘ahumanu, the *ili kupono* of Pi‘opi‘o in Waiākea.

Maly and Maly (2004:8-19) present the tradition of Pikoi-a-ka-‘alalā (Pikoi-son-of-the-crow), which was printed in the *Ku Okoa*, the Hawaiian language newspaper in 1865-1866. According to the account, this represents the earliest written accounts of the cultural practices within the vicinity of the project area, in the upland forests of Waiākea and ‘Ōla‘a. Pikoi-a-ka-‘alalā was a kūpua, a supernatural being with the ability to change his body forms and was skilled at the pana pua or the use of bow and arrow.

In this tradition, Pikoi-a-ka-‘alalā travels throughout the islands and competes against other archers. On his arrival in Hawai‘i, he learns that the chief of Hawai‘i Island, Keawenui a ‘Umi, needed help getting rid of two supernatural ‘elepaio birds that were interrupting the canoe makers in a clearing in upland ‘Ōla‘a called Kalehaupueo. The birds roosted in a large koa tree and when they would hear the striking of the adzes they would fly down and call out, “Say Keawenui a ‘Umi! Leave it behind; it is a bad canoe, a canoe that will shatter a rotted hull” (2004:10). The chief had already enlisted Mainele, an archer from O‘ahu to rid him of the troublesome birds, promising him the hand of his daughter Keakalaulani if he could accomplish the task. Although Mainele bragged of his abilities, he was not able to kill the ‘elepaio birds.

During this time, Pikoi-a-ka-‘alalā` befriended the steward of the chief Waiākea, and takes up residence with him in Hilo. He hunts in the uplands of ‘Ōla‘a where he kills many birds and gives them to the chief for food. Learning that Mainele has not been able to kill the ‘elepaio birds, Waiākea asks the chief if his friend Pikoi-a-ka-‘alalā` might be given a chance to kill the birds and Keawenui a ‘Umi agrees.

Pikoi-a-ka-‘alalā` and Waiākea set out for the Kalehaupueo clearing. On the way they stop at a resting place called Mahina‘akaaka along the trail to ‘Ōla‘a. There Pikoi-a-ka-‘alalā` shoots a

large rat named ʻAkiʻakiaʻiole. Further along he stops at a place called Makaulele where he becomes engrossed in making leis from the fragrant red and white lehua blossoms. Eventually they reach Kalehaupueo and Pikoi-a-ka-ʻalalā` kills the two supernatural ʻelepaio birds with a single arrow while Waiākea strikes down Mainele and his companions. In gratitude Keawenui a ʻUmi tells Pikoiakaʻalalā that he can wed his daughter, and that he will inherit his kingdom.

Early historic accounts also document the importance of the general Hilo area. In 1823, the missionary William Ellis estimated the population to be 2,000 people in 400 houses and described the extensive use of lauhala thatch in house construction. Lauhala was gathered from eastern Waiākea beyond the Wailoa River. He described the land as intensively cultivated with plantains, bananas, sugar cane, taro, potatoes, melons, coconuts, and breadfruit. Wet taro was grown in mounds (*kipi*) in marshlands. Hilo was a center for trade between the people of Kaʻu, Hamakua, and Hilo. Between the 1790s and 1820s, sandalwood was cut and brought to Hilo for export. *Pulu* and *pia* (arrowroot) were also exported. Ellis also describes coastal fishing.

Ellis recalls a visit to the Puna District and describes the nearby community of Keaʻau (or Kaau) as "the last village in the division of Puna. It was extensive and populous, abounding with well cultivated plantations of taro, sweet potatoes, and sugar cane, and probably owes its fertility to a fine, rapid stream, which, descending from the mountains, runs through it into the sea" (1963: 60).

In 1824, a missionary station was established in Waiākea. Soon after, churches and schools were established. Whalers began stopping at Hilo in the mid-1820s. In the 1830s, a sawmill was built and two stores were opened. By the end of the decade, a sugar cane plantation and mill were established on Ponahawai lands. In 1840, the Wilkes Expedition arrived in Hilo and constructed an observatory on Waiākea Point on the east side of Hilo Bay.

In 1841, members of the United States Exploring Expedition, under the command of Charles Wilkes, accompanied by a party of native Hawaiians and foreign residents (numbering nearly three hundred individuals) traveled to the summit of Mauna Loa. The party departed from Waiākea, traveled *mauka* through ʻŌlaʻa, and on to Kīlauea. Observations and exploration were undertaken at Kīlauea, and then the party traveled through Keauhou, *mauka*, along the forest above ʻŌlaʻa and Puʻu Makaʻala, and on to Mauna Loa.

The Volcano Trail was the primary transportation route between Hilo and Kilauea, and potentially represents the route traveled by Wilkes. McEldowney describes this trail as follows:

> ...From here to Mountain View or just beyond the "halfway house," the trail crossed on to an extensive Kīlauea pahoehoe flow and continued along its western margin, which abutted mostly ash-covered Mauna Loa flows. The route of this old trail basically corresponds to the Ōlaʻa- Keaʻau boundary line on the current U.S.G.S. maps. Descriptions of scattered, stunted trees, mixed with ferns, grasses, ʻōhelo (Vaccinium sp.), and low shrubs, sound typical of pioneer or early successional plant communities. When compared to the previous portion of the trail, ferns became more dominant, *pia* disappeared, and scattered clumps of woods, probably small *kīpūkas*, replaced the groves.

> ...the woods started one or two miles SE and NW of the path, giving it the appearance of an unwooded corridor. Several villages, as well as scattered huts along the forest edge, were reported without much detail other than the presence of fertile soil and a burial cave marked with poles. Most describe leaving this open stretch somewhere beyond the "halfway house" by entering a thick forest, which Pickering [1840-41] placed at 1,500 ft elevation (1979:20).

In the 1840s, a political act of the Hawaiian Kingdom government would forever change the land tenure system in Hawai`i and have far-reaching effects on its people. The historic land transformation process was an evolution of concepts brought about by fear, growing concerns of takeovers, and western influence regarding land possession.

King Kamehameha III, in his mid-thirties, was persuaded by his *kuhina nui* and other advisors to take a course that would assure personal rights to land. One-third of all lands in the kingdom would be retained by the king; another one-third would go to *ali‘i* as designated by the king; and the last one-third would be set aside for the *maka`ainana* or the people who looked after the land. In 1846, King Kamehameha III appointed a Board of Commissioners, commonly known as the Land Commissioners, to "confirm or reject all claims to land arising previously to the 10th day of December, AD 1845." Notices were frequently posted in *The Polynesian* (Moffat and Kirkpatrick, 1995); however, the legislature did not acknowledge this act until June 7, 1848 (Chinen 1958:16; Moffat and Kirkpatrick 1995:48-49) and the act is known today as *The Great Māhele.* In 1850, the Kingdom government passed laws allowing foreigners to purchase fee simple lands (Speakman 2001:91).

The Waihona ‘Aina (2000) Mahele Database; which is a compilation of data from the Indices of Awards (Indices 1929), Native Register (NR n.d.), Native Testimony (NT n.d.), Foreign Register (FR n.d.) and Foreign Testimony (FT n.d.) provides information on the Land Commission Awards (LCA) awarded during the Mahele. This database lists 51 parcels claimed by 37 claimants within Waiākea, though only 26 of the claims were subsequently awarded. All of the awarded claims in the coastal portion of the ahupua‘a, except two that are located at the approximately 100 ft elevation, are situated well seaward of the WTMA.

Land use described in the LCA claim testimony for Waiākea includes agriculture, pasture, burial, and residence. Thirty-four houses are mentioned and one describes the presence of a grave. Most of the claim testimony mentions cultivated fields. Crops include wet taro, sweet potatoes, breadfruit, coffee, and *kukui*. A *hala* (Pandanus spp.) grove and fishponds are also mentioned.

During the Māhele, ‘Ōla‘a Ahupua‘a was relinquished by Kaunuohua to Kamehameha III and retained as Crown Land (Maly and Maly 2004:40). Only one Land Commission Award was claimed in ‘Ōla‘a. LCA 11049B was claimed by Naiilima for a parcel of land in the *ili* of Kupalu. The claim was not awarded (Waihona ‘Aina 2000). The Crown Lands were further opened up for homesteading under the Land Act of 1895, and large section of ‘Ōla‘a Ahupua‘a was segmented into the ‘Ōla‘a Lots, located to the south of the WTMA.

The first sugar plantation was established in the Hawaiian Islands on Kauai in 1836 (Kent 1983:22, 23, 29), although sugar cane was cultivated on all the islands at the time of Cook's arrived in 1778. According to Orr (2004:14), the Chinese on Lanai are credited with first producing sugar as early as 1802. The commercial cultivation of sugarcane occurred in 1835 to replace the declining sandalwood industry (Kuykendall and Day 1976:92).

Although sugar plantations were established in the Hilo and Kohala Districts by the 1860s, it wasn't until 1899 that a plantation was established in Puna. This plantation was the Puna Sugar Company founded by Benjamin Dillingham, Lorrin Thurston and James Castle (Dorrance 2000:105-107). A year later they founded the Olaa [Kea'au] Sugar Company (No. 49) on lands owned by the Shipman family.

The following is an excerpt from Sugar Waters by Dorrance (2000:105-107):

> The rocky, acidic Puna District south of Hilo had a much smaller number of plantations. In the 1890s the land was peppered with small homesteads, some devoted to coffee growing. After Hawai`i was annexed to the United States [1898], Benjamin Dillingham saw a sugar-growing opportunity in Puna. Along with investors that included Lorrin Thurston and James Castle, he incorporated Olaa Sugar Company to exploit the land. At the time Dillingham was building the Hilo Railroad Company and considered the new plantation a source of revenue for the railroad. By 1905 Olaa Sugar Company had a modern mill, and 7, 676 acres under cultivation serviced by the only gauge plantation railway in Hawai`i.
>
> Production increased when Olaa Sugar Company began milling Puna Sugar Company's harvest in and around Kapoho. But Olaa Sugar Company waxed and waned during the first 20 years of its life, paying dividends only twice in all that time. The land was rocky, sticky, acidic, and difficult to clear and cultivate. Not every acre received adequate rainfall, growth was stunted, and irrigation water was lacking. An infestation of leaf hoppers in 1916-1917 ruined 10,000 tons of sugar from the 1918 crop. In later years mechanical harvesting was limited because field equipment rusted and eroded too rapidly under the difficult conditions.
>
> In the 1930s, cultivated acreage stabilized at slightly over 15,000 acres. The fields extended up to 23 miles from the mill. Harvests were delivered via the Glenwood branch of Hawaiian Consolidated Railway, which ran from Olaa toward Kilauea Volcano, and stopped seven miles short of it at the village of Glenwood. Harvests from the Pahoa region were delivered by the Kapoho branch of tracks that extended 17 miles southwest of the mill. Flumes and the plantation's railroad took care of about half of each harvest, while the Hawaiian Consolidated Railway hauled the rest, and also transported product to the Hilo docks.
>
> In 1935 the plantation housed 5,648 workers and dependents in 1,086 company-supplied houses distributed among over 15 camps or villages. In addition, some 230 homesteaders lived and grew cane on family plots. Maximum production of the combined Olaa and Puna/Kapoho enterprises was 52,011 tons of sugar in 1937.

> The tsunami of 1946 struck a serious blow when it caused the Hilo railroad to shut down. Then the 1955 volcanic eruption covered thousands of acres in the Kapoho Division and isolated it. Despite all, the plantation company, renamed Puna Sugar Company in 1960 at the urging of landowner Herbert Shipman (1892-1976), struggled on.
>
> By 1982, the Olaa mill generated over 40 million kilowatt hours of electric power that was sold to Hawai`i Electric Light Company. The end of sugar operations came when its owners, Amfac, Inc. closed the Puna Sugar Company in the same year. But the mill's generating capability was perpetuated and increased. Oil was burned in the furnaces instead of the former mixture of bagasse and oil, and fulfilled a dire need for electrical energy.
>
> Shops in nearby Kea‘au (Olaa) served the mill camps and homesteaders who supplied harvests to the Olaa mill. When it shut down in 1982, many small businesses were devastated. Highway 11 leading to Kilauea Volcano bypassed the town and further accentuated the demise of its prosperity.

In the early 1800s, missionaries established a mission station at Hilo because of its large population, abundant freshwater, and cultivation potential. Soon churches and schools were established. Whalers stopped at Hilo because of the protected anchorage and availability of freshwater and provisions. Sugar cane cultivation, cattle ranching, and trade in *pulu*, arrowroot, and sandalwood rapidly changed the traditional subsistence economy during the early to mid-1800s.

By the late 1800s, vast areas were in sugar cane production and large scale timber harvesting was underway. Transportation infrastructure including a railroad system and wharf facilities were established. The area underwent a dramatic increase in population as people came to the area to work for the plantations and other commercial developments.

By 1857, there were three sugar cane mills in the Hilo area. Large tracts of land were put in the cane cultivation and sugar cane was also grown by individuals around their houses. In 1861, a stone wharf was constructed at Waiākea landing on the west side of Waiākea Point. A sugar mill was established in Waiākea at the inland end of Waiākea Fishpond in the late 1870s. A railroad transport system was constructed for the Waiākea Mill between 1879 and 1880. By 1880, 1,400 acres of sugar cane were in cultivation and by the end of the decade over 5,600 acres were cultivated. In 1877, a 16 ft high tsunami struck the coast of Waiākea destroying all houses within 100 yards of the shore along with a wharf, storehouse, a quarantine hospital on Coconut Island, and a bridge.

Between 1900 and the 1930s, the population of the area grew dramatically with the expansion of sugar cane cultivation, pineapple production, the timber industry, and other commercial developments. In the 1910s, the Hilo Railroad Company expanded the rail system to Puna and Hilo Town. A railroad wharf was built north of the mouth of the Wailoa River. Between 1909 and 1913, the railroad was extended to North Hilo and Hamakua Districts.

The ʻŌlaʻa Flume passes through the WTMA in a north-south direction and angles to the southeast, terminating at the ʻŌlaʻa Mill. The flume fed an extensive network of smaller ditches that branch out and provided water to the plantation. Two flume houses that direct the flow of water are located on the main ditch line. The Lower Flume House is located within the boundaries of the WTMA and the Upper Flume House is situated to the north. The ʻŌlaʻa Flume originates in upper Kaumana at the ʻŌlaʻa Flume Spring located in Punahou Ahupuaʻa 2 at approximately 1,980 ft elevation. The ʻŌlaʻa Back Road extends from the flume to the southwest, passing through and long the southern side of portions of the WTMA.

While sugarcane was the dominant industry in the area, other agricultural pursuits were being undertaken at the turn of the 20th Century. According to Baldwin:

> The Olaa section of Puna is a fine agricultural region, but owing to the want of a market, small truck farming does not pay. However, vanilla, tobacco, pineapples, and bananas grow well; and the rubber industry is destined to be an important one, as the climate is particularly well adapted to the growth of rubber trees. The cultivation of coffee in Olaa has been abandoned, as the trees did not thrive.
>
> All the lower lands of Olaa are planted with the cane of the Olaa Sugar Company. This is one of the largest plantations on Hawaiʻi, and occupies nearly all of the available cane land of the Puna district... (1908:78-79)

The Stainback Highway extends through the WTMA in a northeast by southwest direction. According to Hammatt and Bush, this road was constructed by the Territorial Department of Institutions in 1945 and was used to provide access to the Kulani Prison (1999a:12). The prison was subsequently renamed the Kulani Honor Camp and is currently referred to as the Kulani Correctional Facility. The following description of the road's construction, from a 1945 Honolulu Advertiser article, is presented in Hammatt and Bush:

> Hacking out the land for the new Kuulani [sic] Prison is a rough job and the date of its completion would be a risky conjecture, according to Thomas Vance, Director of Institutions, who recently returned from Hawaiʻi where he observed the completed five mile stretch of road to the site.
>
> "Eight operational days were spent in building the first five miles with one bulldozer" he said, "but with two bulldozers and good weather we should cut our work in half."
>
> "Barring delays, the 10-mile road, the first step to completion of the prison project, should be completed in six weeks," he said. (1999a:12).

The Stainback Highway was named for former State Governor Ingram M. Stainback who was instrumental in annexing the Kulani Prison lands from the Upper Waiākea and Olaa Forest Reserves and setting aside the lands to the Department of Institutions for the Kulani Prison Farm (Maly and Maly 2004:98).

Summary of historical documentary research: Kumu Pono Associates

In 2004, Kumu Pono Associates conducted a detailed study of historical and archival literature documenting the natural and cultural landscape and history of land use in the vicinity of the Puʻu Makaʻala Natural Area Reserve, and adjoining lands of Waiākea and ʻŌlaʻa. The WTMA is situated in the same ahupuaʻa as Puʻu Makaʻala NAR: Waiākea, in the South Hilo District and ʻŌlaʻa, in the Puna District. A portion of Puʻu Makaʻala NAR was once part of the WTMA and contains stands of plantation timber that predate its designation as a NAR, which occurred in 1981. As such, the historical information documented in the 2004 study is similarly relevant to WTMA. The full study is included as Appendix E.

The Puʻu Makaʻala Cultural Study includes detailed oral testimonies—describing the lands, traditional and customary practices, and historical land use—from native residents of lands in the ʻŌlaʻa, Waiākea-Humuʻula, and Keauhou vicinity, collected in the 1870s to 1890s. The documentation reflects the product of years of research and includes specific research conducted for the study between October 2003 to April 2004. The research was conducted in private and public collections, and that documentation includes written narratives that cover the period from antiquity to the 1980s.

Portions of the Study are reproduced below:

> Cultural-Historical Context of the Lands and Forests of the Hilo and Puna Districts
>
> For generations following initial settlement, it appears that communities were clustered along the watered, windward (koʻolau) shores of the main Hawaiian Islands. Along the koʻolau shores, in areas such as Waiākea, Punahoa-Piʻihonua, and Laupāhoehoe, streams flowed, rainfall was reliable, and agricultural production could become established. To a lesser extent, locations in Puna, such as in the Keaʻau and Hāʻena vicinity, and in the Kapoho vicinity, early populations could also find the necessary resources for establishing community centers. Along these koʻolau shores, sheltered bays offered access to both deep sea and near shore fisheries. The latter, being enriched by nutrients carried in the fresh water flowing from the mountain streams, and in underground lava tube systems, and by which fishponds and estuarine systems could be developed. In these early times, the residents generally engaged in subsistence practices in the form of fishing, and in agriculture on lands extending towards the uplands from the bays (Handy, Handy and Pukui 1972:287).
>
> Over a period of several centuries, areas with the richest natural resources became populated and perhaps crowded, and by ca. 900 to 1100 AD, the population began expanding to the more remote sections of Puna and the larger Kona (leeward) side of the island (Cordy 2000:130).
>
> As a general summary of lowland residency and cultivation of food resources in the Waiākea section of Hilo, Handy, Handy and Pukui (1972) reported that:
>
>> Hilo as a major land division of Hawaii included the southeastern part of the windward coast...the northern portion, had many scattered settlements above streams running

> between high, forested kula lands, now planted with sugar cane. From Hilo Bay southeastward to Puna the shore and inland are rather barren and there were few settlements. The population of Hilo was anciently as now concentrated mostly around and out from Hilo Bay... The Hilo Bay region is one of lush tropical verdure and beauty, owing to the prevalence of nightly showers and moist warmth which prevail under the northeasterly trade winds into which it faces…
>
> In lava-strewn South Hilo there were no streams whose valleys or banks were capable of being developed in terraces, but cuttings were stuck into the ground and on the shores and islets for many miles along the course of the Wailuku River far up into the forest zone. In the marshes surrounding Waiakea Bay, east of Hilo, taro was planted in a unique way, known as kanu kipi. Long mounds were built on the marshy bottom with their surface two or three feet above water level. Upon the top and along the sides of these mounds taro was planted. Flood waters which occasionally submerged the entire mound are said to have done no harm, as the flow was imperceptible. This swampy land is now abandoned to rank grass. Kipi (mounds) were also formerly made along Alenaio Stream above Hilo… [Handy, Handy and Pukui 1972:538-539]

Cultural Practices and Significance of the Landscape

The native traditions and historical accounts associated with the neighboring lands of the upper Hilo-Puna forests span many centuries, from Hawaiian antiquity to the later period following western contact. The narratives describe customs and practices of the native people who resided on these lands, walked the trails, and who were sustained by the wealth of the forest lands.

Among the most detailed descriptions of the Hilo-Puna forest lands, including documentation of traditional and customary rights, are those found in the Kingdom collections, documenting the history of land tenure, and defining the boundaries of *ahupuaʻa* of Waiākea and ʻŌlaʻa. In 1862, a Commission of Boundaries (the Boundary Commission) was established in the Kingdom of Hawaiʻi to legally set the boundaries of *ahupuaʻa* that had been awarded to *Aliʻi, Konohiki*, and foreigners during the *Māhele*. The primary informants for the boundary descriptions were old native residents of the areas being discussed (generally born between the 1780s to 1820s). The native witnesses usually spoke in Hawaiian, and their testimony was translated into English and transcribed as the proceedings occurred. These oral testimonies document the traditional knowledge and occurrence of native practices in the lands of Waiākea and ʻŌlaʻa.

The selected native testimonies describe a wide range of traditional practices in the uplands of Waiākea, ʻŌlaʻa, and in adjoining lands. The types of usage includes: travel on native trails, land use in a wide range of elevational zones; collection of resources; the collection of, or "hunting" of birds; canoe making; and the subsequent practices associated with hunting introduced ungulates—all under the control of *Konohiki*. The testimonies also record that changes had occurred on the landscape during the lifetime of the witnesses. It is of importance to note that the boundaries were known by the native tenants, and the rights to take or hunt

resources in traditional times were fiercely protected—individuals without chiefly, genealogical claims, or residency ties to given lands were not allowed to trespass and take resources from the *ahupuaʻa*.

In regards to hunting, it will be noted that descriptions of traditional hunting practices are limited to native species of birds, including the *uaʻu, nēnē, mamo* and *ʻōʻō*; while description of historical hunting practices are limited to goats, which were hunted under contract of *Konohiki*, the Crown, or the Government.

These records also reflect native traditions and beliefs, that Hawaiians shared spiritual and familial relationships with the natural resources around them. Each aspect of nature from the stars in the heavens, to the winds, clouds, rains, growth of the forests and life therein, and everything on the land and in the ocean, was believed to be alive. Indeed, every form of nature was a body-form of some god or lesser deity. As an example, in this context, *Kū-ka-ʻōhiʻa-Laka*, is a deified guardian of the *ʻōhiʻa* growth of ʻŌlaʻa; *Ua-kuahine*, is the body form of a goddess of the rains in ʻŌlaʻa; and *Kū-lili-ka-ua* is the god of the thick mists that envelop the forests of the upper Puna, Waiākea, and Keauhou lands. Indeed, tradition also demonstrates that the gods and goddesses of these forest lands were very protective of them. In olden times, travel through them was accompanied by prayer, and care. Traditions tell how many a careless traveler, or collector of resources, found themselves lost in a maze of overgrowth and dense mists as a result of disrespectful and careless actions.

In the Hawaiian mind, care for each aspect of nature, the *kino lau* (myriad body-forms) of the elder life forms, was a way of life. This concept is still expressed by Hawaiian *kūpuna* (elders) through the present day, and passed on in many native families. Also, in this cultural context, anything which damages the native nature of the land, forests, ocean, and *kino lau* therein, damages the integrity of the whole. Thus caring for, and protecting the land and ocean resources, is a way of life.

**

We find that shortly after western contact—the introduction of alien herbivores, and financial value being placed upon resources of the forests and mountain lands—the health and integrity of the resources began to decline. After western contact, the forests were primarily evaluated in the terms of the western economic system. While in the centuries prior to the arrival of westerners in 1778, and subsequently into the reign of Kamehameha I, the system of land tenure and management mirrored the natural landscape of the islands, later management systems focused on what, and how much could be gotten from the land.

Immediately, upon western contact, foreigners looked at the land—first as a source of provisions for ships; and second as a means for earning money, through the trade of natural resources such as *ʻiliahi* (sandalwood). In 1778, European boars, goats, rams, and ewes were introduced by Captain Cook. While offered as a "gift," one of the motivating factors was that

leaving the animals behind would produce a breeding stock to supply other foreign ships. Later, in 1793, cattle were brought to Hawai‘i by Captain Vancouver. Given as gifts to Kamehameha I, the cattle were first let off at Kawaihae (then at Kealakekua), and were placed under a ten-year *kapu* to protect them and allow them to reproduce. Between 1793 and ca. 1811, new stock was added, and the numbers of cattle had increased dramatically. The introduced cattle, goats and sheep rapidly became a problem to the native population and forests.

While the introduced animals were making their way into the higher elevations, other economic pursuits also led to the clearing of large tracts of land. In the early 1800s (ca. 1810-1829), tens of thousands of pounds of *‘iliahi* (sandalwood) were cut from the forests above Waiākea and Keauhou, Ka‘ū. Describing the collection of *‘iliahi* in 1823, from the uplands of the Waiākea region, Ellis wrote:

In Hilo, the party was under the care of the chief Ma‘alo (written Maaro), Ellis and companions offer the following narratives, describing the land there about and activities of the people, among which included hundreds of residents being required to go to the mountains above, and gather sandalwood for their chiefs:

> …we overtook Maaro, the chief of Waiakea, and three or four hundred people, returning with sandal wood, which they had been cutting in the mountains. Each man carried two or three pieces, from four to six feet long, and about three inches in diameter. [Ellis 1963:214] The bark and sap had been chipped off with small adzes, and the wood appeared lighter in colour than what is usually sold at Oahu, probably from its having been but recently cut down…. Although a plant of slow growth, it is found in abundance in all the mountainous parts of the Sandwich Islands, and is cut in great quantities by the natives, as it constitutes their primary article of exportation.
>
> It is brought down to the beach in pieces from a foot to eighteen inches in diameter, and six or eight feet long, to small sticks not more than an inch thick and a foot and a half long. It is sold by weight, and the merchants, who exchange for it articles of European or Chinese manufacture, take it to the Canton market, where it is bought by the Chinese for the purpose of preparing incense to burn in their idol temples. …Dense fogs and heavy rains are more frequent at Waiakea, and over the whole division of Hilo, than in any other part of the island... [Ellis 1963:215].

By the 1830s, the forest had been stripped of sandalwood and many other plants of the forest were impacted by the clearings made for collection and transportation of the *‘iliahi*. Another reason that large sections of the lower forests were cleared, was to develop lands on which western-introduced food crops could be cultivated and harvested for sale to visiting ships.

Contemporary cultural practices
Gathering of plant material for lei making, medicinal use, or other Native Hawaiian traditional uses is believed to occur within the WTMA; however, no specific cultural practices were identified by consulted parties during pre-consultation.

VII. ENVIRONMENTAL IMPACTS AND PLANNED MITIGATION MEASURES

This section provides an analysis of the environmental consequences of implementing the proposed action as compared to current conditions. Impacts are described for the main aspects of the environments described above, including physical, biological, socio-economic, and cultural resources. The potential effects to these resources as a result of implementing the proposed action is then assessed. In addition to the previous section, DOFAW staff experience, existing databases and inventories, relevant plans, studies, and past and current research were used for this analysis. Cumulative impacts, including impacts to resources from reasonably foreseeable events and impacts resulting from interaction of DOFAW actions with actions taking place outside the WTMA, are addressed in the final subsection.

The qualitative terms intermediate, minor, and negligible are used to describe the magnitude of the effect:

Negligible. Resources would not be affected, or the effects would be at or near the lowest level of detection. Resource conditions would not change or would be so slight there would not be any measurable or perceptible consequence to a population, wildlife or plant community, recreation opportunity, visitor experience, or cultural resource.

Minor. Effects would be detectable but localized, small, and of little consequence to a population, wildlife or plant community, recreation opportunity, visitor experience, or cultural resource. Mitigation, if needed to offset adverse effects, would be easily implemented and successful.

Intermediate. Effects would be readily detectable and localized; with consequences to a population, wildlife or plant community, recreation opportunity, visitor experience, or cultural resource. Mitigation measures may be needed to offset adverse effects and would be extensive, moderately complicated to implement, and probably successful.

Major (significant). Effects would be obvious and would result in substantial consequences to a population, wildlife or plant community, recreation opportunity, visitor experience, or cultural resource within the local area and region. Extensive mitigating measures may be needed to offset adverse effects and would be large scale in nature, very complicated to implement, and may not have a guaranteed probability of success. In some instances, major effects could include the irretrievable loss of the resource.

Effects may also be short-term (generally would last less than 1 year or season) or long-term (would last for longer than one year).

Table VII-1 provides an overview of the anticipated environmental effects of the proposed action. The effects are described in terms of the change from current conditions.

Table VII-1. Summary of effects

	Proposed Action
EFFECTS TO PHYSICAL ENVIRONMENT	
Effects to Soils	Minor to intermediate, negative
Effects to Water	Minor, negative
Effects to Air Quality	Negligible
Effect on Wildfire Potential	Negligible
EFFECTS TO BIOLOGICAL RESOURCES	
Effects to Threatened or Endangered Species	
Effects on ʻōpeʻapeʻa	Minor, negative
Effects on ʻio	Minor, negative
Effects on *Drosophila mulli*	Negligible
Effects on *Cyrtandra giffardii*	Negligible
Effects to Vegetation	Minor to intermediate, negative
Effects to Birds	Minor, negative
Effects to Game Animals	Minor, negative
Effects to Invertebrates	Minor, negative
Effects on Significant and Sensitive Habitats	Negligible
EFFECTS TO SOCIAL AND ECONOMIC CONDITIONS	
Effects on Hunting	Short-term, intermediate, negative; Long-term, minor, negative
Effects on Recreational Use	Short-term, intermediate, negative Long-term, minor, positive
Effects on Gathering	Minor, negative
Effects on Research	Negligible

	Proposed Action
Effects on Visual Resources	Short-term, minor, negative
Effects on Economics	Minor to intermediate, positive
Effects on Traffic Patterns	Intermediate, negative
EFFECTS TO CULTURAL, HISTORIC, AND ARCHAEOLOGICAL RESOURCES	
Effects to Cultural, Historic, and Archaeological Resources	Minor, negative

A. Effects to Physical Environment

Effects to soils

The proposed action involves the use of heavy equipment for harvesting, road maintenance, site preparation, and replanting activities. Timber harvesting operations also require the construction of temporary skid trails and landings. Additional soil disturbance is possible during tree felling, while logs are skidded to landings, decked, and loaded, and when preparing a site for replanting (which involves crushing or removing existing vegetation).

The soils in the WTMA are well drained with rapid permeability, slight erosion potential, and slow to medium runoff (USDA 1973). Average slope is six percent throughout the WTMA (although much higher in ravines). Where the soil overlies ʻaʻā lava, the substrata is also rapidly permeable. Although the pāhoehoe lava is slowly permeable, water moves rapidly through cracks in the lava.

Management objectives for the long-term productivity and sustainability of the WTMA forest resources necessitate the protection of soil resources on site. Best management practices will be incorporated to minimize the potential for soil movement, erosion, and compaction during tree thinning and harvesting, road maintenance, and site preparation and would include, for example, proper engineering in the design and location of skid trails and landings, avoiding the use of heavy equipment in the steeper and more erosion-prone portion of the project area, phasing harvesting to reduce exposed ground areas, avoiding earthwork in inclement weather or periods of excessively wet soil conditions, using vegetative buffers for erosion control and soil stabilization, and revegetating of bare areas with vegetative cover as an interim measure between harvest and replanting.

It is anticipated that negative effects to soils would be minor to intermediate, because the soils have slight erosion potential, the long-term viability of the timber management area depends on protecting the existing soils, and best management practices would be incorporated into each phase of the proposed action. Effects would not be widespread throughout the WTMA, but would be localized in the specific areas being harvested or undergoing reforestation, and would be temporary.

Effects to Water

The proposed action involves timber harvesting, road maintenance, site preparation, and replanting

activities. The major sources of water quality degradation from these activities are sediment, nutrients, pesticides, and debris. The project area has no running streams except during periods of heavy rainfall, and normal patterns in the area consist mainly of storm water runoff and percolation. All forest management activities would be designed to comply with State water quality standards.

Best management practices would be incorporated to minimize the potential for erosion and encourage normal runoff patterns. These include for example, proper engineering in the design and location of skid trails and landings, avoiding any disruption of natural drainages, preventing excessive soil displacement, providing drainage in case of slope instability, providing culverts, dips, water bars, and cross drainages on roads and skid trails to minimize erosion, avoiding earthwork in inclement weather or periods of excessively wet soil conditions, using vegetative buffers for erosion control and soil stabilization, and revegetating of bare areas with vegetative cover as an interim measure between harvest and replanting. To minimize water quality degradation from nutrients and pesticides, best management practices would be incorporated including choosing pesticides or herbicides suitable for use on the target species and used in strict adherence with all label requirements and incorporating protocols for transportation, storage, use, and disposal of chemicals to minimize opportunities for spills or contamination. Spray will be limited to manual applications in an area about two to three feet in radius around seedlings. Chemical quantities would be carefully prescribed at levels to control the specified target population, and would not be applied in DOFAW-identified buffer zones.

Due to distance from the ocean and the incorporation of best management practices, no impacts to marine water quality are anticipated. Further, due to the incorporation of best management practices, the underlying soil characteristics, the lack of streams in the project area, and existing patterns of runoff, no significant changes to the quality or quantity of existing discharges is anticipated. Overall, it is expected that the proposed action will have minor negative impacts on water quality.

Effects to Air Quality

Limited air pollution from use of heavy machinery and small power tools will be unavoidable; however, emissions from these forest management activities are not expected to exceed the state and national standards. Additionally, discharge of visible fugitive dust, if any, is not anticipated to travel beyond the property line of the forest reserve. Further, any spraying of approved herbicides (e.g., backpack spraying) would be done in accordance with recommendations on the label attached to the product (e.g., applying large droplets for sufficient coverage, avoid application of herbicides on windy days or certain times of day) to avoid spray drift. Loads will be covered if cargo characteristics indicate potential fugitive dust potential, and dust abatement measures will be implemented as necessary.

Based on the characteristics of the planned action, the planned best management practices to be incorporated, the location of the project within a forest reserve and away from development, and the surrounding environment, effects to air quality from the proposed action are anticipated to be negligible. Proximity to an erupting volcano (a significant source of air pollution on the island) is likely to obscure any effect on air quality this project may have. However, due the proximity of a stationary air quality monitoring station in Mountain View, unanticipated impacts to air quality from the proposed action may be identified and remedial steps taken as necessary.

Effect on wildfire potential

The WTMA is located in a high rainfall zone where wildfire occurs only during extreme drought conditions. Though rare, the potential occurrence of drought does require active fire control planning. In February 1926, an escaped trash fire burned 125 acres in WFR, and in March 1926, a land-clearing fire escaped and burned 20 acres of forest. In late March 1926, a fire started from a fisherman's camp on the coast burned 4,000 acres, 700 of which were in the Panaʻewa Forest Reserve. Smaller fires occurred more recently in 1970-1972, and in 1998.

Typically, fire risk increases in forested areas with increased human activity. This area normally is very wet and does not burn readily. During dry periods, DOFAW will post fire prevention signs, distribute brochures, and employ Public Service Announcements to increase public awareness of fire risk. In extreme conditions, DOFAW will consider public access restrictions and minimize timber management activities to mitigate increased risk due to drought.

The proposed action involves timber harvesting, road maintenance, site preparation, and replanting activities using heavy equipment that may get hot and pose a fire threat. Best management practices to be incorporated include no smoking or open fires and the development and implementation of a fire response plan. Maintenance of the road network within the WTMA for timber management activities would have a secondary benefit of improving access and facilitating rapid containment of fire should one occur.

Based on the environmental conditions within WTMA, the incorporation of best management practices, and the maintenance of the road network, effects on wildlife potential from the proposed action are anticipated to be negligible.

B. Effects to Biological Resources

Effects to threatened or endangered species: ʻōpeʻapeʻa

The endangered Hawaiian Hoary Bat, or ʻōpeʻapeʻa, has been detected in the WTMA, but the extent of their distribution and density is unknown. Even though there are no known observations of roosting or breeding ʻōpeʻapeʻa in the area, there is insufficient data to rule out the possibility that they are utilizing forest within the project area for those purposes. Noise and activities associated with commercial harvest operations, road maintenance, and replanting may temporarily disrupt the activities of the ʻōpeʻapeʻa.

The following measures will be taken to avoid any impacts to the ʻōpeʻapeʻa from harvesting or other silviculture activities within the WTMA:

- Timber felling will not be allowed between June 1 and September 15, which is the period when non-flying juveniles may occur in the project area;
- If any ʻōpeʻapeʻa fall to the ground during operations, the operator must immediately cease all activities in the immediate area and contact DOFAW;

- Loss of habitat due to harvesting will be minimized by utilizing lower impact harvesting methods (selective harvest, patch cut, regeneration harvest limited to 40-acre blocks, and no simultaneous harvest of adjacent 40-acre blocks).

However, the restriction on timber felling between June 1 and September 15 may be modified or lifted upon additional surveys and the development and implementation of additional mitigation actions, if DOFAW Wildlife staff and USFWS concur that the proposed mitigation actions will adequately protect the bat from take during ongoing harvesting activities.

Any loss of habitat due to harvesting will be temporary in nature as reforestation efforts and natural regeneration will replace the vegetation in the harvested area. Harvesting of 40 acre blocks may potentially be beneficial to the bats by increasing open areas adjacent to forest stands which are preferred for foraging by the ʻōpeʻapeʻa.

The negative impact on the ʻōpeʻapeʻa is anticipated to be minor because no ʻōpeʻapeʻa have been observed roosting in the project area, harvesting activities will be restricted from June 1 to September 15 to prevent harm to undetected juveniles, ʻōpeʻapeʻa are crepuscular and harvesting activities would occur during the day, and harvesting activities could provide short-term benefits by increasing foraging opportunities.

<u>Effects to threatened or endangered species: ʻio</u>
The endangered Hawaiian hawk, or ʻio, has been detected foraging in the WTMA, but the extent of their distribution and density is unknown. Hawks commonly hunt in forests, but also forage in agricultural and residential areas. Even though there are no known observations of breeding ʻio in the area, there is insufficient data to rule out the possibility. Noise and activities associated with commercial harvest operations, road maintenance, site preparation, and replanting may temporarily disrupt the activities of the ʻio. While human activity appears to have little effect on foraging birds, disturbance at nest sites is known to cause nesting failure and abandonment of young (Griffin 1985).

The following measures will be taken to avoid any impacts to the ʻio from harvesting and related silviculture activities within the WTMA:

- If any breeding ʻio or potential ʻio nests are encountered during operations, the operator must immediately contact DOFAW and suspend all activity in the immediate area until all young ʻio have fledged.

Any loss of habitat due to harvesting will be temporary in nature as reforestation efforts and natural regeneration will replace the vegetation in the harvested area. The negative impact on the ʻio is anticipated to be minor because ʻio density is lower in Puna than in equivalent habitat elsewhere on the island and ʻio density is relatively low in non-native timber plantations, ʻio have not been observed nesting in the project area, ʻio populations on the island appear to be stable, and harvesting activities will be suspended if ʻio nests are discovered.

Effects to threatened or endangered species: Drosophila mulli

D. mulli is historically known from the WTMA, which contains approximately 48 acres of critical habitat for this species. This species is found only associated with its host plant, the endemic palm *P. beccariana*. To avoid negative impacts to *D. mulli*, a buffer will be placed around designated critical habitat within the WTMA and no harvesting related activities will be allowed within the critical habitat or surrounding buffer. Moreover, DOFAW will conduct surveys for the palm prior to the commencement of any timber harvest activities in a particular 40-acre unit, and will place a buffer around any individual trees present outside designated critical habitat. The proposed action is anticipated to have a negligible impact on *D. mulli*, because *D. mulli* has not been observed since 2001, populations are extremely variable depending on rainfall and environmental factors, and the only known host plant will be protected during all timber harvesting activities.

Effects to threatened or endangered species: *Cyrtandra giffardii*

Cyrtandra giffardii has been observed within the WTMA, within timber stands along the western boundary, in an area regenerating into native forest. No harvesting activities will occur in this area. Discussions will take place with the Hawai‘i DOFAW botanist, and with the PEP (Plant Extinction Prevention) program as needed, to determine if cuttings or seed collection is warranted and to identify any additional mitigation measures that should occur. Because no harvesting activity will occur in the vicinity of this plant, the proposed action is anticipated to have a negligible negative impact on *C. giffardii.* Because this plant was not previously known from WTMA, and because it was discovered due to surveys related to the proposed action, the long-term impact to the species may be positive, as cuttings or seeds may be collected to contribute to the establishment of stable populations of this plant in other protected areas.

Effects on Vegetation

The proposed action involves timber harvesting, road maintenance, and site preparation for replanting activities, all of which involve clearing or removing vegetation in varying degrees. All intensive forestry operations will be conducted on areas that were previously converted to non-native timber stands for the purpose of future harvest; native forest areas will not be disturbed. Non-native trees and shrubs dominate the WTMA, and of the few remaining native species in the WTMA, most are common. Because the number of and percent cover of native plants in the WTMA is low, minor overall damage to existing native vegetation is anticipated from the proposed action.

Botanical surveys will be conducted prior to harvest in a particular 40-acre block to ensure that no rare or threatened or endangered plant species are accidentally destroyed. Though not anticipated, if any rare or listed plants are found during harvesting or replanting activities, rare species protocols (e.g., flagging plants, identifying buffer zones, etc.) would be implemented to minimize impact to rare or listed plant species. Known locations of rare or listed plant species would be visited to collect seed or cuttings for propagation as needed, and outplanting of these seeds or cuttings would occur in areas actively managed for rare plant species where possible.

Conversely, the effect on non-native plant species would be greater than on native plant species because of their dominance in the WTMA. These effects are anticipated to be temporary in nature.

Non-native trees will be cut and removed from the site during thinning and harvesting, and competitive weedy vegetation will be controlled mechanically and/or chemically prior to planting. Timber harvesting will be limited to 40-acre blocks and no adjacent 40-acre blocks will be harvested simultaneously. Intentional reforestation through plantings and re-growth from existing on-site seed banks is anticipated to replace vegetation after harvest. Given that the timber species were planted specifically for the purpose of future harvest, that replanting will occur within six months of harvesting activities, and that much of the non-native understory vegetation is common elsewhere, the negative effect of harvesting activities on non-native species is anticipated to be minor.

Introduced timber species planted in the WTMA have the potential to impact native forests by spreading into adjacent native ecosystems. Proposals for utilizing new timber species during replanting activities would be evaluated under the Hawai‘i Pacific Weed Risk Assessment and other appropriate methods to determine invasiveness before any planting may occur. The potential for the spread of non-native timber species into native forest would be increased if a large disturbance event such as fire or hurricane should occur and create suitable habitats for them to become established, but this potential also exists under the no-action alternative. As such, the impact on vegetation of replanting timber species is considered minor.

Invasive plant species such as strawberry guava and glorybush have spread across large areas of the WTMA. Intensive forestry operation could potentially spread these species further across the timber management area on machinery, gear, and equipment. Harvest operations will be strongly encouraged to move from upper elevations down to lower elevations to minimize opportunities for spreading common low-elevation weeds, such as *Clidemia hirta*, into upper elevations where these weeds are not yet found. A sanitation protocol for machinery, gear, and equipment will be prescribed to minimize the potential for introduction of new species and prevent the movement of established and incipient invasive species found within the WTMA, covering plants, invertebrates (such as fire ants and coqui frogs), soil-born organisms, etc. Species-specific protocols will be developed as necessary to contain problem species known to occur in portions of WTMA and prevent their spread in WTMA and to adjacent native forest areas.

Stands of native forest will not be harvested under the proposed action. It should be noted that although native forest initially was cleared for the establishment of non-native forest plantations in Waiākea, DOFAW has not cleared any native forest on the island of Hawai‘i since the early 1970s and introduced legislation (enacted in 1997) that prohibits the conversion of native forests to introduced forest plantations on public lands.

Effects on Birds

Native forest birds are infrequently observed within WTMA, due to the density of disease-carrying mosquitoes below 4,000 ft elevation. Key habitat for the native forest birds is native forest, and there are no known observations of breeding native forest birds in the timber plantations of WTMA. Noise and activities associated with commercial harvest operations, road maintenance, site preparation, and replanting may temporarily disrupt the activities of the few native forest birds foraging or transiting the WTMA. However, because sizable native forest bird populations are unlikely within WTMA due to the

low elevation and lack of native forest habitat, because native forest birds have not regularly been observed using the WTMA, and because areas of native forest within WTMA will not be subject to harvesting activities, the negative impact on native forest birds is anticipated to be minor.

Noise and activities associated with commercial harvest operations, road maintenance, site preparation, and replanting may temporarily disrupt the activities of non-native bird populations as well. The native effect of the proposed action on non-native birds is anticipated to be minor given that non-native bird species were introduced to the WTMA, that non-native bird species largely exist in sizable populations outside the WTMA, and that these birds can easily fly to other locations.

Effects on Game Animals

Game animals may be disturbed by noise and activity associated with timber harvesting, road maintenance, site preparation, and replanting, but these activities will be temporary in nature at specific locations. The clearing of areas as part of harvesting activities may have a positive impact on game populations, but again, may be temporary in nature. The negative effect of the proposed action on game animals is anticipated to be minor given that game animals were introduced to the WTMA, that these non-native species largely exist in sizable populations outside the WTMA, and that these animals can move easily to other portions of WTMA.

Effects on Invertebrates

Given the lack of data on invertebrate numbers and diversity in the WTMA and their habitat needs, it is difficult to assess the impact the proposed action would have on native or non-native invertebrate populations. Existing invertebrates could be disturbed by timber harvesting and site preparation activities, but because of harvest restrictions (regeneration harvest will be limited to 40-acre non-adjacent blocks) and planned replanting, the negative impacts are anticipated to be short-term and minor, as invertebrate communities could re-colonize as vegetation is re-established. Because invertebrate species may occupy protected habitats in the nearby Upper Waiākea, Waiākea and ʻŌlaʻa Forest Reserves and in the Puʻu Makaʻala NAR, the long-term negative effect of the proposed action on invertebrate abundance and diversity is anticipated to be minor.

Effects on significant and sensitive habitats

WTMA overlaps with approximately 48 acres of critical habitat for *D. mulli*. To avoid negative impacts to *D. mulli*, a buffer will be placed around designated critical habitat within the WTMA and no harvesting related activities will be allowed within the critical habitat or surrounding buffer. As such, the impact of the proposed action on critical habitat of *D. mulli* is anticipated to be negligible.

C. Effect on Social and Economic Conditions

Effect on hunting

As noted, game animals may be disturbed by noise and activity associated with timber harvesting, road maintenance, site preparation and replanting, but these activities will be temporary in nature at specific locations. Public access for hunting will be restricted to portions of the WTMA during active harvesting and transporting operations for safety, but restrictions will be temporary and limited in

duration. Signs will be put in place at least one month in advance to alert the public. Habitat changes will occur, as timber is cut and new seedlings are replanted, but access throughout the WTMA is anticipated to improve over time as roads are maintained to support harvesting operations. The proposed action is anticipated to have a short-term intermediate negative impact and a long-term minor negative impact on hunting given that the majority of WTMA is anticipated to remain open to hunting at any given time, that game animals are expected to move throughout the WTMA as harvesting activity occurs, and the existing acreage available for hunting in the general area outside the WTMA (Upper Waiākea Forest Reserve, ʻŌlaʻa Forest Reserve, Puʻu Makaʻala NAR).

Effect on recreational use

Besides hunting, recreational use is primarily composed of use by all-terrain vehicles and motorcycles, mountain biking, and horseback riding. These recreational activities will still be allowed within the WTMA, but public access will be restricted in portions of the WTMA during active harvesting and transporting operations for safety. These restrictions will be temporary and limited in duration. When harvesting activities are occurring in any block containing or adjoining any of the trails used recreationally, it is anticipated that those trails will be closed. Signs will be put in place at least one month in advance to alert the public.

The nature of harvesting activities (felling timber, crushing slash, replanting seedlings) will necessarily alter the recreational landscape. Upon completion of harvesting, existing access roads will be restored to their condition prior to harvest. Existing off-road single and double track routes will be re-established in coordination with the recreational users, with routes planned to limit impacts to replanted seedlings. For the area below Quarry Road, some slash may be specifically moved to provide obstacles for mountain bike trail riders. It is anticipated that the proposed action may increase overall opportunities for recreational use as harvesting activities clear and maintain access roads and trails that have become overgrown. Given that closures will be temporary in nature and the potential for improved access within the WTMA, the proposed action is anticipated to have a short-term minor negative impact and potential long-term minor positive impact on recreational use.

Effect on gathering

Gathering activities within the WTMA for personal, cultural, religious or traditional use will still be allowed within the WTMA, but public access will be restricted in portions of the WTMA during active harvesting and transporting operations for safety. These restrictions will be temporary and limited in duration, and potential gatherers will be redirected into other open locations (either in WTMA or in adjacent Forest Reserves) where possible. Given that closures will be temporary in nature, and that gathering may be redirected into other areas, the negative impact of the proposed action is anticipated to be minor.

Effect on research

Harvesting activities are not planned for units that have been previously identified as important for long-term research, and there is potential for additional field studies within the WTMA, especially in regard to introduced timber species in Hawaiʻi. The impact of the proposed action on research is anticipated to be negligible because existing research is likely to continue unaffected and specific

future research is currently speculative.

Effect on visual resources

Generally speaking, the remote, undeveloped nature of WTMA and the surrounding topography means the area is not visible from any public highways or from homes or vantage points in Hilo or Volcano. It is visible as part of a larger forested greenscape viewed by tour helicopters visiting the volcano or touring the island.

During initial planting efforts in the WTMA, a native forest corridor was left intact along Stainback Highway (approximately 100 feet wide on each side) for aesthetic and wildfire pre-suppression purposes. This buffer will not be disturbed during harvesting activities, and as such, visual impacts along the Stainback Highway should be negligible.

The visual aesthetics of the project area will be temporarily impacted by the proposed action because of rapid reduction in vegetative cover. To minimize this impact, regeneration harvest is limited to 40-acre units, and adjacent units will not be harvested simultaneously. All harvested areas will be replanted within six months. As such, negative visual impacts from the air should be short-term and minor.

Effect on economic conditions

DOFAW plans to issue a request for proposals for harvesting the WTMA in a manner that supports a consistent flow of timber from the land over time, rather than a short-term intense harvesting operation. This would support continual direct employment of persons associated with harvesting, transporting, and replanting activities, and would also support continued employment of persons associated with processing or using the timber and wood resources.

The 2004 survey “Economic Value of Hawaii’s Forest Industry in 2001” revealed that over 900 workers were employed in the Hawai‘i forest industry, with a corresponding payroll of $30.7 million (Yanagida et al. 2004). The retail value of Hawai‘i-grown forest products was estimated at $23.9 million, among all the main islands; however, the majority of this value (75 percent) was associated with sales of koa (Friday et al. 2006).

Some local purchases associated with harvesting activities may include rental of heavy equipment, lodging for harvesting crews, purchase of seedlings, herbicide, and other supplies, and transportation costs associated with moving the timber from the site for processing. Salary spending associated with harvesting, site restoration, and timber license monitoring could generate secondary benefits by providing jobs in other industries where monies are spent. Personal spending could include rent, utilities, food, entertainment, gas, etc.

The WTMA has an estimated economic stumpage value of several million dollars, which would be paid to DOFAW over the life of the timber land license (estimated at 10 to 20 years) as timber is harvested. The value-added economic gain may be significant, if the raw materials are processed into products of higher value (such as furniture, veneer, etc.). DOFAW's goal is for the timber resources of the WTMA to be used to manufacture locally desired wood products or to be used as biofuel to reduce

dependence on imported oil, but the actual use of the timber resources will depend largely on market interest demonstrated during the RFP process. All revenues received would be deposited into the Forest Stewardship Special Fund and be spent on future forest reserve management.

The project is not expected to have any negative economic impacts. Positive economic impacts are the creation of new jobs and additional revenues for forest management. Given the size of the project relative to the overall DOFAW budget or to other economic inputs into the local economy, the effects to economic resources are minor to intermediate.

Effect on traffic

Transporting forest products from the Waiākea Timber Management area will increase the use of Stainback Highway, Volcano Road (Route 11), and to a lesser extent North Kūlani Road, which may be used on a temporary basis if needed. It is anticipated that a fully operational active harvesting operations will require no more than 28 truckloads, regularly spaced, per day.

Transportation on public roadways is expected to occur up to 7 days a week during active harvest times. DOFAW will require that all transportation of timber comply with applicable state and county requirements regarding oversize and overweight vehicles. In addition, loads will be covered as necessary to prevent logging debris (leaves, limbs, etc.) from blowing off and becoming a safety hazard for other vehicles. Clearing or sweeping of the paved road will be conducted as necessary to remove mud, gravel and other debris from the paved road.

During timber transportation, operators will be required to utilize appropriate road and traffic warning signs and use signal cars, if necessary. Additionally, a press release will be issued to inform the public of their activities along these roadways. The County of Hawai‘i (Pana‘ewa Zoo) and the State Department of Public Safety (Kūlani Correctional Facility) will be specifically notified about anticipated use patterns.

Overall, the impact to local traffic along Stainback Highway and Volcano Road (Route 11) from the proposed action is not anticipated to be significant based on observations of the impact of transporting timber from a similarly sized harvesting operation in Hamakua. Recognizing that differences do exist between the two areas, DOFAW will monitor the transportation situation, and restrictions regarding the timing of timber transport (e.g., reduce or restrict transport during peak traffic times) may be implemented or alternate transportation routes may be explored. Given the low annual average daily traffic (AADT) and 24 hour truck volumes as determined by Hawai‘i Department of Transportation (HDOT) surveys for the roadways, the low traffic volume contribution of this project, the characteristics of Stainback Road, and the driving habits of the local residents, the anticipated negative impact on existing traffic is intermediate.

D. Effects to Cultural, Historic and Archaeological Resources

An Archaeological Inventory Survey completed in April 2014 concluded that the WTMA was utilized prehistorically as evidenced by the previously identified burial cave, but that the majority of traditional

land use in this area was likely for the procuring of natural resources (e.g., timber, medicinal plants, olona, and birds) and temporary habitation associated with this activity. As such, the physical evidence of these activities would have been ephemeral and left little if any surviving physical evidence. The AIS further noted that the absence of prehistoric sites in the survey blocks was not unexpected due to "the extensive ground disturbance that has occurred in the area since the early 1960s and the expected low site density predicted by McEldowney's (1979) settlement pattern model."

The AIS documented two modern historical features: a badly disturbed remnant of the historic ʻŌlaʻa Flume associated with the sugarcane industry and a historic road (ʻŌlaʻa Back Road) that is currently in use by local residents as Ihope Road). While assessed as significant for their information content, and (for the flume) in association with the broad pattern of sugarcane agriculture, the AIS concluded that existing documentation is adequate and no further work or preservation is recommended.

A previously documented burial cave could not be re-located, despite repeated efforts. The entrance may have been blocked by a sheared off section of ridge or the cave may have been inaccurately plotted in 1985. To minimize the possibility of harm to this cave during timber harvest operations, DOFAW will require archaeological monitoring for any activities within a 500-square meter (61.7 acre) area centered on the reported location of the burial cave, as recommended by the AIS.

The negative impact on archaeological and cultural resources is anticipated to be minor because the area was mechanically cleared approximately fifty years ago, no known features are listed on the State or National Register of Historic Places, no new cultural resources have been discovered within the WTMA, and consultation did not uncover any cultural activities that could be impacted by the proposed action.

Should evidence of any undetected archaeological or cultural property (e.g., burial cave) be encountered during timber harvest, road maintenance, site preparation or replanting, activities will stop and the appropriate parties be consulted immediately. Where possible, cultural resources will be avoided. Minimization options, in addition to site avoidance, would include data recovery, using either collection techniques or in-site site stabilization protection.

<u>Cumulative Impacts</u>
HAR §11-200-2 defines cumulative impact as

> *"The impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."*

Cumulative impacts are the overall, net effects on a resource that arise from multiple actions. Impacts can "accumulate" spatially, when different actions affect different areas of the same resources. They can also accumulate over the course of time, from actions in the past, the present, and the future. Occasionally, different actions counterbalance one another, partially canceling out each other's effect

on a resource. But more typically, multiple effects add up, with each additional action contributing an incremental impact on the resource. In addition, sometimes the overall effect is greater than merely the sum of the individual effects, such as when one more reduction in a population crosses a threshold of reproductive sustainability, and threatens to extinguish the population.

A thorough analysis of impacts always considers their cumulative aspects, because actions do not take place in a vacuum; there are virtually always some other actions that have affected that resource in some way in the past, or are affecting it in the present, or will affect it in the reasonably foreseeable future. So any assessment of a specific action's effects must in fact be made with consideration of what else has happened to that resource, what else is happening, or what else will likely happen to it.

DOFAW is not aware of any past, present, or planned actions that would result in a significant cumulative impact when added to the proposed action.

VIII. ANTICIPATED DETERMINATION

The Division of Forestry and Wildlife anticipates a **Finding of No Significant Impact (FONSI)** declaration for this project.

IX. FINDINGS AND REASONS SUPPORTING ANTICIPATED DETERMINATION

In determining whether the proposed action will have a significant impact on the environment, the Division considered the phases of the proposed action (from planning through implementation, including timber harvest, transporting the timber, and replanting), the expected consequences, both primary and secondary, and the cumulative as well as short and long-term effects of the action. In addition, the Division specifically evaluated the project under the following 13 significance criteria, as provided in HAR §11-200-12:

1. Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;

Sustainable timber harvesting operations would create a temporary disturbance to portions of the forest, and all harvesting activities will be followed by replanting. Existing native forest will not be harvested. The WTMA will remain a working forest and continue to support existing recreational uses of the forest. As discussed more fully above, the proposed action is anticipated to have a minor negative impact on water quality, the endangered ʻōpeʻapeʻa, the endangered ʻio, and cultural resources, and a minor to intermediate negative impact on soils and vegetation. No irrevocable loss or destruction of natural or cultural resources is involved.

2. Curtails the range of beneficial uses of the environment;

The proposed project does not curtail the range of beneficial uses of the environment. Opportunities for public enjoyment and outdoor recreation activities, such as hunting, off-road vehicle use, mountain biking, and horseback riding, will continue, though access to specific areas of WTMA will be

temporarily limited during periods of active harvesting and loading operations. Gathering plant material from the project area for personal, cultural, religious, and traditional uses will still be encouraged, though access to specific areas of WTMA may be temporarily limited during periods of active harvesting and loading operations and alternate gathering locations within WTMA may be recommended. Finally, road maintenance conducted to support harvesting and transportation of timber should positively impact public use, by improving access within the WTMA.

3. Conflicts with the state's long-term environmental policies or goals and guidelines as expressed in HRS Chapter 344;

HRS §344-3 provides in part:

> It shall be the policy of the State, through its programs, authorities, and resources to:
> (1) Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augmenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which humanity and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawaii. …

HRS §344-4 provides in part:

> In pursuance of the state policy to conserve the natural resources and enhance the quality of life, all agencies, in the development of programs, shall, insofar as practicable, consider the following guidelines:
> …
> (2) Land, water, mineral, visual, air, and other natural resources
> (A) Encourage management practices which conserve and *fully utilize* all natural resources; …
> (D) Encourage management practices which conserve and protect watersheds and water sources, forest, and open space areas; …
> (5) Economic development.
> (A) Encourage industries in Hawaii which would be *in harmony* with our environment; …
> (D) Encourage all industries including the fishing, aquaculture, oceanography, recreation, and forest products industries to protect the environment; … (emphasis added).

The proposed action is based on sound forest stewardship and sustainable, long-term productivity. The existing timber in WTMA is mature, and harvesting the timber as proposed in this document would improve forest health and vigor while encouraging an emerging forest products industry in a manner harmonious with the environment.

In addition, the proposed action is consistent with DLNR-DOFAW's existing Forest Products Development program and with DOFAW's mission statement "to grow high quality forest products in sustained yield systems and practices to create job opportunities in rural areas and to broaden Hawaii's

economic base." This project will provide employment opportunities, and the State's economic base will be enhanced. The proposed action focuses on utilizing the resources of an existing non-native timber forest and supports development of a forest products industry that does not rely upon exploitation of native forest. As such, the proposed action does not conflict with the state's long-term environmental policies or goals and guidelines as expressed in HRS Chapter 344.

4. Substantially affects the economic welfare, social welfare, and cultural practices of the community or State;

The proposed action does not substantially affect the economic welfare, social welfare or cultural practices of the community or State. The economic and social welfare of the community and state will be improved with the implementation of the proposed project through the creation of new jobs and additional revenues for forest management. The WTMA has an estimated economic stumpage value of several million dollars. However, the value-added economic gain to the local economy is anticipated to many times that of the actual stumpage value. DOFAW's goal is for the timber resources of the WTMA to be used to manufacture locally desired wood products or to be used as biofuel to reduce dependence on imported oil, but the actual use of the timber resources will depend largely on market interest demonstrated during the RFP process. All revenues received would be deposited into the Forest Stewardship Special Fund and be spent on future forest reserve management. No specific cultural practice has been identified that would be affected by the proposed action.

5. Substantially affects public health;

The proposed action does not substantially affect public health.

6. Involves substantial secondary impacts, such as population changes or effects on public facilities;

The proposed action does not involve substantial secondary impacts (such as population changes or effects on public facilities).

7. Involves a substantial degradation of environmental quality;

The proposed action does not involve a substantial degradation of environmental quality. The WTMA will remain forested watershed; harvesting will be spread over time and re-planting of an area will occur within six months of harvest. Invasive species protocols will be incorporated to minimize the potential spread of invasive species into and within the WTMA during all activities.

8. Is individually limited but cumulatively has considerable effect upon the environment or involves a commitment for larger actions;

The proposed action does not have considerable cumulative adverse effects nor does it involve a commitment for larger actions.

9. Substantially affects a rare, threatened or endangered species or its habitat;

The proposed project does not substantially affect a rare, threatened, or endangered species, or its habitat. As noted earlier, the native Hawaiian Hoary Bat, or ʻōpeʻapeʻa, has been detected in the WTMA, but the extent of their distribution and density is unknown. Because no ʻōpeʻapeʻa have been observed roosting in the project area, because harvesting activities will be restricted from June 1 to September 15 to prevent harm to undetected juveniles, because ʻōpeʻapeʻa are crepuscular and harvesting activities would occur during the day, and because harvesting activities could provide short-term benefits by increasing foraging opportunities, the anticipated negative impact on the ʻōpeʻapeʻa is minor.

The endangered Hawaiian hawk, or ʻio, has been detected foraging in the WTMA, but the extent of their distribution and density is unknown. Because ʻio density is lower in Puna than in equivalent habitat elsewhere on the island and because ʻio density is relatively low in non-native timber plantations, because ʻio have not been observed nesting in the project area, because ʻio populations on the island appear to be stable, and because harvesting activities will be suspended if ʻio nests are discovered, the anticipated negative impact on the ʻio is anticipated to be minor.

The threatened picture-wing fly, *Drosophila mulli* is historically known from the WTMA, which contains 48 acres of critical habitat for this species. Because *D. mulli* has not been observed since 2001, because populations are extremely variable depending on rainfall and environmental factors, because no harvesting activities will occur within the critical habitat, and because the only known host plant (*Pritchardia beccariana*) will be protected by a buffer where found outside critical habitat from all timber harvesting activities, the proposed action is anticipated to have a negligible impact on *D. mulli.*

The endangered plant *Cyrtandra giffardii* has been observed within the WTMA, within timber stands along the western boundary, in an area regenerating into native forest. No harvesting activities will occur in this area. Because no harvesting activity will occur in the vicinity of this plant, the proposed action is anticipated to have a negligible negative impact on *C. giffardii.* Because this plant was not previously known from WTMA, and because it was discovered due to surveys related to the proposed action, the impact to the species may be positive, as cuttings or seeds may be collected to assist in the establishment of stable populations of this plant in other protected areas.

There are no other known threatened and endangered species in the project area. Botanical surveys will be conducted throughout areas that will be immediately impacted by timber harvesting activities to ensure that no rare or threatened and endangered plant species are present. Though not anticipated, if any endangered plants are found during harvesting or replanting activities, rare species protocols (e.g., flagging plants, identifying buffer zones, etc.) would be implemented to avoid impact to any rare plant species. Known locations of rare or threatened and endangered plant species would be visited to collect seed or cuttings for propagation as needed, and outplanting would occur in areas actively managed for rare plant species.

10. Detrimentally affects air or water quality or ambient noise levels;

The proposed action does not detrimentally affect air or water quality or ambient noise levels.

Effects on air quality from the proposed action are anticipated to be negligible based on the characteristics of the planned action, planned best management practices to be incorporated, location of the project within a forest reserve and distance to the nearest development, and the surrounding environment. Proximity to an erupting volcano (a significant source of air pollution on the island) is likely to obscure any effect on air quality this project may have. However, unanticipated impacts to air quality from the proposed action may be identified through the nearby stationary air quality monitoring station in Mountain View and remedial steps taken as necessary.

Due to distance from the ocean and the incorporation of best management practices, no impacts to marine water quality are anticipated. Further, due to the incorporation of best management practices, the underlying soil characteristics, the lack of streams in the project area, and existing patterns of runoff, no significant changes to the quality or quantity of existing discharges is anticipated. Overall, it is expected that the proposed action will have minor negative impacts on water quality.

Periodic noise from heavy equipment, power tools and other activities associated with this project will be unavoidable. The WTMA for the most part, is contained within the forest reserve. There are only a few adjacent residences located primarily on the southern boundary of the project location. Noise impacts are anticipated to be negligible to the general public, including visitors to the forest reserve on weekends.

11. Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;

The proposed action does not affect nor is likely to suffer damage by being located in an environmentally sensitive area such as a floodplain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters. The Waiākea Timber Management Area is not located in or near any of the above-mentioned environmentally sensitive areas.

12. Substantially affects scenic vistas and viewplanes identified in county or state plans or studies; or

The proposed action does not affect scenic vistas and viewplanes identified in county or state plans or studies.

The WTMA is not identified as a scenic vista or viewplane. Generally speaking, the remote, undeveloped nature of WTMA and the surrounding topography means the area is not visible from any public highways or from homes or vantage points in Hilo or Volcano. It is visible as part of a larger forested greenscape viewed by tour helicopters visiting the volcano or touring the island.

During initial planting efforts in the WTMA, a native forest corridor was left intact along Stainback

Highway (approximately 100 feet wide on each side) for aesthetic and wildfire pre-suppression purposes. This buffer will not be disturbed during harvesting activities, and as such, visual impacts along the Stainback Highway should be negligible.

The visual aesthetics of the project area will be impacted by the proposed action, through a rapid reduction in vegetative cover. To minimize this impact, regeneration harvest is limited to 40-acre units, and adjacent units will not be harvested simultaneously. All harvested areas will be replanted within 6 months. As such, negative visual impacts from the air should be short-term and minor.

13. Requires substantial energy consumption.

The proposed action does not require substantial energy consumption. Petroleum fuels will be used by the heavy equipment utilized for timber harvesting, road maintenance, timber transportation, and site replanting, but this energy consumption is not anticipated to be substantial, especially in comparison to island-wide energy consumption.

X. LIST OF PERMITS REQUIRED

Implementation of the proposed action may require the following permits and permissions:

Permit	**Issuing Agency**	**Comment**
National Pollution Discharge Elimination System (NPDES) General Permit	State Department of Health Clean Water Branch	NPDES general permit coverage required if construction activities involve clearing, grading and excavation that result in the disturbance of one or more acres.
Board approval	Board of Land and Natural Resources	HRS §183-16.5 requires BLNR approval of a Forest Management Plan before timber harvest on state-owned land.

XI. ENVIRONMENTAL ASSESSMENT PREPARATION INFORMATION

This environmental assessment was prepared by the Division of Forestry and Wildlife of the Department of Land and Natural Resources, with assistance from Anden Consulting.

XII. REFERENCES

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