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OFFICE OF ENVIRONMENTAL
QUALITY CONTROL

May 12, 1999

AQUACULTURE DEVELOPMENT
PROGRAM
AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND
ENVIRONMENTAL AFFAIRS
CONSERVATION AND
RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT
WATER RESOURCE MANAGEMENT

Ms. Genevieve Salmonson, Director
Office of Environmental Quality Control
235 South Beretania Street, Suite 702
Honolulu, HI 96813

Dear Ms Salmonson:

Subject: Final Environmental Assessment for Pu`u Kukui Watershed Long-Range Management Plan, for the Pu`u Kukui Watershed Management Area Natural Area Partnership Program; TMK 4-1-1-17, 4-2-1-1 (portion), 4-1-4-23 (portion), 4-1-5-10, 4-1-5-13, 4-1-5-16, 4-1-5-17, 4-3-1-1 (portion), 4-3-1-17 (portion) District of Lahaina, County of Maui, State of Hawai`i.

The Department of Land and Natural Resources has reviewed the Final Environmental Assessment for the subject project and determined a Finding of No Significant Impact. Please publish notice of availability for this project in the May 23, 1999 *Environmental Notice*.

We have enclosed a completed OEQC Publication Form and four copies of the Final EA. Please contact Betsy Gagné at 587-0063 if you have any questions.

Sincerely,

MICHAEL G. BUCK,
Administrator

enc.

1999-05-23-MA-~~FEA~~ - (rest of title in yellow)

MAY 23 1999

FILE COPY

**Environmental Assessment
Management Plan for Fiscal Years 2000-2005
Pu`u Kukui Watershed Management Area
Natural Area Partnership Program**

Final Environmental Assessment

For the

△ Pu`u Kukui Watershed Management Area ★
Natural Area Partnership Program

This Environmental document prepared pursuant to Chapter 343, HRS

PREPARED FOR

DIVISION OF FORESTRY & WILDLIFE
DEPARTMENT OF LAND AND NATURAL RESOURCES
STATE OF HAWAII

PREPARED BY

MAUI PINEAPPLE COMPANY, LTD.
P. O. BOX 187
KAHULUI, HI 96732-0187

MAY 1999

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I. SUMMARY

**CHAPTER 343, HAWAII REVISED STATUTES (HRS)
ENVIRONMENTAL ASSESSMENT**

Project Name: Pu`u Kukui Watershed Management Area (WMA) Natural Area Partnership

Proposing Agency / Applicant:

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

Maui Pineapple Company, Ltd.
P. O. Box 187
Kahului, HI 96732-0187

Approving Agency:

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

Project Location:

Pu`u Kukui WMA, 8,661 acres in the District of Lahaina, County of Maui, State of Hawaii

Tax Map Key	Acreage
4-1-1-17	5,780.00
4-2-1-1 (portion)	2,450.38
4-1-4-23 (portion)	0.40
4-1-5-10	1.75
4-1-5-13	2.48
4-1-5-16	<0.01
4-1-5-17	<0.01
4-3-1-1 (portion)	92.00
4-3-1-17 (portion)	334.00

Agencies Consulted/Requested to Review EA:

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Federal:

US Department of Agriculture
Natural Resource Conservation Service - Maui District
US Department of Interior
Fish & Wildlife Service - Pacific Islands Ecoregion - Environmental Services

State:

DLNR/ Division of Forestry & Wildlife - Maui District
DLNR/ Division of Land Management - Maui District
DLNR/ State Historic Preservation Division
Natural Area Reserve System Commission

County:

Department of Planning - Maui
Department of Water Supply - Maui

Private:

National Audubon Society - Hawai'i Chapter
Natural Resources Defense Council
Earth Justice Legal Defense Fund
The Nature Conservancy of Hawai'i

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II. PROJECT DESCRIPTION

Background

The Pu`u Kukui Watershed Management Area (Pu`u Kukui WMA or PKWMA) was established in 1988 to protect watershed forests and associated native plants and animals. At 8,661 acres, the Pu`u Kukui WMA is the largest privately-owned nature preserve in the state. Maui Pineapple Company, Ltd. (MPC), a subsidiary of Maui Land & Pineapple, Inc. (ML&P), began management programs in August 1988 under a management agreement with The Nature Conservancy of Hawai`i (TNCH). The Nature Conservancy assisted MPC's PKW supervisor to implement management programs, and has continued to act as a consultant to the project on an ad hoc basis. In July of 1992, ML&P entered into a six-year contract with the State of Hawai`i as the first private landowner participant in the Department of Land & Natural Resources' (DLNR) Natural Area Partnership (NAP) program. An Environmental Assessment was previously prepared for this project to satisfy NAPP requirements. However, because the Pu`u Kukui WMA contract is scheduled to be renewed in 1999, MPC has prepared a new 6-year management plan and this document. This Environmental Assessment describes possible impacts from management activities for the next six years in the Pu`u Kukui WMA as required by the Natural Area Partnership program and State of Hawai`i law.

The following section of this Environmental Assessment consists of a brief description of the Pu`u Kukui WMA, overview of the native resources that are protected, and how those resources complement the Natural Area Reserve System (NARS). In the next section, management considerations that have shaped the management programs are documented. A description of each management program follows, and includes a goal statement, an explanation of the management method chosen, and a detailed timeline.

Summary description of the Affected Environment

Location

The Pu`u Kukui Watershed Management Area (PKWMA) stretches from about 480 feet elevation at Honokohau Stream to the Pu`u Kukui summit, the highest point on Mauna Kahalawai (a.k.a. the West Maui Mountains) at 5,788 feet elevation. The rain forests and bogs of the Pu`u Kukui WMA serve as a stable water source for West Maui residents and industries. Maui Land & Pineapple Company depends on the watershed for agricultural and resort use, and supplies water to the county water system and neighboring landowners. Native vegetation is an essential component of this watershed system. Forest cover protects fragile mountain soils from erosion, and acts like an immense sponge that absorbs heavy rains. Water is gradually released into streams and groundwater aquifers, rather than running off the surface in torrents to the sea. Subsequently, ML&P's conservation efforts in the Pu`u Kukui WMA also benefit the shoreline resources of the Honolua - Mokulei`a Marine Life Conservation District. Unique bog and stream ecosystems and native-dominated forests and shrub lands make up the majority of the watershed.

A significant amount of fresh water used by West Maui's residents, agriculture, and other commercial businesses comes from this watershed area, and active management by all West Maui landowners is needed to prevent damage to the native forests by feral ungulates (pig, goat & deer) and invading weeds. Nine strategic fences have been built cooperatively by MPC, the State Division of Forestry & Wildlife (DOFAW), and TNCH staff in the PKWMA,

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Kahakuloa (4 fences) and Honokowai (4 fences) sections of the NAR, and the Kapunakea (1 fence) Preserve. These kinds of cooperative projects improve the efficiency of management efforts and benefit the entire Kahalawai/West Maui area.

Access to foot trails leading into the lower edge of the watershed area is along MPC owned roads through pineapple fields. Pineapple harvesting and other agricultural activities involve the use of large trucks on unpaved (and often muddy) roads, making access dangerous. This, coupled with the fragile native ecosystems in the watershed, results in a policy of restricted public access to the Pu`u Kukui WMA. The road to Haela`au Cabin at 2,980 feet elevation on Kaulalewalewa is the only direct road access into the watershed, and is passable only by four-wheel drive vehicle. This environmental assessment does not address any impacts resulting from MPC's agricultural activities below the PKWMA.

Flora and Fauna

Pu`u Kukui WMA contains 17 terrestrial native natural communities (Appendix 1). These natural communities vary from lowland shrub lands to montane forests and bogs. One of these communities is considered rare, as it occurs in fewer than 20 sites worldwide: `Ohi`a (*Metrosideros*) Mixed Montane Bog. Seven of the native natural communities found in the Pu`u Kukui WMA, including `Ohi`a Mixed Montane Bog, are also found in the West Maui NAR.

Pu`u Kukui WMA is also home to at least 30 species of rare plants; including the only known *Acaena exigua* (Liliwai) and five other rare plants endemic to West Maui (Appendix 2). Seven species of rare plants found in the PKWMA are listed as Endangered by the U. S. Fish & Wildlife Service (USFWS). Twenty-three other rare plant species are also listed as either Candidate (C) or Species of Concern (SOC) by the USFWS.

Three native forest birds found in the PKWMA's forests are also found in the West Maui NAR: the `Apapane (*Himatione sanguinea sanguinea*), `Amakihi (*Hemignathus virens wilsoni*), `I`iwi (*Vestiaria coccinea*). The PKWMA also provides habitat for the Pueo (*Asio flammeus sandwichensis*, Hawaiian Short-eared Owl) - a USFWS Species of Concern, as well as for migratory and sea birds such as Koa (*Pluvialis fulva*, Pacific Golden Plover), `Ulili (*Heteroscelus incanus*, Wandering Tattler), Koa`e Kea (*Phaethon lepturus dorotheae*, White-tailed Tropicbird), and the endangered `Ua`u (*Pterodroma phaeopygia*, Dark-rumped Petrel).

Seven species of rare native tree snails (*Partulina perdix*, *P. splendida*, *P. tappaiana*, *Perdicella kuhnsi*, etc.; see Appendix 2) have been observed and recorded in the PKWMA in the past ten years. A snail species not seen on Maui for half-a-century; *Newcombia cumingi*, was rediscovered in the PKWMA in 1994 by PKW staff. Other rare invertebrate species include the endemic Hawaiian damselfly (*Megalagrion pacificum*); a candidate endangered species, as well as others. Also, Hawai`i's only endemic land mammal; the endangered Hawaiian Hoary Bat (*Lasiurus cinereus semotus*) has been observed by PKW staff at various locations throughout the watershed.

Historical/Archeological and Cultural Sites

Although no archaeological surveys have been conducted within the boundaries of the Pu`u Kukui WMA no

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historic sites are known to exist in the area. In the lower elevations, agricultural related structures such as ditches and terraces are expected to be present while in the higher elevations only trails and/or temporary shelters might be expected. After a preliminary review of the proposed management activities by the State Historic Division (SHD) followed by an staff discussion between SHD and DOFAW, it was agreed that to ensure the proposed management activities would have negligible or no impact on any possible historic sites, MPC will contact the SHD prior to the commencement of any of these activities so that SHD may inspect the project areas. No survey of the management sites is called for at this time. In the event that MPC staff do encounter evidence of historic sites at a site of management activity, they will notify SHD staff to obtain their input and suggestions. Proposed fencing projects which might be considered a source of disturbance will be of short length, require minimal line cutting and will be constructed with metal T-stakes that will pose little risk to potential sites. In the long term, the proposed activities should provide protection for historic resources by eliminating disturbance from ungulates.

Adjacent Natural Resources

The PKWMA lies between the Kahakuloa and Honokowai sections of the state's West Maui Natural Area Reserve (Figure 1). These three areas, and the 1,200 acre Kapunakea Preserve (managed by The Nature Conservancy of Hawai`i), form 13,000 acres of contiguous forests that are protected by the programs of state and private natural area managers. According to DOFAW records, at least eight of the native natural communities found in Pu`u Kukui WMA, including `Ohi`a Mixed Montane Bog, are also found in the West Maui NAR. Of the 30 rare plants found in Pu`u Kukui, 16 are known from the West Maui NAR. Four species of land snails listed in Appendix 3 are also found in the West Maui NAR.

Sensitive Habitats

The sensitive habitats and resources listed above and in the appendices are found both within and adjacent to the Pu`u Kukui WMA. The intent of all proposed management activities is to provide long term resource protection to these habitats. Negative effects such as introduction of new weeds along newly constructed fences or monitoring transects are recognized and standardized precautions will be taken to minimize the risks. Management activities that affect adjacent sensitive habitats in State Natural Area Reserves or The Nature Conservancy of Hawai`i preserves will be coordinated with appropriate staff from these organizations to reduce any potential negative impacts.

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General description of the action's technical, socioeconomic and environmental characteristics

Technical

Management Considerations

The management goal for Pu`u Kukui WMA is to maintain the native ecosystems as intact watershed, and protect the habitat of rare plants and animals. This project is a long term one consisting of several different phases. Maui Pineapple Company, Ltd. will be responsible for the completion of the management work. This section describes specific management strategies that will be undertaken to maintain and enhance the PKWMA. These strategies are shaped by the following considerations.

1. The Pu`u Kukui WMA encompasses a very large area, much of which is remote and extremely rugged. Management units have been defined by biological and topographical features (Figure 4). Priorities for management have been determined for each unit according to the proximity of the unit to stream drainages that feed MPC's water intakes, the extent of current disturbance, the urgency of other biological threats within and near the unit, and the feasibility of management.
2. Feral ungulates are the primary threat to the watershed, and limiting pig damage is the top management priority. Prior to active management efforts, moderate to heavy damage by pigs had occurred throughout most of the watershed. Pig rooting on the forest floor destroys plants, promotes erosion and weed invasion, threatens the stability of the watershed and introduces silt and disease to West Maui's water supply. Most weeds cannot establish themselves in undisturbed ground, but will readily grow in soil turned by pigs. Standing water collects in pig wallows and encourages the breeding of mosquitoes, which transmit bird diseases that may be responsible for the low numbers of native birds on West Maui.
3. Many non-native plants observed in the watershed are shade intolerant and pose no major problem if pigs are removed and the native forest canopy and ground cover remain intact. There are several non-native weed species, however, which form monotypic stands and displace native vegetation over large areas. These habitat modifying weeds are "priority weeds" for management. Weed control activities will focus on these priority weeds throughout the watershed, with special attention to removing incipient "satellite" (outlying) weed patches to prevent their spread.
4. Access to the entire watershed area is restricted by MPC. This policy is intended to minimize trampling of fragile areas, prevent the spread of weeds by hikers, and protect public safety. Volunteers or other visitors will be accompanied by appropriate staff and restricted to designated areas and trails in the watershed. Human traffic in pristine areas, especially the upper elevation bogs, will be kept to the minimum required for watershed protection.
5. Management activities in the watershed that affect adjacent NARS will be coordinated with state Natural Area Reserves staff. Staff of The Nature Conservancy will assist the Watershed Manager with planning and technical advice as requested. These partnerships will maximize the cost effectiveness of management efforts at the Pu`u Kukui WMA, and provide a larger pool of management expertise to draw from.

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Management Unit Descriptions

The Pu`u Kukui Watershed Management Area has been divided into 10 management units defined by topographical and biological features (Figure 1). Highest management priority will go to the fragile bog areas and upper reaches of units 6, 7, 8, 9, all of unit 10, other designated Special Ecological Areas (SEA) and drainages mauka of MPC's Honolua Ditch system intakes. Descriptions of the units' resources, and threats to these resources, follow.

Unit 1: HONOKOHAU

The Honokohau unit covers approximately 1,250 acres and ranges from 480 feet in the stream bed of Honokohau Valley up to the 4,400 foot rim of Mauna `Eke. This unit shares its east boundary with the state's Kahakuloa section of West Maui Natural Area Reserve. Four strategic fences have been built by DOFAW and PKW staff across narrow ridges and stream corridors to prevent pigs from moving between the areas, and up to the pristine, flat-topped summit of Mauna `Eke. *Tibouchina herbacea* and *Clidemia hirta* (Koster's curse) are the two most invasive weed species in this unit, and are concentrated along the `Eke Trail. Although not yet recorded in the PKWMA proper, Andean Pampas grass (*Cortaderia jubata*), is known from the Kahakuloa section of the West Maui NAR immediately adjacent to unit 1 and is considered a serious threat to native ecosystems due to its invasive reputation in California and New Zealand. Native plant communities range from montane wet shrublands along the steep upper valley walls to lowland mesic forest at the lowest elevation.

Unit 2: KALUANUI

The Kaluanui unit's 1,000 acres range between 1,040 and 2,920 feet elevation, and collect rainfall destined for the Honokohau Ditch system's #1 and #2 intakes, respectively located in Honokohau Stream and Kaluanui Stream (the northwest drainage of Honokohau Stream). Formerly heavy pig damage has been reduced through pig control efforts in the past few years, however; continued pig control is needed to remove pigs that come up from lower elevations through the gulches. *Tibouchina herbacea* and *Clidemia hirta* are prevalent weeds. Natural communities include wet and mesic plant community types.

Unit 3: HONOLUA

The Honolua unit encompasses 1,100 acres stretching from 1,040 to 2,800 feet elevation between Kaluanui (the northwest drainage of Honokohau Stream) and Honolua streams. These streams transport rainwater to the Honokohau Ditch system's #2 and #3 intakes, respectively. The two landmark peaks of unit 3 are Keahikauo (labeled as Keahikano @ 2,013 feet elevation on USGS Lahaina Quad.) and the prominent ridge line of Honolua (2,627 feet elevation). Moderate to high levels of pig damage exist in this unit. *Tibouchina herbacea*, *Clidemia hirta*, and *Andropogon virginicus* (broomsedge) are the principal weed species. Natural communities include a range of wet and mesic community types.

Unit 4: KEKA`ALA`AU

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The 800-acre Keka`ala`au unit ranges from 1,040 feet elevation at Honolua stream to the 3,000 foot contour between Honolua and Honokahua streams. Prominent landmarks include Pu`u Kaeo (1,683 feet elevation), and Keka`ala`au (2,358 feet elevation). Pig damage in this unit has been reduced by construction of two strategic fences and removal of pigs. *Tibouchina herbacea*, *Cinnamomum burmannii*, *Ardisia elliptica* are major weed species, with a few occurrences of *Rubus argutus* (Prickly Florida blackberry). Natural communities contain a variety of lowland mesic and wet forests, including remnant Koa mesic forest. This unit also contains two designated *Special Ecological Areas*: the *Ctenitis squamigera* (pauoa) SEA; a USFWS Endangered species, and the Keka`ala`au summit SEA; comprised of such rare taxa as *Joinvillea ascendens* ssp. *ascendens*, *Gardenia remyi*, and six tree snail species.

Unit 5: PU`U MAKANI (labeled as Pu`u Makina on USGS Napili Quad.)

One of the smallest units of the watershed, the Pu`u Makani unit covers about 400 acres from 1,440 feet elevation to the 3,000 foot contour between Honokahua and Kahana streams. Relatively little pig damage has occurred in this narrow unit, and two strategic fences have been built across narrow ridges to prevent pigs from moving up into the watershed from lower elevations. A non-native coniferous plantation (circa 1920) dominates around Pu`u Makani (1,970 feet elevation). Wet shrubland emerges at the 2,080 foot contour and grades into `ohi`a and `uluhe dominated wet forest at higher elevations along the ridge.

Unit 6: KAULALEWALEWA (labeled as Kaulalewelewe on USGS Lahaina Quad.)

The only unit with direct 4-wheel drive access, the Kaulalewalewa unit also marks the location of MPC's Haela`au Cabin on Kaulalewalewa peak (2,980 feet elevation), and the Pu`u Kukui trail head. Ranging from 1,440 feet to 3,650 feet elevation between Kahana Stream and the Pu`u Kukui Trail, this unit encompasses 650 acres and borders state lands and the Honokowai section of West Maui NAR on the southwest. Pig damage in this unit has been nonexistent for the past three years, due to pig control activities over the past ten years. *Rubus argutus*, *R. discolor* (blackberry), and *Tibouchina herbacea* are the priority weeds; with blackberry infestation the highest of any unit due to its original introduction at Haela`au Cabin. The range of blackberry along the trail has been reduced over the past ten years of management, and this control will continue. Natural communities include a wide variety of plant community types. This unit also hosts the *Newcombia cumingi* SEA; designated to protect the only known population of a rare native tree snail species rediscovered by PKW staff in 1994.

Unit 7: PU`U 3,540'

At 400 acres, the Pu`u 3,540' unit crosses between Kahana and Honolua streams, stretching from 3,000 - 4,000 feet in elevation. The unit centers around an unnamed hill at 3,540 feet elevation; some upper sections of forest are in nearly pristine condition. Pig damage in this unit has been reduced to zero for the past six years through intensive snaring and two strategic fences constructed between units 4, 5, and 7. *Tibouchina herbacea* and *Rubus argutus* are the prevalent weeds. Natural communities consist of montane wet forests and shrublands.

Unit 8: HONOLUA MAUKA

The Honolua Mauka unit consists of 500 acres of `Ohi`a/mixed shrub and `Ohi`a/`Olapa montane wet forests

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extending from the 2,800 foot contour between Honolua Stream and the northwest tributary of Honokohau Stream up to the 4,000 foot contour. This unit also includes a rare, remnant 'Ohi`a Mixed Montane, Bog community on an exposed ridge at 3,600 feet. Formerly heavy pig damage occurred through most of the unit, but pig control programs continue due to a limited incursion of fresh pig sign in 1997. *Tibouchina herbacea* is the most prevalent weed in this unit. A few blackberry plants are scattered between 2,800 feet and 3,400 feet elevation. The unit's upper section is as pristine as the upper elevations of unit 7.

Unit 9: NAKALALUA

Nakalalua unit covers about 800 near-vertical acres of upper Honokohau Valley wall from the 1,000 foot elevation at Honokohau Stream to the 4,503 foot twin peaks of Nakalalua. Consisting mostly of montane wet forest and shrubland communities, the formerly heavy pig damage has been reduced to zero except for intermittent activity restricted to the Honokohau Stream corridor. *Tibouchina herbacea* and *Clidemia hirta* are the priority weed invasions. Two strategic fences have been built across the Pu`u Kukui trail to prevent pigs from moving upslope. The Honokowai section of West Maui NAR neighbors this unit to the southwest. The 2.5 kilometer Pu`u Kukui Boardwalk, which is currently being extended the last 1000 meters to the summit, begins at the raingauge situated along the Pu`u Kukui trail at the base of the upper peak.

Unit 10: PU`U KUKUI

Perhaps due to its spectacularly rugged topography, severe weather and isolation, the 1,100 acre Pu`u Kukui unit has experienced the least pig damage in the watershed. However, a few pigs have historically reached the 5,788 foot summit of Pu`u Kukui and the threat of invasion into the unit along the summit approaches from adjacent properties continues to exist. Pigs that have made their way above and around Mauna `Eke to the narrow ridge between Honokohau and Waihe`e valleys have been removed. The unit ranges in elevation from 720 feet at Honokohau Stream to the Pu`u Kukui summit and borders the Honokowai section of the NAR on the west and the Kahakuloa section of the West Maui NAR at Mauna `Eke. It supports rare Montane Bog communities as well as a number of rare plants found only on West Maui. The 2.5 kilometer Pu`u Kukui Boardwalk is currently being extended the last 1000 meters through the bogs to the 5,788 foot summit and has already been shown to protect the fragile bog habitat by reducing the impacts of both PKWMA staff, visiting researchers, and a limited number of eco-tourists traveling through the bogs.

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Management Goals & Programs

The long-range goal for each management program is listed below, followed by a brief description of the program strategies and how they will change over the six-year period covered in this plan. The goals and objectives are presented roughly in order of priority, but they fit together to form an integrated management strategy.

The management emphasis for the Pu`u Kukui WMA in Year 1 will be the continued reduction of pig activity that has been underway in the past ten years. Monitoring for pig activity and weed distribution will be maintained via utilization of the four existing transects. Four areas for strategic fences have been identified as needed to restrict pig movement within the PKWMA, and an average of one fence will be built each year over the next six years. Weed control in Year 1 will continue to focus on five of the top ten priority weeds; including *Clidemia hirta* and *Rubus argutus* (blackberry). Because the wide extent of *Tibouchina herbacea* infestation in the PKWMA, manual & chemical control of that species will be limited to select areas; such as the Pu`u Kukui trail, to keep from further vectoring of seeds along high traffic zones. Existing priorities to map and control other priority weeds will be reevaluated in Year 1 and mapping undertaken as necessary; control of these other weeds will begin as resources permit. Monitoring techniques for specific resources within the PKWMA (other than the transects used to gauge effectiveness of ungulate and weed control programs) will be identified according to the guidelines developed via the University of Hawai`i's Secretariat for Conservation Biology's (SCB) Natural Resources Monitoring Working Group (NRMWG) and implemented when they become available. Programs for the protection of specific rare species will be developed and implemented as soon as the threats from ungulates are reduced to maintenance levels.

Non-native Species Control Program

Ungulate Control

GOAL: Eliminate ungulate activity in all Pu`u Kukui WMA management units.

MPC has established a program to prevent pig access to pristine regions and reduce pig numbers in all watershed units to zero. Progress towards this goal will be determined by the following methods:

1. Field observations of PKWMA staff
2. Alien Threat Monitoring Transect data
3. Forward Looking Infra-Red (FLIR) reconnaissance, and
4. Permit Hunting Program Capture data

Since 1988, 19 strategically located fences have been built to block or redirect pig movements, and snares set to remove pigs from the watershed. Feral goats, *Axis* deer and cattle have been reported adjacent to the area in past years, but are not currently a problem. However, if these animals are detected in the watershed, immediate efforts will be made to remove them.

Approximately 750 snares are currently maintained throughout the watershed area. Additional snares will be

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set where new pig activity is detected, and snares will be maintained on a quarterly basis throughout the watershed until data from monitoring programs indicate zero pig activity for at least three years. MPC employees and a limited number of others are given permits to hunt on company lands below the PKWMA boundary. Permit hunting helps reduce the pig population below the PKWMA and keeps population pressures low enough to keep pigs from moving up into the PKWMA from the lower elevations in search of additional food supplies, etc. The PKWMA supervisor will maintain contact with local hunting clubs and remind them of the opportunities for their members to hunt for feral pigs on company lands below the PKWMA.

The current monitoring system of four transects will be maintained to continue gathering information on ungulate damage throughout a larger area of the watershed. All transects will be monitored annually to determine preserve-wide levels of pig activity, and to identify areas where increased management is needed. Field notes from quarterly snare group maintenance checks will also be utilized to adjust snare numbers accordingly in response to changing levels of pig activity. Aerial ungulate population surveys will be conducted on a quarterly basis with a helicopter equipped with a FLIR camera. The FLIR is heat sensitive, and can detect the warmth of an animal's body in low-growing or open vegetation, which can help identify areas that need management attention. Locations for four additional strategic fencing projects have been identified, and these fences will be built at a rate of about one per year over the next six years.

Ungulate Control Timeline

Year 1

Maintain existing 750 snares; replace snares as needed due to breakage, etc., and add or remove snares as necessary on a quarterly basis by management unit.
Inspect and maintain 19 strategic fences.
Monitor ungulate damage along 4 existing transects at least once a year.
Conduct 1 FLIR over-flight per quarter.
Continue permit hunting program below PKWMA boundary.
Begin strategic Fence Project 1 near the lower watershed boundary in management unit 3.

Year 2

Maintain existing 750 snares; replace snares as needed due to breakage, etc., and add or remove snares as necessary on a quarterly basis by management unit.
Inspect and maintain 20 strategic fences.
Monitor ungulate damage along 4 existing transects at least once a year.
Conduct 1 FLIR over-flight per quarter.
Continue permit hunting program below PKWMA boundary.
Complete strategic Fence Project 1 near the lower watershed boundary in management unit 3.

Years 3/4

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Add snares in any unit with fresh pig sign.
Replace other snares in remaining snare groups as needed on a quarterly basis by management unit.
Inspect and maintain 20 strategic fences.
Monitor ungulate damage along 4 existing transects at least once a year.
Continue permit hunting program below PKWMA boundary.
Conduct 1 FLIR over-flight per quarter.

Y3: Begin Fence Project 2: Install 4 strategic fences in the Kaluanui fingers area of unit 2.

1. Kaluanui Ridge @ 2380' asl (below *Cyanea asplenifolia*)
2. Kaulanakola Ridge @ 2440' asl
3. East Ridge @ 2200' asl (Main spur & Cabin Falls spur)

Y4: Begin Fence Project 3: Install Honokohau-Poelua fence along unit 1 boundary with Kahakuloa NAR and GMA.

Years 5/6

Add snares in any unit with fresh pig sign.
Inspect and maintain 25 strategic fences.
Monitor ungulate damage along 4 existing transects at least once a year.
Continue permit hunting program below PKWMA boundary.
Conduct 1 FLIR over-flight per quarter.

Y5: Add 1 strategic fence across Honokohau Valley flood plain across boundary of units 1 & 9.

Y6: Add 2 strategic fences in `Eke Mauka area of unit 10 as needed (possible WMMWP project).

Weed Control

GOAL: Reduce the range of habitat-modifying weeds and prevent introduction of non-native plants.

Progress towards this goal will be met by concentrating weed control efforts in the following areas:

1. Satellite populations of priority weed species.
2. Immediate threats to Rare taxa or SEA.
3. Incipient populations of new invasive species.
4. *Tibouchina herbacea*, *Rubus argutus* along lower Pu`u Kukui trail.
5. Monitoring of invasive species populations adjacent to PKWMA.
6. Available biological control agent releases for *Clidemia hirta*, etc.

Reducing disturbances to intact native vegetation will be one of the most effective methods to prevent weeds from becoming established. However, there are weeds established in the preserve that require control. The weed control strategy for the Pu`u Kukui WMA will concentrate on controlling "satellite" populations of priority weeds and preventing further expansion of weeds into pristine areas. Incipient weed populations will be targeted for expedited eradication. Treatment of large, well established weed populations is generally not practical or cost-efficient, and

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these weeds are controlled only enough to prevent their further spread until existing and future biological control agents can be developed and made available. Weed control efforts will require an integrated program of applying known control methods, monitoring effectiveness, and refining control methods.

The 4 monitoring transects used to measure ungulate damage are also used to note all weed presence and densities using a modified Braun-Blanquet scale. Maps showing ranges of priority weeds can be used to track the location of known populations, and to determine if the weeds are expanding their range. Existing range maps include; *Ardisia elliptica*, *Cinnamomum burmannii*, *Clidemia hirta*, *Myrica cerifera*, *Rubus argutus*, *R. discolor*, *Tibouchina herbacea*. Existing maps and additional maps of priority weed species will be updated on an annual basis as deemed necessary.

Pu`u Kukui WMA staff and volunteers have already treated approximately 2-3 acres of blackberry along the Pu`u Kukui Trail, and pulled several thousand *Clidemia* plants in units 1 and 3. All blackberry along the Pu`u Kukui trail will be treated annually, until the blackberry no longer resprouts. All newly discovered incipient populations of blackberry will be removed as soon as possible.

The use of chemical control methods will be minimized and only herbicides approved for use in watersheds will be used. All staff will undergo required pesticide application training to maintain their existing Hawai`i Department Of Agriculture (HDOA) Commercial Pesticide Applicator licenses. Weed control is labor-intensive and benefits from technologically sophisticated techniques, and will require technical support from the University of Hawaii Cooperative Extension Service, the National Park Service, and other researchers. The development of biological control methods for priority weeds by programs underway in the U. S. Forest Service, National Park Service and at the HDOA will be encouraged by making study sites available as requested.

The PKWMA supervisor has served as chairman of the Tri-Isle Resource, Conservation and Development Council's (Tri-Isle RC&D) Melastome Action Committee since its inception in 1991 and as the chairman of the Tri-Isle RC&D's Maui Invasive Species Committee since its creation in December, 1997. These committees' goal is to identify solutions to reduce the invasions and extent of Melastomes and other invasive pest species in forested and watershed areas throughout the state through long-term biological control, and short-term manual and chemical control.

MPC will continue its ongoing policy of field equipment & gear sanitization to prevent the introduction and spread of new and/or established weeds in the PKWMA. Those who enter the watershed area will be required to clean their clothing, boots, equipment and camping gear of soil and plant material to prevent weed introduction. Wherever possible, helicopter flights into the watershed will originate from weed free areas such as wooden platforms or pavement, and all materials hauled into the watershed will be inspected and cleaned to remove soil, plant material, and insects. Helicopter landing sites and areas frequented by staff will be inspected for weeds each trip.

A 2.5 kilometer boardwalk has been built over severely damaged sections of the Pu`u Kukui trail to reduce the spread of weeds in the pristine bog areas of unit 10. Much of the higher elevation trail crosses boggy areas with very fragile ground cover. In some areas hikers had created 20 foot wide paths to avoid sinking in the deep mud. Delicate native ground-cover was being destroyed and weeds were spreading along the disturbed trail corridor. The boardwalk will be extended another 1000 meters to prevent further damage in the bog and inter-bog areas from Nakalalua to the Pu`u

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Kukui summit.

Although the extent of *Tibouchina herbacea*' infiltration of the Pu`u Kukui WMA has rendered manual and chemical controls ineffective, the PKWMA staff will continue to treat satellite populations that are found in the SEAs, immediately surrounding rare taxa, and along the lower Pu`u Kukui trail. Additionally, the PKWMA supervisor will continue participation in MISC/MAC in hopes of the eventual discovery and development of an effective biological control agent(s) for *Tibouchina herbacea* and other invasive plant pests.

Weed Control Timeline

Year 1

Continue participation in Tri-Isle RC&D MISC/MAC to promote biological control solutions to widespread *Tibouchina herbacea* and other eradication strategies for other priority invasive species in the PKWMA.
Continue implementing biological control agents targeting *Clidemia hirta*.
Continue satellite population control of priority weed species.
Continue control of weeds threatening rare taxa or SEAs.
Continue eradication of incipient populations of invasive weeds in and immediately adjacent to PKWMA on ML&P lands and with approval from adjacent landowners.
Continue control of priority weed species along Pu`u Kukui trail corridor.
Continue monitoring weed presence & densities along 4 existing transects (see ungulate control section).
Update lists & range maps of prevalent and priority weeds annually.

Year 2

Continue participation in Tri-Isle RC&D MISC/MAC to promote biological control solutions to widespread *Tibouchina herbacea* and other eradication strategies for other priority invasive species in the PKWMA.
Continue implementing biological control agents targeting *Clidemia hirta*.
Continue satellite population control of priority weed species.
Continue control of weeds threatening rare taxa or SEAs.
Continue eradication of incipient populations of invasive weeds in and immediately adjacent to PKWMA on ML&P lands and with approval from adjacent landowners.
Continue control of priority weed species along Pu`u Kukui trail corridor.
Continue monitoring weed presence & densities along 4 existing transects (see ungulate control section).
Update lists & range maps of prevalent and priority weeds annually.

Years 3 / 4

Continue participation in Tri-Isle RC&D MISC/MAC to promote biological control solutions to widespread *Tibouchina herbacea* and other eradication strategies for other priority invasive species in the PKWMA.
Continue implementing biological control agents targeting *Clidemia hirta*.
Continue satellite population control of priority weed species.
Continue control of weeds threatening rare taxa or SEAs.
Continue eradication of incipient populations of invasive weeds in and immediately adjacent to PKWMA on

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ML&P lands and with approval from adjacent landowners.
Continue control of priority weed species along Pu`u Kukui trail corridor.
Continue monitoring weed presence & densities along 4 existing transects (see ungulate control section).
Update lists & range maps of prevalent and priority weeds annually.

Years 5 / 6

Continue participation in Tri-Isle RC&D MISC/MAC to promote biological control solutions to widespread *Tibouchina herbacea* and other eradication strategies for other priority invasive species in the PKWMA.
Continue implementing biological control agents targeting *Clidemia hirta*.
Continue satellite population control of priority weed species.
Continue control of weeds threatening rare taxa or SEAs.
Continue eradication of incipient populations of invasive weeds in and immediately adjacent to PKWMA on ML&P lands and with approval from adjacent landowners.
Continue control of priority weed species along Pu`u Kukui trail corridor.
Continue monitoring weed presence & densities along 4 existing transects (see ungulate control section).
Update lists & range maps of prevalent and priority weeds annually.

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TABLES 1 & 2*¹

TABLE 1: PREVALENT HABITAT-MODIFYING WEED SPECIES OF THE PU`U KUKUI WMA & ADJACENT AREAS

TABLE 2: *PKWMA PRIORITY WEED CONTROL SPECIES (in boldface)

1.	<i>Tibouchina*</i> <i>Tibouchina herbacea</i>
2.	<i>Clidemia (Koster's curse)*</i> <i>Clidemia hirta</i>
3.	Prickly Florida blackberry* <i>Rubus</i>
	<i>argutus</i>
4.	Broomsedge* <i>Andropogon virginicus</i>
5.	Hilo grass* <i>Paspalum conjugatum</i>
6.	Formosan koa* <i>Acacia confusa</i> (outside
	PKWMA)
7.	Tasmanian blackwood <i>Acacia melanoxylon</i>
	(outside PKWMA)
8.	Maui pamakani <i>Ageratina adenophora</i>
9.	Kukui <i>Aleurites moluccana</i>
10.	Sweet vernal grass* <i>Anthoxanthum odoratum</i>
11.	Shoebuttan <i>Ardisia*</i> <i>Ardisia elliptica</i>
12.	<i>Blechnum fern</i> <i>Blechnum occidentale</i>
13.	Butterfly bush <i>Buddleia asiatica</i>
14.	Padang cassia* <i>Cinnamomum burmannii</i>
15.	Andean pampas grass* <i>Cortaderia jubata</i>
	(outside PKWMA)
16.	<i>Tropical ash*</i> <i>Fraxinus uhdei</i> (outside PKWMA)
17.	Velvet grass* <i>Holcus lanatus</i>
18.	Moonflower <i>Ipomoea alba</i>
19.	Bog rush* <i>Juncus effusus, J. planifolius</i>
20.	Molasses grass* <i>Melinis minutiflora</i>
21.	Wax myrtle* <i>Myrica cerifera</i> (outside PKWMA)
22.	Vasey grass* <i>Paspalum urvillei</i>
23.	Waiawi, Strawberry guava* <i>Psidium</i>
	<i>cattleianum</i>

¹ List order beyond #5 does not reflect order of priorities.

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24.	Guava	<i>Psidium guajava</i>
25.	Himalayan blackberry*	<i>Rubus discolor</i>
26.	Thimbleberry	<i>Rubus rosifolius</i>
27.	Glenwood grass	<i>Sacciolepis indica</i>
28.	Brazilian pepper	<i>Schinus terebinthifolius</i>
29.	African tulip*	<i>Spathodea campanulata</i>

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Invertebrate and Small Mammal Control

GOAL: To reduce negative impacts of non-native invertebrates and small mammals.

Non-native insects, mollusks and small mammals (rats, mongooses, feral cats, etc.) are poorly understood but widely acknowledged threats to native species and ecosystem stability. Ants, yellow jackets and snails like *Euglandina rosea* (Rosy wolf snail) have displaced native invertebrate fauna at lower elevations. Rats and mongooses are major predators of both flora and fauna. Over the next six years at Pu`u Kukui WMA, incidental sign of small mammals and non-native invertebrates will be noted, and traps will be set where mammal sign is seen. In Year 3, the incidental sign data gathered will be evaluated and the need for a more comprehensive control program determined. Also in Year 3, the Pu`u Kukui WMA supervisor will confer with other natural area managers and the SCB's Natural Resources Monitoring Working Group (NRMWG) to determine best invertebrate monitoring and/or control methods in the watershed.

Small mammal control will continue in Year 1 by setting traps around camp sites for rats and mongoose during each visit. Material attractive to these pests will be securely stored or removed. Incidental sign of small mammals will continue to be noted as part of the daily field observations of PKWMA staff.

Invertebrate and Small Mammal Control Timeline

Year 1

Continue to set rat and mongoose traps around camp sites and observe for small mammal sign.
Continue to set traps in SEAs to protect rare native species.
Continue to bait Diphacinone rodenticide bait stations at selected intervals along the Pu`u Kukui trail.
Continue to bait Diphacinone rodenticide bait stations in the *Newcombia* SEA.
Note daily field observations of small mammal sign and non-native invertebrate presence.

Year 2

Set rat and mongoose traps around camp sites and observe for small mammal sign.
Set traps in SEAs and around rare taxa to protect rare native species.
Continue to bait Diphacinone rodenticide bait stations at selected intervals along the Pu`u Kukui trail.
Continue to bait Diphacinone rodenticide bait stations in the *Newcombia* SEA.
Note daily field observations of small mammal sign and non-native invertebrate presence.

Years 3/4

Set rat and mongoose traps around camp sites and observe for small mammal sign.
Set traps in SEAs and around rare taxa to protect rare native species.
Continue to bait Diphacinone rodenticide bait stations at selected intervals along the Pu`u Kukui trail.
Continue to bait Diphacinone rodenticide bait stations in the *Newcombia* SEA.
Note daily field observations of small mammal sign and non-native invertebrate presence.
Evaluate small mammal and invertebrate observations gathered, and determine need for more comprehensive

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control and/or monitoring plan.

Confer with other natural area managers and the SCB's NRMWG to determine best invertebrate monitoring and/or control methods in the watershed as needed.

Begin trapping and/or Diphacinone rodenticide baiting in Keka`ala`au summit SEA in unit 4 per evaluation of program.

Years 5 / 6

Maintain trapping and monitoring program.

Evaluate data at 3-year cycles and adjust control program to most efficiently reduce impacts on native species.

Continue invertebrate program as implemented in Year 4.

Monitoring and Research

GOAL: To track biological and physical resources in the watershed and evaluate changes in these resources over time; to identify new threats to the watershed; to provide logistical support to approved research projects that will improve management understanding of the watershed's resources.

Scientific monitoring is needed to measure the effectiveness of management programs, and the condition of natural resources within the watershed. The monitoring transects mentioned in the non-native species control sections evaluate those programs as well as 17 long-range monitoring vegetation plots and over a dozen photo-point monitoring stations established over the past 10 years. Additional monitoring which may be needed to track the major resources and threats to these resources within the watershed will be implemented per the recommendations of the SCB's Natural Resources Monitoring Working Group. The PKWMA staff has also participated in joint USFWS/DOFAW forest bird census training exercises as well as actual monitoring of forest bird resources on Mauna Kahalawai (W. Maui) as secondary observers. The PKWMA staff will also continue data collection and maintenance of its Hawai'i Monitoring Database (HIMONDB) developed by Philip Thomas of the Hawai'i Ecosystems At Risk (HEAR) project and other in-house biological inventory databases.

Scientific research in Pu`u Kukui WMA will be allowed on a permit basis only. The PKWMA supervisor will evaluate all research proposals for potential direct and indirect impacts on the watershed and its resources. Proposed projects will also be evaluated based on the pertinence of the research. Only those projects deemed safe to the resources and of high priority will be allowed. Projects that have been identified as priorities for managers by the Hawaii Conservation Biology Initiative, a research coordinating entity at the University of Hawaii, will be given first preference over others.

Monitoring and Research Timeline

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Year 1

Continue providing logistical support, on a noninterference basis, for approved research projects in the watershed.

Continue updating photo-monitoring point stations as schedule allows.

Conduct at least one remote survey trip annually to identify & inventory native resources and threats to same.

Maintain three meteorological weather stations at Pu`u Kukui, Nakalalua and Kaulalewalewa.

Contract Global Position System (GPS) equipment and Geographic Information System (GIS) consultants and use to improve mapping and relocation abilities for all program activities.

Participate in USFWS forest bird census training to improve bird identification and monitoring capacity for native and non-native birds as available/needed.

Year 2

Continue providing logistical support, on a noninterference basis, for approved research projects.

Continue updating photo-monitoring point stations as schedule allows.

Conduct at least one remote survey trip annually to identify & inventory native resources and threats.

Maintain three meteorological weather stations at Pu`u Kukui, Nakalalua and Kaulalewalewa.

Contract Global Position System (GPS) equipment and Geographic Information System (GIS) consultants and use to improve mapping and relocation abilities for all program activities.

Participate in USFWS forest bird census training to improve bird identification and monitoring capacity for native and non-native birds as available/needed.

Years 3 / 4

Continue providing logistical support, on a noninterference basis, for approved research projects.

Continue updating photo-monitoring point stations as schedule allows.

Conduct at least one remote survey trip annually to identify & inventory native resources and threats.

Maintain three meteorological weather stations at Pu`u Kukui, Nakalalua and Kaulalewalewa.

Contract Global Position System (GPS) equipment and Geographic Information System (GIS) consultants and use to improve mapping and relocation abilities for all program activities.

Participate in USFWS forest bird census training to improve bird identification and monitoring capacity for native and non-native birds as available/needed.

Years 5 / 6

Continue providing logistical support, on a noninterference basis, for approved research projects.

Continue updating photo-monitoring point stations as schedule allows.

Conduct at least one remote survey trip annually to identify & inventory native resources and threats.

Maintain three meteorological weather stations at Pu`u Kukui, Nakalalua and Kaulalewalewa.

Participate in USFWS forest bird census training to improve bird identification and monitoring capacity for native and non-native birds as available/needed.

Rare Species Protection

GOAL: To prevent the extinction of rare species in the watershed.

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Protection of the watershed's natural communities is essential to protecting the rare native species that depend on these ecosystems for survival. In addition, more rare species may be discovered in new areas of the watershed with further exploration. However, particularly rare plants and animals may need more immediate attention and direct management than current habitat protection measures and programs provide.

The goal of this program is to identify the rarest species and threats to them, and implement management to prevent their loss. Surveys of flora and fauna will be conducted in-house by PKWMA staff and visiting biologists at substantial savings over contracted consultants, however; the PKWMA supervisor will not hesitate to hire appropriate expert consultants as needed to assist the PKWMA staff in protecting rare taxa from the threat of extinction. Programs such as *in situ* exclosure fences, *ex situ* propagation and restoration of rare taxa will be implemented as determined necessary or as opportunities arise to enhance the viability of rare species.

Rare Species Protection Timeline

Year 1

Continue maintenance of *Ctenitis squamigera* SEA.
Continue maintenance of *Newcombia cumingi* SEA.
Continue *Pritchardia forbesiana* propagation and restoration project with USDA-NRCS Wildlife Habitat Incentive Program (WHIP) funds.
Continue collection & delivery of rare taxa propagules to appropriate facilities (Lyon Arb., NTBG)
Maintain information exchanges with leading conservation organizations regarding biological resources and threats on Maui.
Continue participation in SCB's NRMWG to determine, develop and implement a rare species monitoring program and in Center for Plant Conservation's Hawai'i Rare Plant Conservation Initiative.
Continue to survey for new plant & animal populations with in-house staff.

Year 2

Continue maintenance of *Ctenitis squamigera* SEA.
Continue maintenance of *Newcombia cumingi* SEA.
Continue *Pritchardia forbesiana* propagation and restoration project with USDA-NRCS Wildlife Habitat Incentive Program (WHIP) funds.
Continue collection & delivery of rare taxa propagules to appropriate facilities (Lyon Arboretum, NTBG)
Maintain information exchanges with leading conservation organizations regarding biological resources and threats on Maui.
Continue participation in SCB's NRMWG to determine, develop and implement a rare species monitoring program and in Center for Plant Conservation's Hawai'i Rare Plant Conservation Initiative.
Continue to survey for new plant & animal populations with in-house staff.

Years 3 / 4

Begin maintenance of Keka`ala`au summit SEA.
Continue maintenance of *Ctenitis squamigera* SEA.

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Continue maintenance of *Newcombia cumingi* SEA.
Continue collection & delivery of rare taxa propagules to appropriate facilities (Lyon Arb., NTBG)
Maintain information exchanges with leading conservation organizations regarding biological resources and threats on Maui.
Continue participation in SCB's NRMWG to determine, develop and implement a rare species monitoring program and in Center for Plant Conservation's Hawai'i Rare Plant Conservation Initiative.
Continue to survey for new plant & animal populations with in-house staff.
Evaluate possibilities for additional SEA designations.

Years 5 / 6

Continue maintenance of Keka`ala`au summit SEA.
Continue maintenance of *Ctenitis squamigera* SEA.
Continue maintenance of *Newcombia cumingi* SEA.
Continue collection & delivery of rare taxa propagules to appropriate facilities (Lyon Arboretum, NTBG)
Maintain information exchanges with leading conservation organizations regarding biological resources and threats on Maui.
Continue participation in SCB's NRMWG to determine, develop and implement a rare species monitoring program and in Center for Plant Conservation's Hawai'i Rare Plant Conservation Initiative.
Continue to survey for new plant & animal populations with in-house staff.
Evaluate possibilities for additional SEA designations.

Personnel, Equipment, and Facilities

GOAL: To provide adequate manpower and equipment to meet the goals and objectives of this plan.

The Pu`u Kukui WMA supervisor is responsible for the implementation of this plan. The volume of work outlined in this plan requires the PKWMA supervisor to be assisted by two full-time field technicians. Two full-time field technicians will help ensure that schedules can be met and longer trips can be made into the remote watershed areas, reducing helicopter time and creating more efficient working schedules. However, contract labor may provide more than one additional person at a time, for labor-intensive trips, such as; fence, boardwalk or platform/shelter construction and installations.

The current staffing level consists of one PKWMA supervisor and two full-time PKWMA Field Technicians. Planning and Technical Assistance funds budgeted will cover consultant fees for technical assistance such as monitoring techniques, and occasional *in situ* consultation with outside consultants.

PKWMA staff will attend regularly scheduled emergency training courses offered by MPC, DOFAW, National Park Service, and the American Red Cross. Staff will attend refresher emergency training courses on an annual basis or as required to maintain certifications.

Volunteers can help reduce management costs of labor-intensive tasks such as fence construction, weed

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control, and trail maintenance. However, working conditions in remote sections of the Pu`u Kukui WMA can be hazardous and adequate safety training and supervision for volunteers must be provided. Also, sufficient insurance coverage should be in place for all volunteers (additional insurance costs are not shown in the following volunteer costs). The Pu`u Kukui WMA supervisor will cultivate and schedule volunteers to assist with appropriate watershed projects. Volunteer group size will be limited to minimize impact on fragile trails or habitat, and volunteers will be escorted by MPC staff in order to support the policy of keeping the watershed closed to the general public.

Maui Pineapple Company's Honolua Plantation baseyard provides space for the Pu`u Kukui WMA supervisor, staff and equipment storage needs, and associated costs as "facilities". Other "facilities" in the PKWMA are needed to improve management efficiency. The Haela`au Cabin, located at the top of the only 4-wheel drive road to the watershed and at the base of the Pu`u Kukui trail, is used by PKWMA staff and volunteers for lower elevation work. Annual maintenance of the cabin is needed to keep this old building in usable condition. Five (4 - 20'x20', 1 - 12'x12') wooden helicopter landing platforms have been established under the previous NAP program contract to provide safe landing zones, to protect fragile vegetation from helicopter landings, and to prevent the establishment of additional weeds. Additional camp platforms/helicopter landing zones (LZ) may be installed as needed. Two LZ/skid-type platforms are needed along the Pu`u Kukui trail at 1st Bog and at the Pu`u Kukui summit to provide safer helicopter operations as well as reducing the impacts of such landings on the fragile bog vegetation. All construction in the Conservation District will comply with current state regulations and NAP program rules.

Currently, the PKW Department has two dedicated 4-wheel drive vehicles to provide access to the watershed's lower areas and helicopter pickup sites by PKW staff and supervisor. Two 4-wheel drive vehicles dedicated to watershed management are needed to ensure regular transportation to and from work sites.

Road and trail maintenance is needed to keep the main ground access routes to the watershed open; principally the 4-wheel drive to Haela`au Cabin, and the Pu`u Kukui Trail on the watershed's southwest boundary. Heavy winter rains cause erosion and washouts on the road, and periodic maintenance is needed to fill potholes and improve drainage to lessen erosion on the only vehicle access to the watershed. The existing 2.5 kilometer boardwalk over the muddy parts of the upper Pu`u Kukui trail is currently in the process of being extended up to the Pu`u Kukui summit of Mauna Kahalawai to prevent further damage to fragile bog vegetation and rare endemic species along the trail corridor. Impacts from these activities should affect only surface vegetation and will be temporary in duration. The boardwalk is currently expected to reach the summit by the end of the year 2000.

Socioeconomic

This project provides full-time employment for three MPC employees. Additionally, the bulk of project expenditures stay in the local economy. Also, the rain forests and bogs of Pu`u Kukui serve as a stable water source for West Maui residents and industries. Maui Land & Pineapple Company depends on the watershed for agricultural and resort use, and supplies water to the county water system and neighboring landowners. Native vegetation is an essential component of this watershed system. Forest cover protects fragile mountain soils from erosion, and acts like an immense sponge that absorbs heavy rains. Water is gradually released into streams and groundwater aquifers, rather than running off the surface in torrents to the sea. Subsequently, MPC's conservation efforts in the Pu`u Kukui WMA will also benefit both the recreational and natural resources of the Honolua - Mokulei`a Marine Life Conservation

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District.

Preservation of biodiversity has been recognized as a legitimate and necessary goal for society. This project provides multiple opportunities to protect and preserve examples of unique natural ecosystems and endemic species. When appropriate, volunteers will be utilized in various management projects thus providing educational and "recreational" opportunities for the general public.

Environmental

This project is expected to create positive impacts on the environment in the form of maintaining or enhancing water quality, maintaining or enhancing native ecosystem habitats, maintaining or enhancing biological diversity. The maintenance of natural "view planes" will enhance the aesthetics of the area. A short term increase in noise levels will occur when helicopters are used to transport staff and supplies to remote areas. Pilots will be instructed to follow flight paths that avoid overflight of residential areas.

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III. SUMMARY OF MAJOR IMPACTS

Major Impacts - Positive

Reduction of ungulate activity to a level that will promote and sustain measurable recovery of native vegetation in all Pu`u Kukui management units.

Reduction of the range of habitat-modifying weeds and prevention of introduction of new problem weeds.

Reduction of known threats by non-native invertebrates and small mammals.

Tracking of biological and physical resources in the watershed and evaluation of changes in these resources over time to identify new threats to the watershed.

Logistical support to approved research projects will improve management understanding of the watershed's resources.

Prevention of the extinction of rare species in the watershed.

Major Impacts - Negative

One potential impact is the accidental introduction or spread of new weed species by managers or visitors on equipment, supplies or transport vehicles; however, with care, no major negative impacts are expected to result from the proposed activities.

IV. ALTERNATIVES CONSIDERED

No alternatives were considered to the proposed activities. A no-action alternative would not provide any of the listed positive impacts and was not considered.

V. PROPOSED MITIGATION MEASURES

To prevent the accidental introduction or spread of weed species, anyone entering the watershed area will be required to clean their clothing, boots, equipment and camping gear of soil and plant material. Wherever possible, helicopter flights into the watershed will originate from weed-free areas such as wooden platforms or pavement, and all materials hauled into the watershed will be inspected and cleaned to remove soil, plant material, and insects. Helicopter landing sites and areas frequented by staff will be inspected for weeds each trip.

VI. DETERMINATION

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A negative declaration is anticipated for this project. No significant negative impacts to the environment are expected to result from the implementation of the proposed activities.

VII. FINDINGS, AND REASONS SUPPORTING DETERMINATION

Implementation of the proposed activities is expected to produce positive impacts on a number of rare species and native ecosystems found in the area. Control of ungulates and weed species will enhance the native ecosystems and protect the native biological diversity of the area. Through a careful and rigorous cleaning and monitoring program, the introduction or spread of new weed species is expected to be minimal. Impacts on historic resources is expected to be negligible, given the remote nature of the area with few, if any, historic resources to be expected and the nature of the proposed activities. Protection of the area will help ensure a stable water source for West Maui's agricultural, tourist and residential needs.

VIII. LIST OF PREPARERS

Randy Bartlett, Supervisor
Pu`u Kukui Watershed
Maui Pineapple Company, Ltd.
Honolua Division
4900 Honoapi`ilani Highway
Lahaina, Maui, Hawai`i 96761

The Pu`u Kukui WMA long range management plan was prepared by MPC's Pu`u Kukui Watershed department staff. The long range plan was submitted to the Natural Area Reserves System Commission for consideration as a Natural Area Partnership (NAP) project for fiscal years 2000 through 2005. This document incorporates many sections and figures from that plan (e.g. all maps, descriptions of resources and proposed activities) and is an updated version of an Environmental Assessment prepared in 1995 by Peter Schuyler, former NARS/NAP Program Manager of the DLNR/DOFAW. Please refer to the management plan for project budget details.

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APPENDIX 1

Natural Plant Communities of the Pu`u Kukui Watershed Management Area

As described by Wayne C. Gagne and Linda W. Cuddihy [Pratt] in the *Manual of the Flowering Plants of Hawai`i*, the floristic composition of the islands can be classified according to environmental situation and the dominance of particular components. *Principal community types* - presented here in boldface - are general groupings based on elevation, moisture and physiognomy regimes. Within the principal community types are found unique plant communities which are named according to their respective dominant components. Seventeen unique plant communities within eight principal community types are found within the lowland and montane regions of the PKWMA:

Lowland Mesic Shrubland

`Ohi`a (Metrosideros) Lowland Mesic Shrubland

Pukiawe/A`ali`i (Styphelia/Dodonaea) Lowland Mesic Shrubland

Lowland Mesic Forest

`Ohi`a (Metrosideros) Lowland Mesic Forest

Koa (Acacia) Lowland Mesic Forest

Lama`Ohi`a (Diospyros/Metrosideros) Lowland Mesic Forest

Kukui (Aleurites) Lowland Mesic Forest

Lowland Wet Shrubland

Mamaki (Pipturus) Wet Shrubland

Lowland Wet Forest

`Ohi`a/Uluhe (Metrosideros/Dicranopteris) Fern Forest

`Ohi`a (Metrosideros) Lowland Wet Forest

`Ohi`a/Olapa (Metrosideros/Cheirodendron) Lowland Wet Forest

Alien Dominated Wet Forest

Montane Wet Sedgelands

Carex Sedgeland

Montane Wet Mixed Communities

`Ohi`a (Metrosideros) Montane Wet Mixed Community

Subtype: `Ohi`a/Kuolohia/Oreobolus Mixed Bog

2

Warren L. Wagner, Derral R. Herbst & S. H. Sohmer, *Manual Of The Flowering Plants Of Hawai`i*, Volume 1, pp. 45-114, UH Press/Bishop Museum Press, 1990.

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Montane Wet Shrubland

Mixed Fern Shrubland

***'Ohi'a (Metrosideros)* Montane Wet Shrubland**

Montane Wet Forest

***'Ohi'a (Metrosideros)* Montane Wet Forest**

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APPENDIX 2
Rare Plants of the Pu`u Kukui Watershed Management Area

Plants listed as Endangered by the United States Fish & Wildlife Service:

Acaena exigua - Liliwai
Ctenitis squamigera - Pauoa
Cyanea lobata - Haha
Cyrtandra munroi - Ha`iwale
Hesperomannia arborescens
Pteris lidgatei
Sanicula purpurea - Snakeroot

Plants considered as Candidates for listing as Endangered by the U.S. Fish & Wildlife Service:

Cyanea asplenifolia - Haha
Cyrtandra filipes - Ha`iwale

Plants regarded as Species of Concern by the U.S. Fish & Wildlife Service:

Bidens conjuncta - Ko`oko`olau*³
Calamagrostis expansa - Reedgrass
Calamagrostis hillebrandii - Reedgrass
Cyanea kunthiana - Haha
Cyrtandra lydgatei - Ha`iwale
Eurya sandwicensis - Anini
Exocarpos gaudichaudii - Hulumoa
Gardenia remyi - Nanu
Geranium humile - Nohoanu*
*Hedyotis formosa**
Hibiscus kokio ssp. *kokio* - Koki`o ula
Hillebrandia sandwicensis - Pua maka nui
Joinvillea ascendens ssp. *ascendens* - `Ohe
Lagenifera maviensis - Howaiulu
Myrsine vaccinioides - Kolea*
Neraudia melastomifolia - Ma`aloa

³ * Indicates plants that are endemic to West Maui

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Phyllostegia stachyoides
Pritchardia forbesiana - Loulu*
Sicyos cucumerinis - Panunu kuahiwi
Strongylodon ruber - Nuku i`iwi
Wikstroemia bicornuta - `Akia

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APPENDIX 3

Rare Animals of the Pu`u Kukui Watershed Management Area

Mammals listed as Endangered by the United States Fish & Wildlife Service:

Lasiurus cinereus semotus - `Ope`ape`a / Hawaiian Hoary Bat

Birds listed as Endangered by the United States Fish & Wildlife Service:

Pterodroma phaeopygia sandwichensis - `Ua`u / Dark-Rumped Petrel

Birds regarded as Species of Concern by the United States Fish & Wildlife Service:

Asio flammeus sandwichensis - Pueo / Hawaiian Short-Eared Owl

Fish regarded as Species of Concern by the United States Fish & Wildlife Service:

Lentipes concolor - O`opu alamo`o

Damselflies considered as Candidates for listing as Endangered by the U.S. Fish & Wildlife Service:

Megalagrion pacificum

Damselflies regarded as Species of Concern by the United States Fish & Wildlife Service:

Megalagrion nigrohamatum

Hemipterid insects regarded as Species of Concern by the U.S. Fish & Wildlife Service:

Coleotichus blackburniae - Koa bug

Snails regarded as Species of Concern by the United States Fish & Wildlife Service:

Newcombia cumingi - Newcomb's Tree Snail

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Partulina perdix - Pupu kani oe / Maui Tree Snail
Partulina splendida - Pupu kani oe / Maui Tree Snail
Partulina tappaniana - Pupu kani oe / Maui Tree Snail
Perdicella kuhnsi
Philonesia spp.
Succinea spp. - Amber snail

JAMES "KIMO" APANA
Mayor

JOHN E. MIN
Director

CLAYTON I. YOSHIDA
Deputy Director



COUNTY OF MAUI
DEPARTMENT OF PLANNING

March 22, 1999

Mr. Randy Bartlett
Maui Pineapple Company, Ltd.
4900 Honoapiilani Highway
Lahaina, Hawaii 96761

Dear Mr. Bartlett:

RE: Draft Environmental Assessment (DEA) for the Puu Kukui
Watershed Management Plan

Thank you for the opportunity to review this document. The Maui Planning Department has no substantive comments at this time, but offer our continued support for this type of important work.

If you have any questions, please contact Mr. William Spence, Staff Planner, of this office at 243-7735.

Very truly yours,

A handwritten signature in cursive script, appearing to read "John E. Min".

JOHN E. MIN
Director of Planning

JEM:WRS:dsa

c: Clayton Yoshida, AICP, Deputy Director of Planning
William Spence, Staff Planner
General File
S:\ALL\WILL\AACORESP\BARTLETT.WPD



United States Department of the Interior

FISH AND WILDLIFE SERVICE
Pacific Islands Ecoregion
300 Ala Moana Boulevard, Room 3-122
Box 50088
Honolulu, Hawaii 96850

MAR 25 1999

In Reply Refer to: KAJ

Mr. Randy Bartlett
Maui Pineapple Company, Ltd.
4900 Honoapiilani Hwy.
Lahaina, HI 96761

Re: Draft Environmental Assessment for Management Plan for Puu Kukui Watershed
Management Program

Dear Mr. Bartlett:

Thank you for providing us the opportunity to review the Draft Environmental Assessment for the Puu Kukui Watershed Management Area Natural Area Partnership Program (DEA), received by us on February 22, 1999. The DEA addresses the management plan of this program for fiscal years 2000 through 2005. The lead agency for this Partnership Program is the Division of Forestry and Wildlife, Department of Land and Natural Resources State of Hawaii (DOFAW). The Service offers the following comments for your consideration.

The DEA adequately describes the proposed action and contains a complete list of the fish and wildlife resources in the action area. The removal of feral ungulates, control of other alien species, and the monitoring of changes in the watershed as a result of these actions will provide positive benefits to the fish and wildlife trust resources in the Puu Kukui Watershed.

Again, thank you for the opportunity to comment on this project. If you have questions regarding these comments, please contact Fish and Wildlife Biologist Karen (Kitti) Jensen at 808/ 541-3441.

Sincerely,

Karen Rosa
Acting Field Supervisor
Pacific Island Fish and Wildlife Office

BENJAMIN J. CAYETANO
GOVERNOR OF HAWAII



TIMOTHY E. JOHNS, CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES

DEPUTIES
JANET E. KAWILO

STATE OF HAWAII

DEPARTMENT OF LAND AND NATURAL RESOURCES

HISTORIC PRESERVATION DIVISION
Kekuhihewa Building, Room 555
901 Kamehameha Boulevard
Kapolei, Hawaii 98707

AQUATIC RESOURCES
BOATING AND OCEAN RECREATION
CONSERVATION AND RESOURCES
ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
HISTORIC PRESERVATION
LAND
STATE PARKS
WATER RESOURCE MANAGEMENT

March 18, 1999

Mr. Randy Bartlett, Supervisor
Pu'u Kukui Watershed
Honolulu Division
4900 Honoapi'ilani Highway
Lahaina, Hawaii 96761

LOG NO: 23109 ✓
DOC NO: 9903CD08

Dear Mr. Bartlett:

SUBJECT: Historic Preservation Review the Draft Environmental Assessment for Pu'u Kukui Watershed Management Area
Various Ahupua'a, Lahaina District, Island of Maui
TMK: 4-1-01:017; 4-1-04:023 (por); 4-1-05:010, 013, 016, 017; 4-2-01:001 (por);
4-3-01:001 (por) and 017 (por)

Thank you for the opportunity to comment on this project. Our review is based on reports, maps and aerial photographs maintained at the State Historic Preservation Office; no field inspection was made of the subject property.

An archaeological inventory survey has not been conducted within the boundaries of the Pu'u Kukui Watershed Management Area. Previous surveys conducted along the lower slopes and along the coastal areas of Honokahua, Honolulu, and Honokahau have identified numerous significant historic sites including religious structures, habitation sites, and burial areas. Agriculture sites are present, as well, along the streams.

The Pu'u Kukui Watershed Management Area extends from approximately 480ft elevation at Honokahua Stream to 5788ft elevation at the summit of Pu'u Kukui. We can only predict the types of archaeological sites that may be present in these areas. Agricultural related structures, such as irrigated kalo terraces and canals ('auwai), are expected in the upper sections near streams. The higher elevations were probably used for gathering forest materials, so historic sites such as temporary shelters and trails are predicted for these areas.

Our concerns at this point are for the installation of fences, the construction of the helicopter landing platforms and camp platforms. These projects may have an effect on historic sites, as they are considered to be ground disturbing activities. To ensure that these projects have "no adverse effect" on significant historic sites that may be present, we recommend contacting our Division prior to the commencement of any of these activities so that we may inspect the project areas. In the event that historic sites are located in the project area, the Division will assess the significance of the find and determine mitigation measures in consultation with your organization.

Please call Cathleen Dagher at 692-8023 if you have any questions.

Aloha,


Don Hibbard, Administrator
State Historic Preservation Division

CD:jen



Maui Pineapple Company, Ltd.
Honolua Division

May 11, 1999

Mr. John E. Min
Director of Planning
County of Maui
250 South High Street
Wailuku, Maui, Hawai'i 96793

RE: Comments on Draft Environmental Assessment (DEA) for the Pu'u Kukui Watershed
Management Plan dated March 22, 1999

Dear Mr. Min:

Maui Pineapple Company appreciates the time you and your staff have taken to review our DEA for the Pu'u Kukui Watershed Management Plan, as well as your continued support for our efforts to conserve an important part of West Maui's natural resources for the current and future benefit of all of Maui's citizens and visitors.

If you or your staff have any further questions or comments, please feel free to contact me at 669-5439 or by email: bartlett@maui.net.

Thank you very much for your assistance,
Mahalo nui loa nou kokua kakou,

Randy Bartlett
Pu'u Kukui Watershed Supervisor

Cc: Wesley Nohara, Superintendent, Honolua Plantation
Randy Kennedy, Manager, State Natural Area Partnership Program
Betsy H. Gagne, Executive Secretary, State Natural Area Reserves Commission

Ph: 808.669.5439

Fax: 808.669.7089

Email: bartlett@maui.net

4900 Honoapiilani Hwy. • Lahaina, Maui, Hawaii 96761 • Telephone (808) 669-6201



Maui Pineapple Company, Ltd.
Honolua Division

May 11, 1999

Ms. Karen Rosa
United States Department of the Interior
Fish and Wildlife Service
Pacific Islands Ecoregion
300 Ala Moana Boulevard, Room 3-122
Box 50088
Honolulu, Hawai'i 96850

RE: KAJ: Comments on Draft Environmental Assessment for the Pu'u Kukui Watershed
Management Plan received March 25, 1999

Dear Ms. Rosa:

Maui Pineapple Company appreciates the time you and your staff have taken to review our DEA for the Pu'u Kukui Watershed Management Plan, as well as your continued support for our efforts to conserve an important part of West Maui's natural resources for the current and future benefit of all of Maui's citizens and visitors.

If you or your staff have any further questions or comments, please feel free to contact me at 669-5439 or by email: bartlett@maui.net .

Thank you very much for your assistance,
Mahalo nui loa nou kokua kakou,

Randy Bartlett
Pu'u Kukui Watershed Supervisor

Cc: Wesley Nohara, Superintendent, Honolua Plantation
Randy Kennedy, Manager, State Natural Area Partnership Program
Betsy H. Gagne, Executive Secretary, State Natural Area Reserves Commission

Ph: 808.669.5439

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Maui Pineapple Company, Ltd.
Honolua Division

May 11, 1999

Mr. Don Hibbard, Administrator
State Historic Preservation Division
Department of Land and Natural Resources
Kakuhikewa Building, Room 555
601 Kamokila Boulevard
Kapolei, Hawai'i 96707

RE: Comments on Historic Preservation Review of the Draft Environmental Assessment (DEA) for the Pu'u Kukui Watershed Management Area dated March 18, 1999

LOG NO: 23109
DOC NO: 9903CID08

Dear Mr. Hibbard:

Maui Pineapple Company appreciates the time you and your staff have taken to review our DEA for the Pu'u Kukui Watershed Management Plan, as well as for your expert comments. Per your suggestions, Pu'u Kukui Watershed staff will contact your Division prior to the commencement of any management activities (fence installations and camp/helicopter landing platforms) mentioned in your letter so that your staff may inspect the project areas at your discretion.

If you or your staff have any further questions or comments on our efforts to conserve an important part of West Maui's natural resources for the current and future benefit of all of Hawai'i's citizens and visitors, please feel free to contact me at the numbers provided below.

Thank you very much for your assistance,
Mahalo nui loa nou kokua kakou,

Randy Bartlett
Pu'u Kukui Watershed Supervisor

Cc: Wesley Nohara, Superintendent, Honolua Plantation
Randy Kennedy, Manager, State Natural Area Partnership Program
Betsy H. Gagne, Executive Secretary, State Natural Area Reserves Commission

Ph: 808.669.5439

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Email: bartlett@maui.net

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