

**STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS
Honolulu, Hawaii**

November 22, 2010

**Board of Land and
Natural Resources
State of Hawaii
Honolulu, Hawaii**

REGARDING: **The Haleakalā High Observatory Site Management Plan**

APPLICANTS: University of Hawai`i, Institute for Astronomy

AGENT: Mike Maberry, Assistant Director, University of Hawai`i, 34 `Ōhi`a Kū,
Room 216, Makawao, HI 96768

LANDOWNER: State of Hawai`i, set aside by Executive Order 1987 to the University of
Hawai`i

LOCATION: Haleakalā High Altitude Observatories Site (HO) at Pu`u Kolekole,
ahupua`a of Papa`anui, moku of Honua`ula, Makawao District, Maui

TMK: (2) 2-2-007:008

ARE OF PARCEL: 18.166 acres (HO)

AREA OF USE: 0.86 acres

SUBZONE: General

DESCRIPTION OF AREA AND CURRENT USE

Haleakalā High Altitude Observatories Site (HO), popularly known as “Science City,” lies in the Pu`u Kolekole volcanic cone near the summit of Haleakalā. The 18.166 acre parcel is wholly contained in Kolekole, and ranges in elevation from 9840 to 10,000 feet above mean sea level (AMSL). The project location is on the southern side of the parcel, at 9980 AMSL.

HO is a single use parcel which was conveyed to the University of Hawai`i in 1961 by Executive Order 1987 with the provision that land was to be used for “the Haleakalā High Altitude Observatory Site purposes only.” EO 1987 has no expiration date.

Approximately 40% of the parcel is currently developed with roads, buildings, parking areas, and walkways. The site has housed astronomical facilities since the early 1950s. Current observatories include the Mees Solar Observatory, the Zodiacal Observatory, Pan-STARRS, the Advanced Electro-Optical System, the Maui Space Surveillance Site, the Ground-based Electro-Optical Deep Space Surveillance (GEODSS), the Airglow Facility, the Neutron Monitor Station, and the Faulkes Telescope North. An additional facility, the Advanced Technology Solar Telescope (ATST), is being proposed and currently working through the approval process.

These facilities observe the sun, provide research time to students and educators worldwide, use lasers to measure the distances to satellites, track and catalogue man-made objects, track asteroids and other potential threats to Earth, and obtain detailed images of spacecraft. HO is the principal site for optical and infrared surveillance, inventory and tracking of space debris, and active laser illumination of objects launched into Earth orbit, all of which are crucial to the nation’s space program.

The current Conservation District Use Permits (CDUPs) for HO are:

CDUP	Approval Date	Project
386	1973	Lunar Ranging Experiment
2705	1994	Advanced Electro-Optical System
3032	2001	Faulkes Telescope Facility
3201	2004	Pan-STARRS (PS-1)
3308	2006	Transportable Laser Ranging System (TLRS)
3542	(2010)	Advanced Technology Solar Telescope (proposed)

Exhibit 1 shows the Facility History at HO.

Exhibit 2 shows the overall site plan for HO.

The site plan shows that HO has neared its capacity for development. Future development will likely require the removal and replacement of existing structures.

Access to HO is via Haleakalā Crater Road (State Route 378). The upper 10.6 miles of the road, from the entrance to Haleakalā National Park to the summit, is owned and managed by the National Park Service. The road is heavily used; in 2007, there were 248,224 vehicles and approximately 3,650 buses, while in 2008 there were 205,977 vehicles and approximately 6,570 buses. The entry to HO is just past the turn off to Pu`u `Ula`ula. There is no general public access to the site.

Skyline Drive is an unimproved access road that branches off from the main road a half mile from HO. The road traverses the southwest rift zone, ultimately leading to Spring

State Recreation Area (also known as Polipoli State Park). DLNR maintains a locked gate at the summit.

Exhibit 3 details the existing access at HO.

Geography

Kolekole is one of three cones at the apex of the southwest rift zone on the Mākena-side of Haleakalā. Pu`u `Ula`ula, at 10,023 feet AMSL, is the tallest point on the mountain. A parking lot occupies the shallow caldera, and the short paved trail to the summit is one of the most popular in Haleakalā National Park. This summit in turn overlooks Pu`u Kolekole, 0.3 miles away. Continuing down the ridge, a third cinder cone houses county, state, and federal telecommunications facilities¹.

The next series of cinder cones, including the 8537 foot AMSL Pu`u Kalepeamoā, remain in their natural state. The lands on either side of the ridge are part of the Kula and Kahikinui Forest Reserves, and also remain pristine.

In the other direction, inside Haleakalā National Park and below the Park's Visitor Center, is Pa Ka`oao. This is the 9778 foot AMSL "White Hill" that is popular among visitors and residents for watching the sun rise over Haleakalā.

HO is in the *moku*² of Honua`ula, and *ahupua`a*³ of Papa`anui.

Some sources indicate that Haleakalā's original name was either `Alehe-lā or `Ahelekalā, (*aleha* = to snare, *lā* = the sun), derived from the stories of Maui snaring the rays of the sun here. *Haleakalā*, the "House of the Sun," is the name of a sharp point along the crater rim outside Kaupō Gap which later came to signify the entire mountain.

The eight moku in eastern Maui – Ko`olau, Hana, Kīpahulu, Kaupō, Kahikinui, Honua`ula, Kula, and Hamakualoa – radiate outwards from Pōhaku Pālaha on the northeast rim of Haleakalā's main crater. The moku of Honua`ula traverses a narrow band eastward from Pōhaku Pālaha across the center of the crater, then follows the southwest ridgeline to Pu`u Mākua. Here the moku widens to encompass the coastal communities from Wailea to Kanaio, as well as the nearby islands of Molokini and Kaho`olawe.

Papa`anui is a discontinuous ahupua`a within Honua`ula. A lower section runs from Mākena on the coast to Keonehulu at 4000 feet above mean sea level (AMSL). An upper

¹ OCCL suspects that this is the Pu`u Keokeo mentioned by Thomas Maunupau in "A Visit to Kaupo, Maui and Haleakala," *Ka Nupepa Kuokoa*, 1923; collected in Elspeth P. Sterling's *Sites of Maui* (Bishop Museum Press, Honolulu, 1998).

² Traditional land district

³ Traditional land division within a moku.

section runs along the ridgeline and across the crater, from Pu`u Keōkea to the moku's origin at Pōhaku Pālaha.

Flora and Fauna

There is very little soil development at HO, and the surface area is composed of a mixture of pumice, cinders, and ash. Vegetative cover is correspondingly sparse at five to ten percent, which is typical of alpine dry shrubland ecosystems in Hawai`i. The few plants include two endemic daisies (*Dubautia menziesii* and *Tetramolium numile*), two endemic perennial grasses (hairgrass, *Deschampsia nubigena* and mountain pili, *Trisetum glomeratum*), hairy cat's ear (*Hypochoeris radicata*), and a single pūkiawe (*Styphelia tameiameia*). No wild endangered silverswords (*Argyroxiphium sandwicense*) were found on the site, although there are some being cultivated near the AEOS parking lot.

Fauna are represented by birds, mammals, and arthropods.

85% of the known population of the federally-listed `ua`u (Hawaiian petrel, *Pterodroma sandwichensis*) nests near the Haleakalā summit. At HO there are thirty known burrows along the southeastern perimeter, as well as several burrows to the northwest. This is a typical size for `ua`u colonies in the region. There are an additional 55 burrows within 400 meters of HO but outside of the National Park. Most of the `ua`u population is within Park boundaries.

The birds nest from February to November, with the birds returning to the same nest year after year. `Ua`u leave their nests to feed on ocean fish just before sunrise, and return just before sunset. The petrels have limited vision yet fly at high speeds, which leads to an increased possibility of collision with stationary objects. Other causes of mortality include burrow collapse from wandering goats, predation by owls, and disturbances from road resurfacing activity.

Scientists have observed `ua`u building new burrows deep under the existing facilities. They theorize that the buildings' foundations might allow for more stable burrows as there would be limited risk of collapse from wandering goats.

Exhibit 4 shows the known `ua`u burrows at HO.

Nēnē (Hawaiian goose, *Branta sandvicensis*) have been known to fly over HO, but the Kolekole summit area is outside the known feeding range of the geese.

There have been several sightings of `ope`ape`a (Hawaiian hoary bat, *Lasiurus cenerus semotus*) near the summit, but they are believed to reside primarily in the lowlands due to both the cold and the lack of insects for food at the summit.

Multiple surveys of arthropod fauna have been conducted at HO. While many surveys did not find any species of note, there was one that located one carabid beetle (*Mecyclothorax*) and two species of long horn beetles (*Plagithmysus* spp.). Carabid beetles are at risk from alien predators, and their conservation is important.

No ant colonies were found at HO, although predatory ant species have been found in the neighboring Park. The invasive potential of these ants, particularly from the Argentine ant (*Linepithema humile*), calls for active control programs.

Yellow jackets (*Vespula pensylvanica*) were found at the project location. Yellow jackets are a known threat to diversity at Haleakalā, and active management is also required to control these predators.

Introduced fauna include the chukar (*Alectoris chukar*), feral goat (*Capra hircus*), Polynesian rat (*Rattus exulans*), and roof rat (*Rattus rattus*). The goats and rats are a direct threat to the summit's endemic bird species.

Cultural Resources

While Haleakalā's alpine climate was too extreme for permanent habitation, the summit area is extraordinarily rich in historic and cultural sites. At the HO parcel a 2002 archaeological survey identified a trail remnant, wind shelters, petroglyphs, a possible burial feature, and the remnants from an earlier telescope built in 1952. The survey concluded that the general lack of material culture indicated that the area was used more for short-term shelter purposes than extended period of occupation. The survey recommended passive preservation for all sites, with the possible exception of the telescope remnant.

Historic cultural practices at Haleakalā included gathering of plants; hunting for `ua`u, nēnē, *Platochen pau* (extinct) and *Branta hylobadisies* (extinct); collecting basalt for tool-making; burial of the dead; burial of umbilical cords; the calling of the sun (*e ala e*); and training for astronomers and navigators. There were certainly other practices that were not widely known outside specific lineages, and there are chants that discuss initiations and rites of passage that occurred on the summit.

In the modern period the hunting of `ua`u and nēnē is no longer legal, and if burial ceremonies still occur they are kept secret. Other cultural practices continue today. Hula halau and lapa`au practitioners gather materials at Haleakalā, and the site is still used by both Native Hawaiian groups for sunrise and sunset ceremonies.

The general public is not allowed to access HO, and recreational activities are prohibited. However, the site is not gated and the HO entrance sign welcomes *Na `ōiwi Hawai`i*. The welcome is not translated into English. The University of Hawai`i has funded the placement of two *ahu*, or stone altars, for religious and cultural use. In addition, a Programmatic Agreement for the proposed ATST calls for the University to provide a "place for shelter" for Native Hawaiian practitioners.

A Cultural Resource Survey, a Traditional Practices Assessment, and an Archaeological Inventory were completed in 2003. A subsequent study, Cultural and Historical Compilation of Resources Evaluation and Traditional Practices Assessment, was conducted in 2006 as part of the proposed ATST application.

In 2007 a Supplemental Cultural Impact Assessment was performed with the goals of widening community outreach and to gather additional information on the Traditional Cultural Property of Haleakalā.

Additional archaeological surveys were done in 2005 and 2006, and an Archaeological Preservation Plan was approved by the State Historic Preservation Department in July 2006.

PROPOSED ACTION

UH has developed a Management Plan (CMP) for the Haleakalā High Altitude Observatory Site. UH is seeking the approval of the Board of Land and Natural Resources (BLNR) for the Management Plan under the BLNR's authority to consider such plans, pursuant to Chapter 183C, Hawaii Revised Statutes (HRS). The BLNR's authority to consider management plans falls under Section 183C-1, HRS, which states as follows:

The legislature finds that lands within the state land use conservation district contain important natural resources essential to the preservation of the State's fragile natural ecosystems and the sustainability of the State's water supply. It is therefore, the intent of the legislature to conserve, protect, and preserve the important natural resources of the State through **appropriate management** and use to promote their long-term sustainability and the public, health, safety and welfare.

The Management Plan was prepared to comply with Hawai'i Administrative Rules (HAR) §13-5-25 *Identified Land Uses in the Resource Subzone*, R-3 ASTRONOMY FACILITIES, which states that astronomy facilities are an identified land use in the Conservation District "under an approved management plan." According to the applicant, it is compliant with HAR §13-5 EXHIBIT 3, *Management Plan Requirements*.

The proposed time frame for the Management Plan is from December 1, 2010 through November 30, 2020. It may be extended as appropriate.

An Environmental Assessment was prepared for the University of Hawai'i by KC Environmental. The draft was published in OEQC's *Environmental Notice* on March 23, 2010. The University of Hawai'i was the accepting authority, and the Chancellor signed a Finding of No Significant Impact (FONSI) on October 22, 2010. The FONSI was published in the *Environmental Notice* on November 8, 2010.

"Management Planning" was a part of the Long Range Development Plan (LRDP) developed for HO in January 2005. If approved, the proposed Management Plan will supersede the management actions in the LRDP. The long range planning aspect of LRDP will remain current.

CONTENTS OF MANAGEMENT PLAN

The Management Plan is intended to be the governing document for existing and future development at HO. It was developed to comply with the HAR §13-5, and is not intended to assess the impacts from any construction or operation of any one facility. Individual projects will each need to go through Hawaii's environmental review process.

The main cultural, archaeological, and biological surveys that were done in support of this plan were covered earlier in this report. The Management Plan contains a five page list of plans, studies, and reference documents that were used to prepare the plan.

The Management Plan will be the governing document for existing and future development at HO. It addresses:

1. Specific requirements and guideline for future astronomical facilities
2. Guidelines for US Air Force facilities and other scientific activities at the site
3. Terms and conditions that will be applied to leases, and
4. Future Planning for IfA in support of HO

Key elements of the Management Plan for each resource area are summarized below:

Cultural and Historic Resource Management

- The sign at the entrance to HO will welcome Native Hawaiians engaged in traditional cultural practices
- Contractors and personnel will receive environmental, cultural training, and 'sense of place' training.
- A Cultural Specialist will be engaged on all construction projects that require a permit from DLNR
- All cultural and archaeological sites and features identified in the Inventory Surveys will be protected in accordance with HAR §13-13 Chapter 277, *Rules Governing Requirements for Archaeological Site Preservation Development*.
- An area of 24,000 square feet known as "Area A" will be set aside in perpetuity for the "sole reverent use of the Native Hawaiians for religious and cultural purposes," with the understanding that such use will not interfere with other uses and activities within HO.
- The Preservation Plan for Archaeological Sites approved by SHPD in 2006 will be followed. This plan calls for the passive preservation of all known sites, except for the remnants of Reber Circle. No signage will be used for the sites in order to prevent unwanted attention.

Environmental Resource Management

- IfA will implement practices, subject to State funding, that include
 - weeding of the HO property,
 - engaging in vector control for rodents,
 - following the Storm Water Management Plan to maintain habitat ecosystem,
 - restricting night time lighting to protect `ua`u flight paths, and
 - frequently removing trash to prevent predators from accessing food sources.

- The following elements are designed to control for the introduction of invasive species:
 - A qualified biologist or agriculture inspector will inspect all equipment, supplies, and containers with construction materials that originate off island *prior* to the equipment being transported to the summit. Specimens of non-native species found will be offered to the State for curation, and the remainder destroyed.
 - All construction vehicles that will be used off paved surfaces will be steam cleaned / pressure washed before they travel or are transported through the National Park.
 - Importation of fill material is prohibited, unless such fill is sterilized to remove any biota that could survive at HO and propagate.
 - Contractors will be required to remove trash frequently.

- The following elements are designed to protect the `ua`u colony at HO:
 - If heavy construction is required at HO when `ua`u are present on Haleakalā then there must be consultation with DOFAW, the US Fish and Wildlife Service, and other avifaunal experts to develop mitigation measures.
 - Workers at the site will be informed of vibration, noise, and lighting hazards to `ua`u and other endangered species, and activities that trigger these must be limited to the construction site itself.
 - Noise sources will be shielded when possible.
 - Noise emitting activities will be limited by strict day and time constraints.
 - Equipment and machinery will be maintained in good operation condition, with proper intake and exhaust mufflers, and will be shut down between active operations.
 - Contractors will be provided with a map of current `ua`u burrows.
 - HO personnel will notify USFWS of any `ua`u mortalities.
 - Construction of fences will be avoided.
 - Any lighting at night for construction must be approved by IfA.
 - To avoid attracting `ua`u, contractors will not use lighting the same color as the stars.

- The following elements are designed to protect Pu`u Kolekole cinder cone:
 - No hazardous materials are to be released at the site. Substances such as oil, surplus paint, solvents, and other chemicals must be removed from the site and disposed of properly.
 - Spills must be reported to IfA immediately. UH personnel will supervise spill containment.
 - Spill remediation methods must be approved by the UH Environmental Health and Safety Office. Contractors are liable for the cost of cleanup and any penalties incurred.
 - Washing and curing water will not be released into the soil at the site. A recovery process is required to capture wastewater.

- The following elements are designed to minimize dust:
 - Contractors must establish a written dust control plan.
 - Dust control equipment must be kept on site by the contractor.
 - No oil or chemical treating shall ever be used for dust control.
 - Dust created by surface preparation (e.g. sanding) shall be controlled by the contractor by use of catchments and filtering systems.
 - When possible a designated on site facility be established to clean machinery and equipment prior to them leaving the construction zone.
 - Worker carpools and shuttles will be established

- The following waste management guidelines will be followed:
 - Solid waste cannot be stockpiled or dumped at the site or on the slope below HO.
 - Waste and debris must be secured so that the wind cannot disperse them.
 - Construction and demolition waste will be transported to the Maui Demolition and Construction Landfill.
 - No food will be left on the ground or in HO solid waste storage areas.
 - Non hazardous trash will be transported off site at Maui`s designated landfill.

Facility Design Criteria

- New facilities will not be permitted to obscure the observation function of existing facilities
- New facilities will not be permitted to impact `ua`u habitat. They will not be fenced, and will not have unshielded lights or other attractants.
- New facilities will not impact known archaeological resources, and no construction will be permitted within fifty feet of any site or feature.
- New facilities will be painted to match the color of the cinder and lava when possible, with the understanding that daytime observatories can be painted white in order to keep the inside temperatures cool.
- Construction design will consider sight plains to population centers in Maui.
- When possible natural materials will be used for façades, walls, walkways, entryways, etc.

- IfA will seek broad public comment on any new construction activities.
- New facilities will be designed to minimize potential adverse impacts from natural and anthropogenic hazards.

Reporting Requirements

This Management Plan is scheduled to be in effect from the date of approval through November 30, 2020.

The Management Plan calls for an annual report to DLNR that includes the status of compliance with permit conditions, and “the implementation of land uses pursuant to the approved management plan.” The proposed reporting schedule would run with the fiscal year.

DISCUSSION

OCCL has reviewed the Haleakalā Observatories Management Plan for consistency with the *Management Plan Requirements* outlined in HAR §13-5 Exhibit 3. Our comments on the specific requirements are as follows:

1. General Description.

OCCL finds this section complete.

2. Existing Conditions on Parcel.

OCCL finds this section complete.

3. Proposed Land Uses on Parcel.

OCCL notes that this Management Plan is not proposing any new uses, but rather is suggesting a framework and set of conditions that both existing and proposed uses must comply with. Any new facility would still be required to go through Hawaii’s environmental review process, and the Board of Land and Natural Resources retains the authority to grant, modify, or deny any Conservation District Use Permit.

The Plan sets forth over fifty conditions regarding the protection of the cultural and natural resources of the site; these will be considered to be conditions of any CDUP that is issued for HO. OCCL finds that the conditions appear to be thorough and well thought out, and has no additional recommendations at this time.

4. Reporting Requirements

OCCL finds that this section is compliant with HAR §13-5-39 MANAGEMENT PLAN APPROVALS (b) *An annual report to the department is required which shall include the status of compliance with the permit conditions and the implementation of land uses pursuant to the approved management plan schedule.*

However, due to the sensitive nature of the environment at Haleakalā, and due to its cultural importance, OCCL would suggest that the annual report go beyond meeting the minimum requirements under the law. Specifically, we would like to see the University present an annual report that would include summary updates on the following:

1. Any Construction activities occurring at HO
2. Any Habitat Conservation Plans
3. Any Monitoring Plans for Invertebrates, Flora, and Fauna,
4. Any Programmatic Agreements on Cultural Resources.
5. Any Invasive Species Control Plans
6. Any other related plans being implemented at HO

OCCL would recommend that any reporting requirements required by an individual project be subsumed into this one yearly report.

The Management Plan suggests that the report be due on June 30th of each year. OCCL would suggest that the 'year' instead be counted from the date of Board approval of the plan, so that the University would turn in the report yearly from November 30, 2012 through November 30, 2022.

Thus, staff recommends as follows:

RECOMMENDATION:

Based on the preceding analysis, staff recommends that the Board of Land and Natural Resources approve the University of Hawaii's Haleakalā Observatories Management Plan, subject to the following two conditions:

1. The Requirements set out in the Management Plan for Monitoring Strategies, Cultural and Historic Preservation Management, Environmental Protection of Site Resources, Construction Practices, and Facility Design Criteria should be assumed to be conditions of any new Conservation District Use Permit, unless specifically stated otherwise.
2. Beginning in November 2012 the University will submit to DLNR an annual report summarizing any construction activities occurring at HO; Habitat Conservation Plans; Monitoring Plans for Invertebrates, Flora, and Fauna;

Programmatic Agreements on Cultural Resources; Invasive Species Control Plans and other related plans. The Report should be brief but thorough.

Respectfully submitted,



Michael Cain, Planner
Office of Conservation and Coastal Lands



Laura H. Thielen, Chairperson
Board of Land and Natural Resources

Haleakalā High Altitude Observatory Site Management Plan

Facility History at Haleakalā High Altitude Observatory Site.

Facility	Date	Event
"Reber Circle"	1951	Grote Reber, one of the pioneers of radio astronomy, experimented with radio interferometry using a large steel and wood truss antenna. Site abandoned approximately one year later.
none	1955	Dr. Walter R. Steiger of the UH Department of Physics conducted a site survey study near the summit of Haleakalā to determine the suitability of the location for a solar observatory.
none	1961	EO 1987 from Hawaii's Governor Quinn to UH set aside 18+ acres of land on the summit of Haleakalā to establish the HO site. UH responsible for managing and developing land.
Mees Solar Observatory (MSO)	1957 to 1976	In preparation for the International Geophysical Year, the UH was approached by Dr. C. Kenneth Mees of Eastman Kodak to locate and operate a Baker-Nunn satellite-tracking facility on Haleakalā. In 1964, the MSO facility was named for Dr. C. Kenneth Mees.
	1964 to Present	NSF initially funded, and in later years the National Aeronautics and Space Administration (NASA) funded, the C. E. Kenneth Mees Solar Observatory, which began astronomical studies of the solar corona and chromosphere.
Airglow and Zodiacal Light Programs	1962	Airglow and Zodiacal Light program initiated in the old blockhouse in which Grote Reber had once housed his equipment.
University of Hawai'i Institute for Astronomy (IfA)	1967	The University of Hawai'i founded the Institute for Astronomy. The IfA's primary research activities include the study of galaxies, cosmology, stars, planets, and the Sun. At this point in time, the IfA's assets included the Waiakoa Laboratory in Kula, the Mees Solar Observatory, and the newly constructed Zodiacal Light observatory at the summit.
Airglow Facility	1972	Airglow program equipment moved to new facility.
Lunar Ranging Experiment Observatory (LURE)	1974 to 2004	LURE, which was operated by IfA under contract to the NASA Goddard Space Flight Center, supported the NASA Space Geodesy and Altimetry Projects, has provided NASA with highly accurate measurements of the distance between LURE and satellites in orbit about the Earth, and which was involved in the NASA Crustal Dynamics Project. This project was replaced by the Pan-STARRS test-bed (PS1) in 2006.
Cosmic Ray Neutron Monitor Station	1991 To 2007	Cosmic Ray Neutron Monitor Station, the only such station in the world, operated in association with the University of Chicago Enrico Fermi Institute and the Faulkes Telescope Facility.
Multi-color Active Galactic Nuclei Monitor Project (MAGNUM)	1998 to 2008	The University of Tokyo, the National Astronomical Observatory of Japan, and the Australian National University have installed a 2-meter telescope in the 9-meter North dome of the LURE complex to support the MAGNUM Project.
Faulkes Telescope Facility (FTF)	2004	The Faulkes Telescope Facility at HO houses the largest educational outreach optical telescope in the world in support of astronomy research and education for grades K-college in Hawai'i and the United Kingdom. The FTF on Maui is known as the FTF North and its twin in Australia is known as FTF South.

EXHIBIT 1

Facility History at Haleakalā High Altitude Observatory Site (cont.).

Facility	Date	Event	
Presently known as the Maui Space Surveillance Complex (MSSC)	1963	Construction begins on the Advanced Research Projects Agency (ARPA) Maui Optical Station (AMOS), designated in 1977 as Maui Space Surveillance System (MSSS).	
	1965	AMOS satellite tracking facility achieves first light.	
	1967	ARPA designated MSSS site for Western Test Range midcourse observations, with the University of Michigan (UM) conducting operations and maintenance at the site. About 40 scientists, engineers and technicians worked for UM, about half traveling to the summit on any given day.	
	1969	Routine missile tracking operations began under new contractors AVCO Everett Research Laboratory (AVCO) and Lockheed Missiles and Space Company. AVCO adds about 40 additional personnel for research and development, about half at the summit at any given time.	
	1977	The twin 1.2-meter telescope at AMOS is dedicated to the Maui Optical Tracking and Identification Facility, known now as the MSSC, for daily routine satellite tracking operations. No new personnel were required.	
	1980	Construction begins at MSSS on Ground-Based Electro-Optical Deep Space Surveillance System (GEODSS). Three new domes are built and approximately 10,000 square feet of office and laboratory space on the south side of MSSS.	
	1982	The GEODSS, with three 1-meter telescopes becomes one of four operational sites in the world performing ground-based optical tracking of space objects. It employs about 15 operations and maintenance personnel.	
	1995 to Present	One part of the MSSC is the MSSS, a facility combining operational satellite tracking facilities with a research and development facility. This also includes the Dept. of Defense's (DoD) largest telescope, the Advanced Electro-Optical System (AEOS). Over the years the Air Force operation has grown to include a total of approximately 125 civilian and military personnel housed at the Kihei Research and Technology Park and approximately 115 more based at MSSS.	
Panoramic-Survey Telescope and Rapid Response System (Pan-STARRS) (LURE)	2006	PS1 South Dome	These facilities house a 1.8-meter wide-field optical imaging system equipped with a 1.44-billion pixel charge-coupled device camera. This unique combination of sensitivity and field-of-view will address a wide range of time-domain astronomy and astrophysical problems in the Solar System, Galaxy, and Universe.
	2010	PS2 North Dome	

monitoring are primary users of the unpaved road. There are sections of this trail that have a steep grade and soft cinder roadbed that will not support standard construction truck traffic, only smaller vehicles with four-wheel drive.

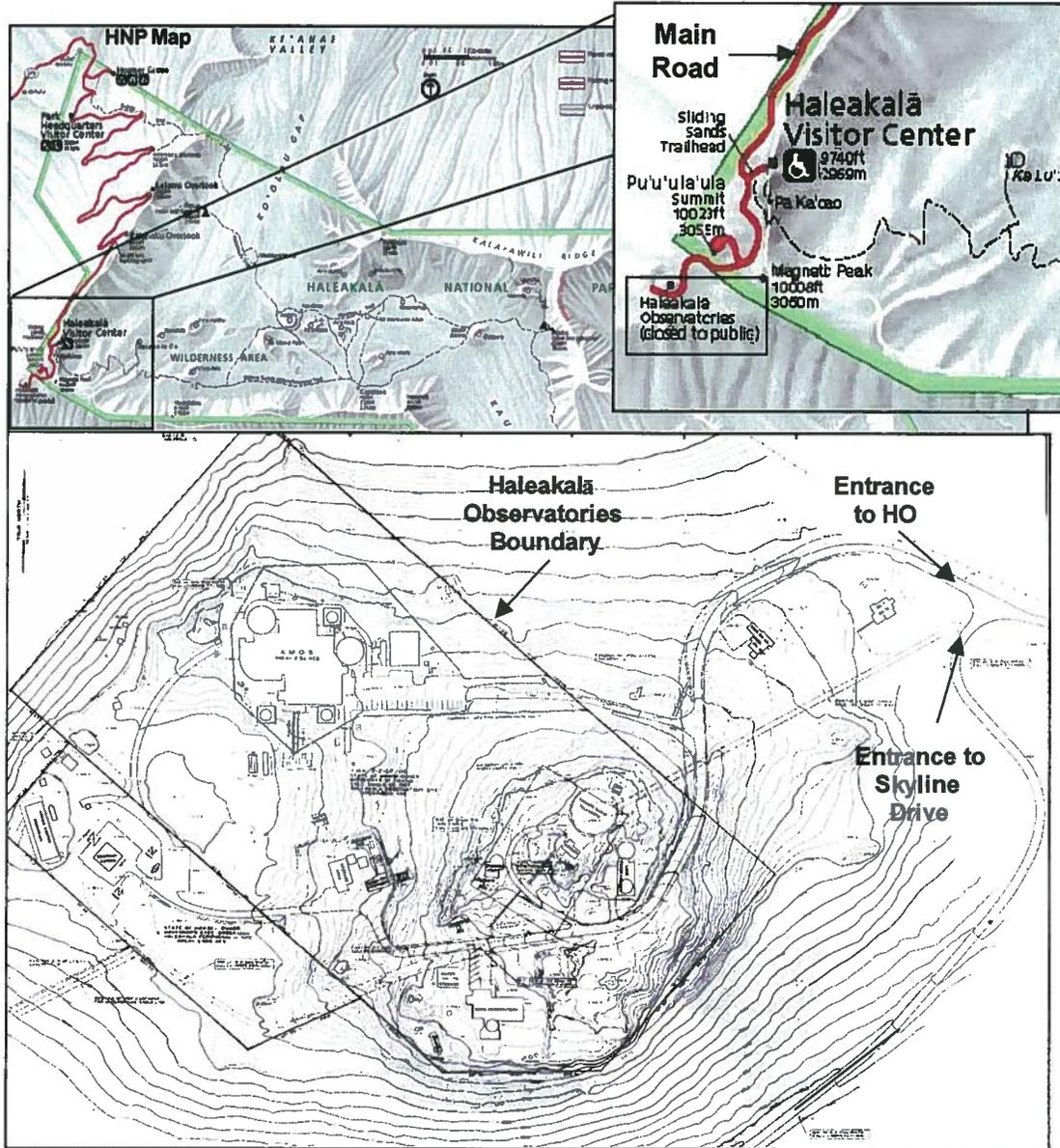
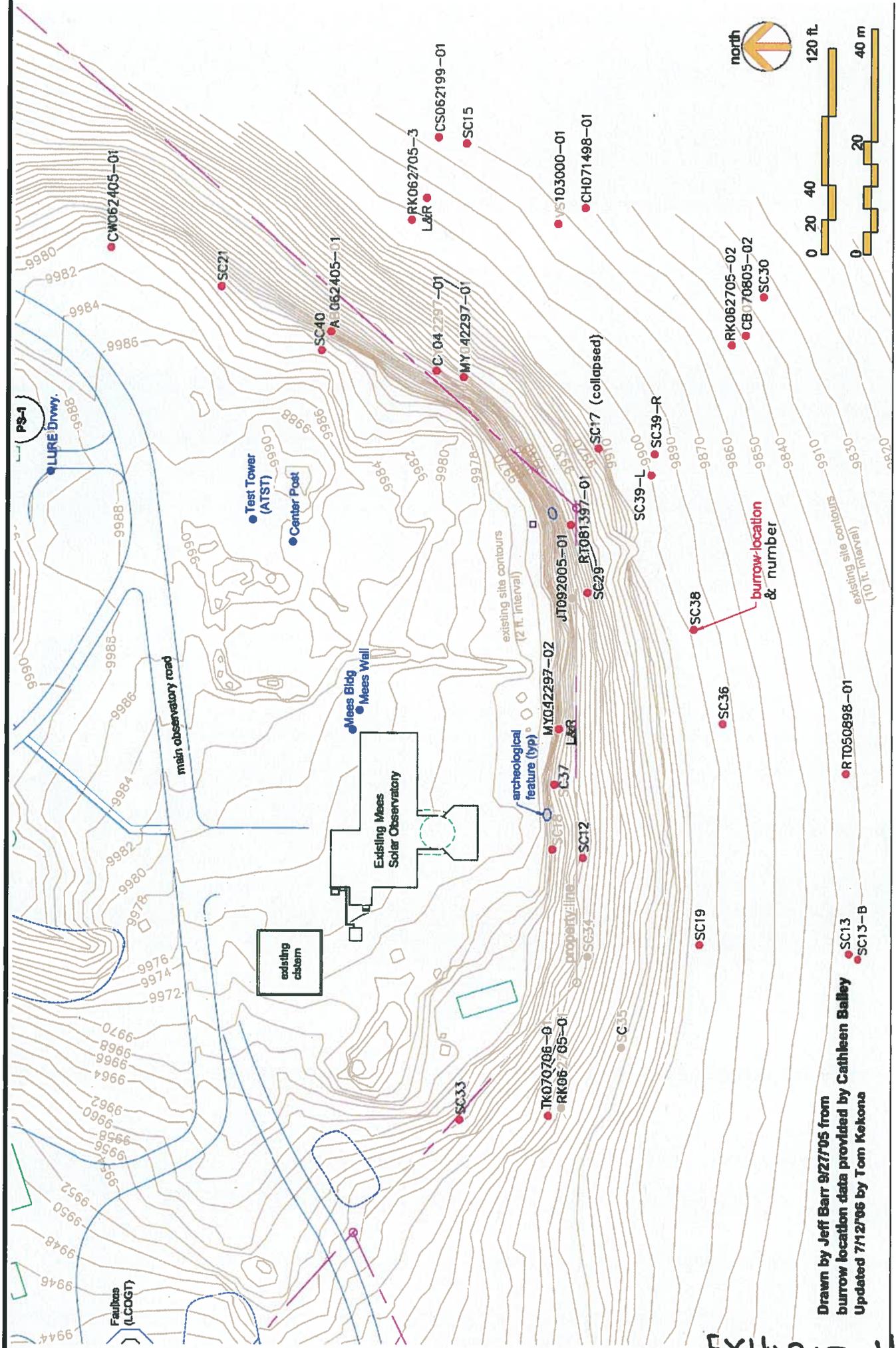


Figure 2-1 Existing Access to HO



Drawn by Jeff Barr 9/27/05 from
 burrow location data provided by Cathleen Bailey
 Updated 7/12/06 by Tom Kekona

EXHIBIT 1