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December 11, 2012

Gary Hooser, Director  
Office of Environmental Quality Control  
235 South Beretania Street, Suite 702  
Honolulu HI 96813

Dear Mr. Hooser:

Subject: Draft Environmental Assessment for HI-SEAS/PISCES Mars Habitat  
Project TMK 3rd. 3-8-001:001, North Hilo District, Island of Hawai'i.

With this letter, the University of Hawai'i, hereby transmits the draft environmental assessment and anticipated finding of no significant impact (DEA-AFONSI) for the subject project for publication in the next available edition of the Environmental Notice.

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

Please contact Dr. Kim Binstead at 808.398.1300 or [Binstead@hawaii.edu](mailto:Binstead@hawaii.edu) if you have any questions.

Sincerely,

Yaa-Yin Fong  
Director

Attachments

c: Kim Binstead, Ph.D.  
(w/o attach) Ron Terry, Ph.D., Project Environmental Consultant

2440 Campus Road, Box 368  
Honolulu, Hawai'i 96822  
Telephone: (808) 956-7800  
Fax: (808) 956-9081

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## OEQC Publication Form The Environmental Notice

**Name of Project:** HI-SEAS/PISCES Mars Habitat Project

**Applicable Law:** Chapter 343, HRS

**Type of Document:** Draft EA

**Island:** Hawai'i

**District:** North Hilo

**TMK:** (3<sup>rd</sup>.) 3-8-001:001 (por.)

**Permits Required:** State of Hawai'i; Conservation District Use Permit; Forest Reserve Special Use Permit; State Historic Preservation Division Determination of No Effect

**Name of Applicant or**

**Proposing Agency:** University of Hawai'i  
Address 2440 Campus Road, Box 368  
City, State, Zip Honolulu, Hawai'i 96822  
Contact and Phone Dr. Kim Binsted, 808-398-1300, binsted@hawaii.edu

**Approving Agency:** University of Hawai'i  
Address 2440 Campus Road, Box 36  
City, State, Zip Honolulu, Hawai'i 96822  
Contact and Phone Dr. Kim Binsted, 808-398-1300, binsted@hawaii.edu

**Consultant** Geometrician Associates  
Address PO Box 396  
City, State, Zip Hilo HI 96721  
Contact and Phone Ron Terry, 969-7090

**Project Summary.** The Department of Information and Computer Sciences at the University of Hawai'i at Manoa UHM), in collaboration with Cornell University and the Pacific International Space Center for Exploration Systems (PISCES), seeks to prepare and manage a temporary experimental site at the 8,000-foot elevation on Mauna Loa, on Hawai'i Island. The site is on a cinder cone ridge surrounded by lava flows and closely resembles the surface of Mars. Experiments conducted over five years would utilize a small, portable "habitat" similar to one that might be constructed for Mars to focus on issues astronauts will experience as they explore the solar system. The central experiment will focus on food needs during long-term planetary exploration missions. The project will also partner with schools for student participation through internships, classes and outreach with K-12 students. The project would install the habitat within an area of about 0.5 acres of State land on a disturbed part of the former quarry in the Mauna Loa Forest Reserve. All wastewater and biological waste will be contained for regular servicing and removal. Power will be supplied either by a solar power provider or an ultra-quiet and efficient LPG generator. The site contains little vegetation, no rare, threatened or endangered species, and no archaeological sites or cultural practices. In order to keep the site isolated, the quarry access road would be gated and locked at a point about 2,300 feet west of Mauna Loa Road during the five years of the experiment. After five years, the project would terminate, the habitat would be removed, and the site would be cleared of any debris or traces of the experiment.

## **HI-SEAS/PISCES Mars Habitat Project Draft EA Distribution List**

Theresa Donham, Archaeology Branch Chief  
State Historic Preservation Division  
40 Po'okela Street  
Hilo HI 96720

Deputy Director  
Environmental Health Administration  
Hawai'i State Department of Health  
P.O. Box 3378  
Honolulu HI 96801

Russell Tsuji, Administrator  
Hawai'i State Land Division  
P.O. Box 621  
Honolulu HI 96809

Dr. Kamana'opono Crabbe, CEO  
Office of Hawaiian Affairs  
711 Kapiolani Blvd., Suite 1250  
Honolulu HI 96813

Bobby Jean Leithead-Todd, Director  
Hawai'i County Planning Dept.  
101 Aupuni Street, Suite 3  
Hilo HI 96720

Hawai'i County Council  
25 Aupuni Street  
Hilo HI 96720

PISCES Cultural Advisory Committee

NOAA - Mauna Loa Observatory  
John Barnes  
1437 Kilauea Ave. #102  
Hilo, Hawaii, 96720

Cynthia Orlando, Superintendent  
Hawai'i Volcanoes National Park  
P.O. Box 52  
Hawaii National Park, HI 96718-0052

Librarian  
Hilo Public Library  
300 Waianuenue Avenue  
Hilo HI 96720

**Dear Participant:**

Attached for your review is a Draft Environmental Assessment (DEA) and Anticipated Finding of No Significant Impact (FONSI) prepared pursuant to the EIS law (Hawaii Revised Statutes, Chapter 343) and the EIS rules (Administrative Rules, Title 11, Chapter 200).

Project Name: **HI-SEAS/PISCES Mars Habitat Project**

Location: Island: **Hawai'i** District: **North Hilo**

Tax Map Key Number: **(3<sup>rd</sup>.) 3-8-001:001 (por.)**

Your comments must be received or postmarked by: **January 22, 2013**

Please send original comments to the:

Consultant: **Geometrician Associates**

Address: **PO Box 396  
Hilo HI 96721**

Contact: **Ron Terry**

Email: [rterry@hawaii.rr.com](mailto:rterry@hawaii.rr.com)

Phone: **808-969-7090**

Copies of the comments should be sent to:

Proposing/Approving

Agency: **University of Hawai'i**  
Address: **2440 Campus Road, Box 368  
Honolulu, Hawai'i 96822**

Contact: **Dr. Kim Binsted**

Email: [binsted@hawaii.edu](mailto:binsted@hawaii.edu)

Phone: **808-398-1300**

If you no longer need the Draft EA, please recycle it. Thank you for your participation in the Environmental Assessment process.

**Dear Participant:**

This notice is to inform you that that a Draft Environmental Assessment (DEA) and Anticipated Finding of No Significant Impact (FONSI) prepared pursuant to the EIS law (Hawai'i Revised Statutes, Chapter 343) and the EIS rules (Administrative Rules, Title 11, Chapter 200) is available for review. As of December 23 2012, the EA is available for download at: <http://hawaii.gov/health/environmental/oeqc/index.html>

Your comments must be received or postmarked by: **January 22, 2013**

Project Name: **HI-SEAS/PISCES Mars Habitat Project**

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Contact: **Dr. Kim Binsted**  
**Email: [binsted@hawaii.edu](mailto:binsted@hawaii.edu)**

Phone: **808-398-1300**

Thank you for your participation in the Environmental Assessment process.

**HI-SEAS/PISCES Mars Habitat Project**

**Draft Environmental Assessment**

**University of Hawai'i**

**December 2012**

**Submitted Pursuant to Chapter 343, Hawai'i Revised Statutes (HRS)**



# **HI-SEAS/PISCES Mars Habitat Project**

## **Draft Environmental Assessment**

Humu'ula, North Hilo District, Island of Hawai'i

Tax Map Key Number: (3<sup>rd</sup>) 3-8-001:001 (por.)

### **PROPOSING/APPROVING AGENCY:**

University of Hawai'i  
2440 Campus Road, Box 368  
Honolulu, HI 96822

### **CONSULTANT:**

Geometrician Associates  
P.O. Box 396  
Hilo, Hawai'i 96721

### **CLASS OF ACTION:**

Use of State Funds and Land  
Use of Land in Conservation District

This document is prepared pursuant to:  
Hawai'i Environmental Policy Act,  
Chapter 343, Hawai'i Revised Statutes (HRS), and  
Title 11, Chapter 200, Hawai'i Department of Health Administrative Rules (HAR)

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## **SUMMARY OF THE PROPOSED ACTION, ENVIRONMENTAL IMPACTS AND MITIGATION MEASURES**

The Department of Information and Computer Sciences at the University of Hawai‘i at Manoa (UHM), in collaboration with Cornell University and the Pacific International Space Center for Exploration Systems (PISCES), seeks to prepare and manage a temporary experimental site at the 8,000-foot elevation on Mauna Loa, on Hawai‘i Island. The site is on a cinder cone surrounded by lava flows and closely resembles the surface of Mars. Experiments conducted over five years would utilize a small, portable “habitat” similar to one that might be constructed for Mars to focus on the operational and psychological issues astronauts will experience as they explore the solar system. The central experiment will focus on food needs during long-term planetary exploration missions, which must consider packaging waste, energy efficiency, scheduling, menu fatigue and social cohesion in the crew. The UHM study, entitled HI-SEAS (Hawai‘i Space Exploration Analog and Simulation), will examine the tradeoffs (energy, effort, satisfaction, waste) between pre-prepared meals and meals that require some preparation.

The project would install a “habitat” within an area of about 0.5 acres on a previously disturbed portion of the quarried cinder cone ridge. The State of Hawai‘i land is within the Conservation District and is part of the Mauna Loa Forest Reserve. It is almost devoid of vegetation and contains no rare, threatened or endangered species. Consultation has revealed no cultural resources or practices. The habitat will be a self-contained unit with sleeping quarters, a kitchen, a computer and lab workspace, and a bathroom, along with an accessory water tank and wastewater tank. All wastewater and biological waste will be contained for regular servicing and removal. Power will be supplied either by a solar power provider or an ultra-quiet and efficient LPG generator. The habitat structure would have about 900 square feet of floor space and be 20 feet in height or less, and will be barely visible from any public vantage point. Access is via a 1.3-mile long 4WD road off of Mauna Loa Road. In order to keep the site isolated, this access road would be gated and locked at a point about 2,300 feet west of Mauna Loa Road during the five years of the experiment.

The habitat would be inhabited by a crew of six for missions up to a year starting in early 2013 and lasting as long as five years. The crews will live and work under strict analog conditions, only venturing outside in simulated space suits, communicating with ‘Earth’ via channels disrupted by latencies and drop-outs, etc. These long-term analog missions also offer opportunity for other researchers, who will be invited to propose research studies to test their ideas in this environment. Possible topics include remote medicine, crew dynamics, communication technologies, psychological support strategies, and so on. The project will also partner with schools for student participation through internships, classes and outreach with K-12 students.

After five years, the project would terminate, the habitat would be removed, and the site would be cleared of any debris or traces of the experiment. If at any time during or after the experiment PISCES determines the site suitable for additional uses, it would reapply for such uses.

## **PART 1 PURPOSE AND NEED FOR THE PROPOSED ACTION**

A number of serious risks are associated with long-term human space exploration, including radiation, microgravity, confinement in small spaces, and nutritional deficits, that can affect crew behavior, health and mission success (<http://humanresearchroadmap.nasa.gov/Evidence/>) To successfully return to the Moon, or venture onwards to Mars, asteroids or other deep-space destinations, scientists will need to assess these risks and develop reliable countermeasures.

Some of these risks that require study are also common to isolated, confined and/or extreme environments here on Earth. These are called analog environments, because they share a significant subset of the conditions astronauts will face in long-term space exploration. Hawai‘i has some very strong analog environments, which have the geological, operational and psychological characteristics of the environments astronauts will experience as they explore the solar system. The Department of Information and Computer Sciences at the University of Hawai‘i at Manoa (UHM), in collaboration with Cornell University, seeks to utilize such an analog environment to gain critical information on the food that astronauts will eat during long-term planetary exploration missions. The current NASA food system, which uses individual pre-prepared meals, was designed for the Space Shuttle and International Space Station. However, longer-term missions must consider packaging waste, energy efficiency, scheduling, menu fatigue and social cohesion in the crew. The UHM study, entitled HI-SEAS (Hawai‘i Space Exploration Analog and Simulation), will look at the tradeoffs (energy, effort, satisfaction, waste) between pre-prepared meals and meals that require some preparation, over the long term. To be valid, this study must take place in a realistic operational analog, with the kind of workload, communications issues, and psychological stresses that an astronaut crew would face.

## **PART 2 PROPOSED ACTION AND ALTERNATIVES**

### *Proposed Action, Location and Property Ownership*

UHM has teamed with the Pacific International Space Center for Exploration Systems (PISCES) to identify and obtain land use permits and prepare and manage an appropriate experimental site on the Island of Hawai‘i, where large extents of high altitude lava landscapes are present. PISCES, an agency of the Department of Business, Economic Development and Tourism (DBEDT) based out of the University of Hawai‘i at Hilo (UHH), is an international research and education center dedicated to the development, verification and validation of new technologies needed for operations on the Moon, Mars and beyond. PISCES is built on partnerships between industry, private entrepreneurs, academia and the governmental agencies of space-faring nations of the world. PISCES is currently planning a simulated lunar outpost (robotic and human) on the Island of Hawai‘i, where research will be conducted and new technologies will be developed. Here the public will be invited to experience first-hand what it will be like to live and work on the Moon and, eventually, on Mars. Because of its local origin and management, PISCES has been successful in accomplishing this program in a way that protects the unique natural and cultural resources of Hawai‘i. A central theme of PISCES activities are opportunities for student

participation through internships, classes and outreach with K-12 students. For these reasons, PISCES is an appropriate partner and host for the HI-SEAS experiment.

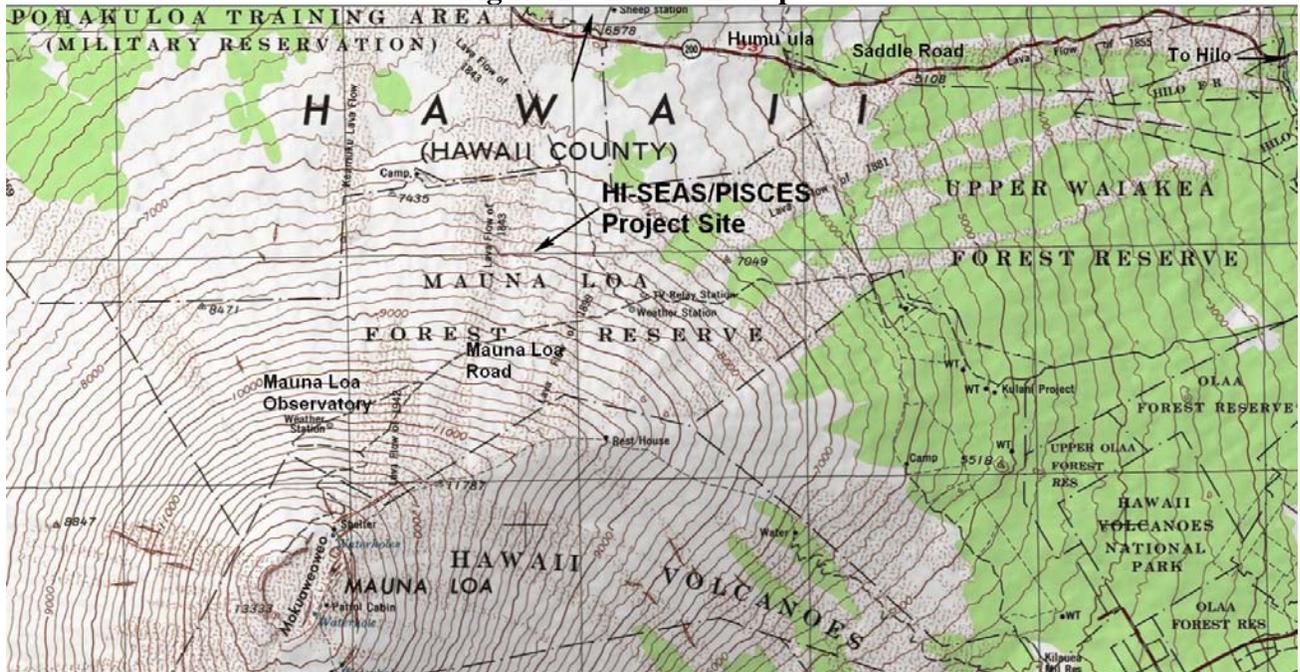
The HI-SEAS/PISCES project would transport and install a “habitat” within an area of approximately half an acre on a previously quarried cinder cone ridge in the Conservation District within the Mauna Loa Forest Reserve, which is owned by the State of Hawai‘i and administered by the Department of Land and Natural Resources, Division of Forestry and Wildlife (DOFAW) (Figures 1-2). The cinder cone ridge is located at about 8,060 feet in elevation on the slopes of Mauna Loa and is dated from between 1,500 and 3,000 years before the present. Access to the site is via a 1.3-mile long 4WD road off of Mauna Loa Road, at UTM 239180 E 2169440 N. A portion of the cinder cone has previously been quarried and reworked by heavy equipment, providing an already disturbed surface (Figure 3).

The habitat, which is currently under design, will be a small, self-contained unit with sleeping quarters, a kitchen, a computer and lab workspace, and a bathroom, along with an accessory water tank and wastewater tank placed near the habitat (Figure 4). All wastewater and biological waste will be contained for regular servicing and removal. Power will be supplied either by a fully self-contained solar power provider equipped with data and communications hardware, and/or an ultra-quiet and efficient Winco PSS21 LPG-fueled generator or similar. Propane will be stored in either a typical household propane tank or smaller units that would be delivered during the weekly truck visits. The habitat structure would have approximately 900 square feet of floor space (including a small loft) and be 20 feet in height or less, which would also be the maximum height of the power generation unit.

The habitat would be inhabited by a crew of six for missions up to 12 months. The series of missions will start in early 2013 and last as long as five years. The crews will live and work under strict analog conditions, only venturing outside in simulated space suits, communicating with ‘Earth’ via channels disrupted by latencies and drop-outs, etc. These long-term analog missions are also an excellent opportunity for other human factors researchers, who will be invited to propose and implement opportunistic research studies to test their ideas in this environment. Possible topics include remote medicine, crew dynamics, communication technologies, psychological support strategies, and so on. Because there are a large number of identified risks that can only be studied under long-term controlled analog conditions, it is hoped to repeat this simulated mission scenario regularly, so that all the necessary countermeasures can be explored, developed and thoroughly tested.

In order to keep the site isolated from casual vehicular access, which would degrade the quality of the experiment, the access road to the quarry would be gated during the five years of the experiment and locked at a point about 2,300 feet west of Mauna Loa Road, at approximately at UTM 240452 E 2169127 N (see Figure 2 for location). A “Knox Box” type of lock is planned for the gate. PISCES will apply through the Hawai‘i County Fire Department to register and obtain the necessary lock, and emergency services including DLNR, the Police Department, the Fire Department and Civil Defense will then have a universal key that will open all Knox Boxes.

**Figure 1 Location Map**



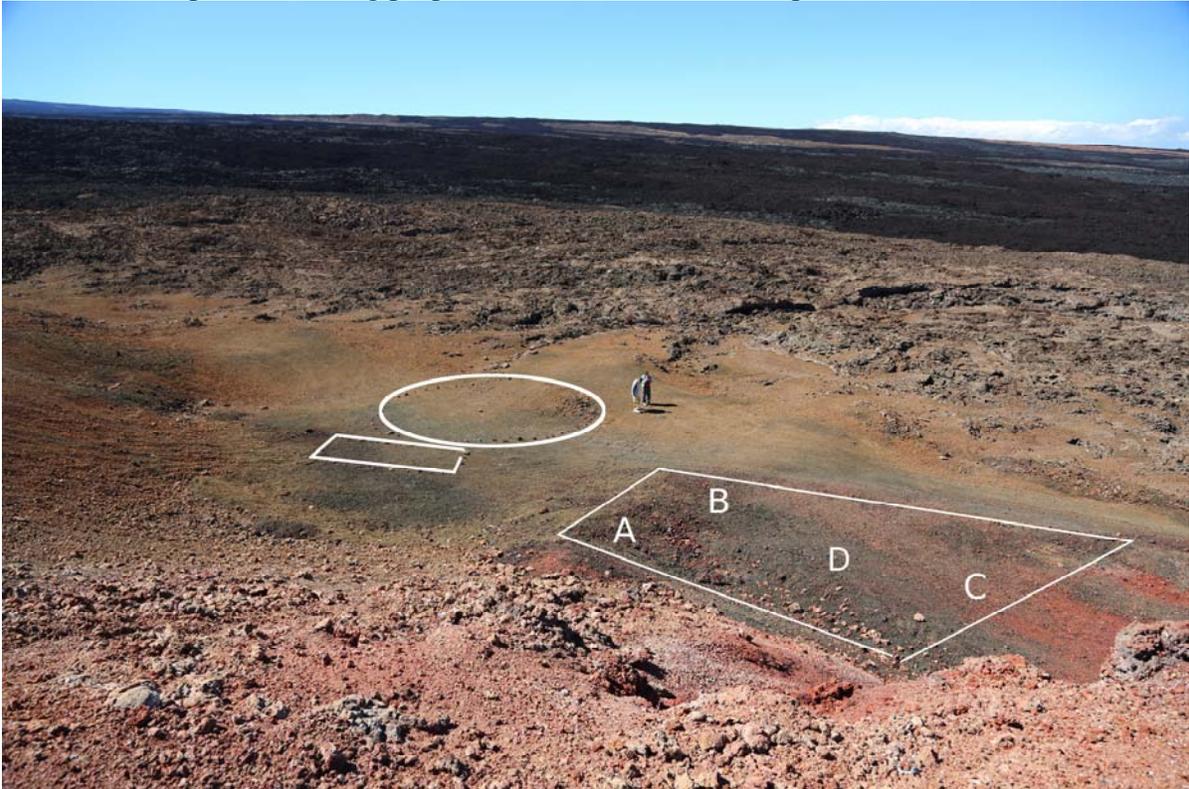
**Figure 2 Aerial Image**



**Figure 3 Project Site Photos**

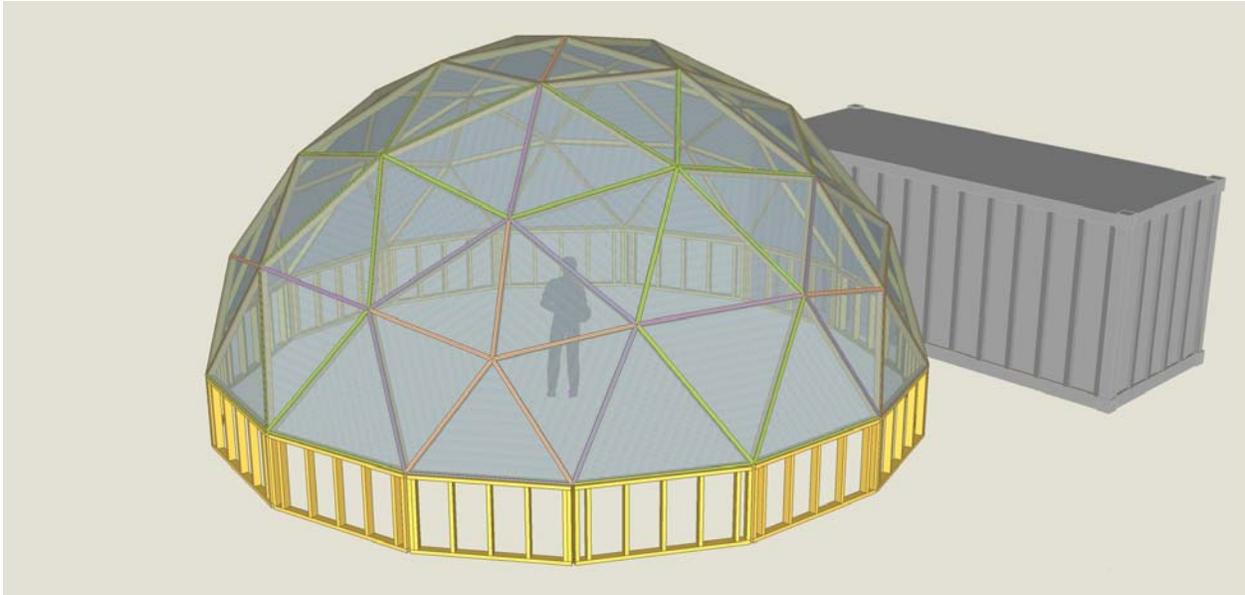


Landscape surrounding proposed habitat site ▲ ▼ Proposed location of habitat

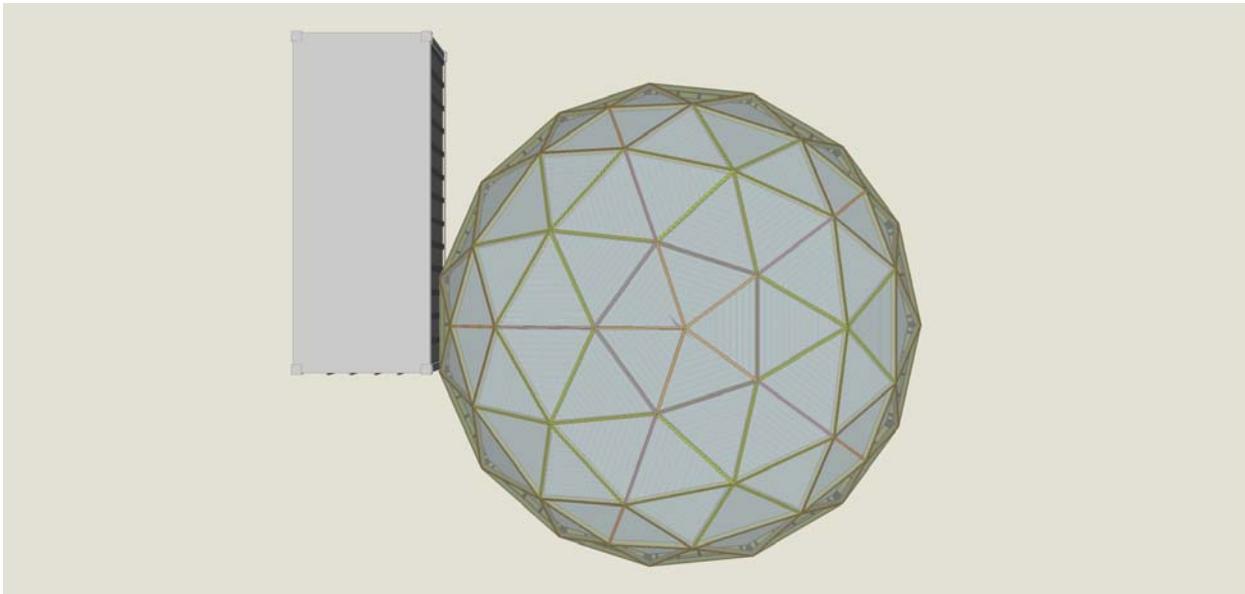


KEY: (Locations conceptual) Circle and rectangle mark habitat site and storage  
A: water tank; B: septic tank; C: power system; D: storage container

**Figure 4. Conceptual Habitat Design**



Profile ▲ ▼ Plan view



The Department of Land and Natural Resources would have a key to a separate lock, and any legitimate access request could be applied for and obtained after consultation with PISCES.

After five years, the project would terminate, the habitat would be removed, and the site would be cleared of any debris or traces of the experiment. If at any time during or after the experiment PISCES determines that the site is suitable for additional experimental uses, it would begin a new Conservation District Use Application and comply with all applicable Hawai‘i environmental laws and regulations.

### *Alternatives*

As discussed above, the project needs a realistic planetary-surface habitat under strong operational conditions to understand and address the risks of long-term human space exploration. The following criteria were considered highly desirable for potential sites:

- Physically isolated from used roads and trails, so that passersby are unlikely
- Visually isolated, so that minimal human activity can be seen from the site
- Low visibility from any roads or nearby public vantages, to discourage sightseers
- Accessible by 4WD vehicle and service trucks, but with a securable access so that a gate can be emplaced to discourage visitors
- Very little vegetation
- Very little macroscopic animal life such as mammals or birds
- Mars-like physical geology
- Pre-graded to minimize disturbance of existing sites but maximize usability of site
- Moderate temperature, so that sorties in mock-up suits are tolerable
- No significant environmental or cultural impact

In general, Mauna Kea is considered more sensitive in terms cultural, biological and hunting resources, and therefore attention was focused on Mauna Loa. The requirement for feasible access limited the search to sites that connected to Mauna Loa Access Road. There are potentially other sites on that have some of these characteristics, but none have been identified except the subject site that met all criteria.

## **PART 3      AFFECTED ENVIRONMENT AND ENVIRONMENTAL CONSEQUENCES**

### **3.1      Geology**

#### **3.1.1    Definition of Resource**

For the purposes of this analysis, geology includes surface geology, topography, geological hazards, and soils.

#### **3.1.2    Region of Influence**

The region of influence (ROI) for geology includes the approximately half-acre area directly affected by physical activities from the proposed project.

### **3.1.3 Surface Geology**

The project site is on the side of an elongated ridge of cinder/spatter cones from a Mauna Loa eruption dated from between 1,500 and 3,000 years before the present (see maps, aerial images and photographs in Figures 1-3). Just west of the ridge of cinder cone is a pahoehoe lava flow associated with the eruption (Wolfe and Morris 1996).

### **3.1.4 Topography**

As illustrated in Figure 3, the surface of the site has been modified by heavy equipment excavating and/or compacting the edge of an elongated cinder cone with multiple vents. The topography is irregular and slopes slightly upwards towards the axis of the cones.

### **3.1.5 Soils**

The lava landscape is too young to have developed soils and is not classified as a soil by the U.S. Natural Resources Conservation Services (U.S. Soil Conservation Service 1973). As a consequence, plants are present in only very restricted locations.

### **3.1.6 Seismicity/Lava Flow Hazards**

The project site is rated Lava Flow Hazard Zone 2 on a scale of ascending risk from 9 to 1. The hazard risk here is based on the fact Mauna Loa is an active volcano. Volcanic Hazard Zone 2 consists of areas on both sides of the northeast and southwest rift zones, which are downslope of potential eruption sites. About 20 percent of this area has been covered by lava in historical time, 5 percent since 1950.

In terms of seismic risk, the entire Island of Hawai'i is rated Zone 4 Seismic Hazard (Uniform Building Code, Appendix Chapter 25, Section 2518). Zone 4 areas are at risk from major earthquake damage, especially to structures that are poorly designed or built.

### **3.1.7 Impacts and Mitigation Measures**

Preparation of the project site will involve only very minor leveling with hand tools or a small loader/excavator, as the habitat can be set on leveled blocks and no other structures will be used. The substrate is adequate for the modest weight of the habitat. UHM and PISCES will monitor volcanic activity in the area and will suspend the activity if eruption activity warrants it.

## **3.2 Water Resources**

### **3.2.1 Definition of Resource**

Water resources are defined here to encompass the nation's lakes, streams, groundwater, wetlands, and coastal areas that are intended to be protected by the federal *Clean Water Act* (33 USC 26 parts 1251 et seq., 2000). Groundwater refers to subsurface hydrologic resources such as aquifers that are used for domestic, agricultural, and industrial purposes. Wetlands are defined by the U.S. Army Corps of Engineers (USACE) as areas that are characterized by a prevalence of vegetation adapted to saturated soil conditions, and are identified based on specific soil, hydrology, and vegetation criteria defined by USACE. For the purposes of this analysis, floodplains are also included in water resources, and they are defined as any low-lying area designated by the Federal Emergency Management Agency (FEMA) subject to inundation by a 100-year flood (i.e., a flood that has a one percent chance of being equaled or exceeded in any given year).

### **3.2.2 Region of Influence**

The region of influence (ROI) for water resources includes the approximately half-acre area directly affected by physical activities from the proposed project, as well as areas immediately downslope, which could be affected by any runoff from the habitat roof. Because the project would not take water or affect water in underlying aquifers, which lie thousands of feet below the project surface, no aquifers are included in the ROI.

### **3.2.3 Water Supply**

There is no existing water supply at the site.

### **3.2.4 Water Quality**

There are no streams, lakes, springs, wetlands or other water bodies in the project area, which contains lava flows too geologically young to have developed surface water features. Basal, perched and perhaps confined artesian aquifers associated with high elevation precipitation input from Mauna Loa and Mauna Kea are presumed to lie several thousand feet below the surface of the Mauna Loa-Mauna Kea Saddle area. The nature of these aquifers is currently being investigated in a research exploratory well project about 10 miles north at Pohakuloa Training Area (UH Hawai'i Institute of Geophysics and Planetology 2012).

### **3.2.5 Floodplains and Drainage**

The project site is not within an area mapped on Flood Insurance Rate Maps prepared by the Federal Emergency Management Agency (FEMA). The project site is thus classified within Zone X, outside a designated floodplain. There are no known areas of local, unmapped flood hazard, due to the highly permeable surface and low rainfall.

### **3.2.6 Impacts and Mitigation Measures**

The proposed project would have no impact on water supply, water resources or floodplains. The habitat will include a water supply of 1,000 gallons that will require filling at least every 18 days via truck; current plans are to top off the tank weekly. As discussed in Section 3.9, below, both grey water and wastewater will be stored and transported offsite. Due to the very restricted nature of new impermeable surface associated with the project – essentially the 1,200 square feet of the footprint of the habitat and accessory structures – there will be no measurable runoff. In addition, the surrounding substrate of volcanic cinder and pahoehoe lava flows is extremely permeable and absorbs all precipitation or other water input immediately, with no runoff.

### **3.3. Biological Resources**

#### **3.3.1 Definition of Resource**

Biological resources are plant and animal species and the habitats in which they occur. This analysis divides these resources into flora and vegetation; fauna; and special status species, including threatened, endangered, and sensitive species and their defined critical habitat.

#### **3.3.2 Region of Influence**

The region of influence (ROI) for biological resources is concentrated on the approximately half-acre area directly affected by physical activities from the proposed project. Although the project should be able to avoid introduction of any invasive species, the ROI also includes high elevation areas of Mauna Loa and Mauna Kea that could be affected by invasive species that might gain a foothold in alpine areas because of activities associated with any the project in this biologically sensitive area.

#### **3.3.3 Flora and Vegetation**

As evident in Figures 2 and 3, the actual project site has very few individual plants because of its location on a previously graded substrate of volcanic ash. Undisturbed areas nearby on the ash and lava substrates contain the typical very sparse vegetation commonly found in similar substrates throughout Mauna Kea and Mauna Loa. Near the project site are a few small clusters of the native shrubs *kupaoa* (*Dubautia scabra*), *pukiawe* (*Leptecophylla tameiameiae*) and *ōhelo* (*Vaccinium reticulatum*). Cracks and undersides of rocks have a few mosses, ferns (*Pellaea ternifolia*) and lichens of various forms.

#### **3.3.4 Fauna**

There are no native mammals in Hawai'i except for Hawaiian hoary bats (*Lasiurus cinereus semotus*), which would not find the area suitable habitat because of the lack of vegetation that

provides roosting and foraging habitat. Similarly, the near absence of vegetation means that very few birds, whether native or alien, would be present.

The presence of feral, non-native goats and/or sheep was indicated by scat. These animals are deleterious to native flora but are valuable as hunting resources. The habitat is extremely marginal for goats or sheep and they are likely present only very occasionally.

Because there are rare native arthropods present in certain high elevation areas, and there is relatively little known about arthropod distribution in high elevation areas of Hawai‘i, the project included a survey for arthropods, the results of which are provided in Appendix 2. Six species of endemic but not rare arthropods were observed, as well as evidence of two moth larvae. The arthropods found during this survey are generally broadly distributed throughout the ‘a‘a and pahoehoe lava habitat types wherever their preferred microhabitat is present. There were no introduced invasive species except for some evidence of aphids on *Vaccinium reticulatum*, which are very commonly observed in this widespread plant. Importantly, no ants were observed.

### **3.3.5 Special Status Species**

No rare, threatened or endangered species were observed on the site or would find the site suitable habitat. However, the wide-ranging endangered Hawaiian Petrel (*Pterodroma sandwichensis*), and the threatened Newell’s Shearwater (*Puffinus auricularis newelli*), nest on the high mountains. The site does not appear suitable for nesting, but these birds may fly over the project site as they do many areas of the Hawaiian Islands. Fledglings of these birds at certain seasons may become disoriented by unshielded outdoor lighting and are vulnerable to injury or death.

### **3.3.6 Impacts and Mitigation Measures**

No impact to vegetation or flora would occur, as there are no plants on the actual site and only common alpine species nearby. As for fauna, there is a little or no use by native birds and no expected use by native Hawaiian hoary bats. The only other mammals very occasionally present are feral goats or sheep, which are not of conservation concern in Hawai‘i. The project would not cause impacts to native arthropods. Free-ranging predators and scavengers found in the substrates are also not likely to have their populations affected by disturbance in the small physical footprint of a half-acre or less.

To avoid the potential downing of Hawaiian Petrels and Newell’s Shearwaters by their interaction with outdoor lighting, no unshielded lighting will be permitted after dark during either construction or operation of the project. All lighting will be shielded in conformance with the Hawai‘i County Outdoor Lighting Ordinance (Hawai‘i County Code Chapter 9, Article 14), which requires shielding of exterior lights so as to lower the ambient glare caused by unshielded lighting.

Projects in relatively undisturbed alpine areas of Hawai‘i should endeavor to avoid introduction of invasive species. It should be noted that all of Mauna Loa Road as well as the specific project site are and have been open to the public and there are no measures in place by DLNR or any other entity to prevent alien species introductions. Furthermore, emplacement of the habitat will involve only very minor leveling with hand tools or a small loader/excavator, and no fresh foods or plant materials are involved in the experiment. Nevertheless, the project will proactively incorporate a number of measures to ensure that invasive plants and animals are not accidentally introduced to the environment. These measures are modified from invasive species protocol in the extremely sensitive summit ecosystem of Mauna Kea and will be incorporated in the project’s operating procedures:

- All vehicles, equipment and supplies destined for the project site will be inspected for invasive plants, insects or other animals prior to travel to the habitat project site, if there is any potential for invasive species. If any plants, insects, or other animals are observed in any vehicle, equipment, or delivery, the items will be cleaned and the species removed. If these are unfamiliar or known highly invasive species, the Hawai‘i Department of Agriculture (HDOA) will be contacted.
- If invasive species are found during an inspection process, one of three options will be undertaken, depending on the circumstances:
  1. Unpack and clean the delivery prior and repeat the inspection prior to leaving pier or other facility where found.
  2. Fumigate, using a State licensed and certified contractor appropriate to the threat identified, the container or delivery.
  3. Reject the delivery.
- If any off-Island motor vehicles and equipment (new or used) are involved, they will be pressure washed before first use at the project site.
- Contractors, subcontractors, and suppliers will be informed of these guidelines.
- Immediate coordination with the Office of Mauna Kea Management (OMKM) will occur if invasive species, particularly ants, are found on the site. Experts associated with OMKM can recommend a course of action, including authorities to contact.

### **3.4. Cultural Resources**

#### **3.4.1 Definition of Resource**

Cultural resources are defined as those sites, structures, landscapes, districts, objects, records, and lifeway skills that are of importance to a culture or community for historic, scientific, traditional, or religious reasons. Cultural resources are tied to places, persons, events, or practices of social custom and traditional skills and are recognized for their heritage, social, educational, and scientific value through the passage of state and federal laws for their protection.

Archeological resources are locations and objects from past human activities. Architectural resources are standing structures that are usually over 50 years of age and of significant historic or aesthetic value. Traditional cultural properties (TCPs) hold importance to Native Hawaiians or other ethnic groups for the continuing practice of traditional culture. Any of these properties may

meet the criteria for inclusion in the State Register of Historic Places. A determination of eligibility (Chapter 6e, Hawai‘i Revised Statutes) is a requirement of the Hawai‘i State environmental assessment process before State-funded initiation of ground disturbance or alteration of a landscape or structure.

### **3.4.2 Region of Influence**

The region of influence (ROI) for historic properties is concentrated on the approximately half-acre area directly affected by physical activities from the proposed project. Historic properties resources in areas outside this are not likely to experience any adverse effects from the proposed HI-SEAS/PISCES uses. The ROI for cultural resources is more difficult to define, because any impact to cultural practices related to the project may have impact to communities outside the immediate area, but for the present discussion it will be defined as the Hawaiian Islands.

### **3.4.3 Historic Properties**

As discussed previously, the project site is the end of a rough, unpaved road in a spot where vehicles have somewhat compacted the area, making it more suitable for the proposed use. There is no evidence of any archaeological features at or near the project site. What appears to be a modern cairn is located at the top of the ridge, well away from the area occupied by the project. Because of the extensive physical disturbance of the surface and the lack of manmade structures, it would appear that there is no potential to affect historic properties.

On November 15, 2012, the State Historic Preservation Division (SHPD) was requested by letter to concur that given the evident absence of historic properties, the project would not affect historic properties, or, if the agency was unable to make that determination based on the information provided, to recommend additional information or reports needed to assess the effect on historic properties. As of December 6, 2012, no response has been received. SHPD has also been provided a copy of the Draft EA for comment, and the Final EA will update the consultation and concurrence process.

### **3.4.4 Cultural Impact Assessment**

The Constitution of the State of Hawai‘i clearly states the duty of the State and its agencies is to preserve, protect, and prevent interference with the traditional and customary rights of native Hawaiians. Article XII, Section 7 requires the State to “protect all rights, customarily and traditionally exercised for subsistence, cultural and religious purposes and possessed by *ahupua‘a* tenants who are descendants of native Hawaiians who inhabited the Hawaiian Islands prior to 1778” (2000). In spite of the establishment of the foreign concept of private ownership and western-style government, Kamehameha III (Kauikeaouli) preserved the people’s traditional right to subsistence. As a result in 1850, the Hawaiian Government confirmed the traditional access rights to native Hawaiian *ahupua‘a* tenants to gather specific natural resources for customary uses from undeveloped private property and waterways under the Hawai‘i Revised

Statutes (HRS) 7-1. In 1992, the State of Hawai‘i Supreme Court reaffirmed HRS 7-1 and expanded it to include,

“native Hawaiian rights...may extend beyond the ahupua‘a in which a native Hawaiian resides where such rights have been customarily and traditionally exercised in this manner” (Pele Defense Fund v. Paty, 73 Haw.578, 1992).

Act 50, enacted by the Legislature of the State of Hawai‘i in 2000, relating to Environmental Impact Statements, stated that:

“...there is a need to clarify that the preparation of environmental assessments or environmental impact statements should identify and address effects on Hawaii’s culture, and traditional and customary rights... “[H.B. NO. 2895].

Material prepared for the Saddle Road Improvements Environmental Impact Statement (EIS) (FHWA-CFLHD 1999, Vols. IV and V) include a Cultural Impact Assessment (CIA) by Pualani Kanahahele Kanaka‘ole and Edward Kanahahele of the Edith Kanakaole Foundation, along with a study of Traditional Cultural Properties (TCPs) by Dr. Charles Langlas. These studies provide a thorough assessment of the cultural background and values in the Saddle between Mauna Kea and Mauna Loa. The studies included extensive archival research, interpretation of chants and *mele*, and interviews with Hawaiian Home Lands (HHL) homesteaders and others. Most of the cultural background information in this EA is derived directly from this study and the summary of it prepared for the Saddle Road EIS (Ibid., vol. 1), which is paraphrased or quoted directly below.

Native Hawaiian culture began at least 1,000 years ago when people from other Polynesian lands arrived to the Hawaiian Islands, *Hawai‘i nei*. Hawaiian culture developed independently from the rest of Polynesia, although there was intermittent input by later Polynesian visitors until at least the 1200s, when transoceanic voyages appears to have ceased. Stages of development of Hawaiian culture include the settlement era and the era of high culture.

- Settlement Era. The beginning date of the settlement era is not known with certainty, but it is likely to have occurred over a thousand years ago. The era encompasses settlement, development of stable water and food sources, and acclimatization of these settlers and their culture to the new environment. These settlers adapted beliefs and practices of their southern islands culture to the Hawaiian Islands. Their religious establishment, food culture, societal structure, and clan system were all altered to form a new Hawaiian culture.
- Era of High Culture. The era of high culture includes the refinement of the Hawaiian society in all aspects from 1200 to the time period of around 1800. This era of high culture saw the coalescing of political power through powerful military chiefdoms that at times took over an entire island or multiple islands. The state religion was an integral part of the political structure. This system was the *kapu* system, which became the backbone of the Hawaiian ruling caste and legal system. The *kapu* system regulated behavior and

dealt out punishment for infractions. Another parallel system, as powerful as the *kapu*, was the *'aumakua* worship, a worship system that serviced clans and extended families. This family worship utilized deified ancestors as their gods and guardians who were seen as empathetic yet powerful clan and family spiritual agents. These *'aumakua* provided security and support of the family system's cultural beliefs and practices.

In 1819, the *kapu* system was abolished by the ruling caste and the Hawaiian Kingdom evolved into a westernized constitutional monarchy. In 1893, the legal government of Queen Lili'uokalani was overthrown from power. A two generation decline in Hawaiian socioeconomic status took place during the 1900s and was not arrested until the "Hawaiian Renaissance" began in 1970.

The proposed project site is within the island of Hawai'i, the *'apana* (political land section or district) of Hilo and the *ahupua'a* of Humu'ula. The high elevation areas of the island are considered to have religious importance to Native Hawaiians. Place names reflect the relationship of this area of concern with the indigenous people, their philosophy of life, and their gods.

According to work by the Edith Kanaka'ole Foundation, *Lono-nui-akea* was the original name for the Island of Hawai'i. It is the sacred name of Lono, the god of stormy weather, dark clouds, and rain. Throughout Polynesia, two islands were honored as *Ka inoa akua* (the god name, or namesake), and the Island of Hawai'i was one of these.

The popular interpretation of Mauna Kea is "white mountain." Mauna Kea is known around the world, and is regarded by many as the highest island mountain, the highest mountain in the world from below sea level, and the best mountain from which to make astronomical observations. To the Native Hawaiian, Mauna Kea is a *Kupuna*, a grandparent or ancestor, and an *One hanau*, birthplace or home, and its name may more properly relate to Wakea, the Sky Father.

Another significant landmark within the project vicinity, located about 15 miles to the northwest, is Ka Pu'u-a-Pele. The top of this cinder cone marks the joining of the *'apana* of Kona, Kohala, and Hamakua.

In the words of Pualani Kanaka'ole Kanahale and Edward Kanahale:

"Wakea and Papa are the original parents of native Hawaiians. Mythologically they are the marriage of sky and earth: Wakea, Sky Father and Papa, Earth Mother. Between the two all things were born. Mauna Kea is the *piko* (center of a beginning or ending) of the island. This *piko* is the initial provider of the land mass of Hawai'i mokupuni. Hawai'i was also the *hiapo*, or first island child, of Papa and Wakea. The responsibilities and resources of Hawai'i and Wakea are needed for the growth and well-being of the island and all living forms of this mokupuni.

The *kalo* (taro, a staple food) was Wakea and Papa's first food child and regarded as an elder brother who fed all indigenous natives, or *kanaka maoli* from the beginning of time today. During the time of *ali'i* (chiefs, elite of the society) it was important for them to trace genealogy to the *kalo* and eventually to Wakea and Papa. When the genealogy could prove the connection they received the status of the senior line or hiapo line. Mauna Kea falls in the senior line genealogy.

The Wakea and Papa beliefs and practices, including the tribute and respect for hiapo and kupuna, extend to contemporary times. Ancestral memory reminds the native Hawaiian that the mountain, like their parents, is the well-spring and provider of physical and spiritual nourishment.

Strands of information from the past are found today in songs and people's actions. Besides land, water is a vital element of life and living. The high mountains attract clouds, then the clouds shed their water and the water soaks into the earth.

The Pohakuloa area has Lilinoe as the female deity of misty rain and heavy fog, while Poliahu is the snow deity which adorns the top of Mauna Kea during the winter. These male and female water forms both belong to the Mauna Kea area.

The ancestors of Native Hawaiians were island people and used the ocean to travel from island to island. Due to the vastness of the ocean and the limited land base, the measurement for survival was the ability to acquire food. Resources for the acquisition of food included the reef, fresh water, and fertile soil. The Hawaiian moon calendar was devised to assist Hawaiians in gathering and planting on fortuitous days. Using the moon calendar, the forefathers calculated the established cycles of all life forms. It was based on many generations of observation and practice, and it proved successful.

Other forms of traditional literature condone the fact that the ancestors made an effort to understand the intricacy of relationships of diverse life forms. One of the reasons for this was to protect and help sustain the food sources. They recognized a hierarchical order as well as a system of harmony and interaction of all existing life forms known to them.

They observed and made critical analyses of their sky, land, and ocean spaces. Rain, ocean, clouds, wind movement, coral species of the ocean, and seeded plants of the uplands are referred to within a common bond for generating regrowth or as a food source. Kane was responsible for regeneration, and the ocean currents, rain, wind, and clouds move together to make this possible. For food systems to regenerate themselves, the sky, land, and ocean spaces unite in a harmonic and natural rhythm to maintain the currents of water particles and clean air. This movement is known as *lokahi*. Lokahi is a system of working in unity and harmony. This knowledge was passed on through protocol, cultural practices, songs, and stories.

Lokahi is the antithesis of hierarchy. Lokahi is the system which bypasses the *hiapo* system and does not give precedence to first born or senior line. It is the system which states that everything is equal because everything, no matter how small or large, has a function which is necessary to maintain the overall well being of the whole entity. Native Hawaiian ancestors lived within these two systems and measured everything by this frame of reference.

One example is the division of ocean, sky, and land. These spaces were divided horizontally and vertically. The land division would be of primary concern for the proposed project. The most familiar is the vertical divisions, or *moku* and *ahupua'a* sections common to maps of today. The boundary lines run from mountains to the ocean. The vertical boundaries followed mountains, rivers, streams, and cinder cones.

The natural vegetation growth was the measuring device for the horizontal pattern of the second land division. For this division, vegetation growth dictated land division name changes. The forest, like the coral bed, is the food source and therefore a vital system for the continuum of life and life cycles. The trees house food for birds, insects, animals, and man, and produce seeds for regeneration. The forest provides vegetation used for medicinal purposes, spiritual adornment, housing construction, and many other items. The following information identifies the horizontal space and the kinds of flora typical to each of these horizontal land areas.

Kuahiwi. Kuahiwi means the mountain top, the backbone of the island, which is too high in elevation for heavy vegetation to grow. It is a very important area because of its height.

Kualono. Kualono is the region near the mountain top. Little vegetation grows in this area. The mamane and naio are the only hardy trees to grow at this height. Both of these are hardwood trees. The flower of the mamane was a specialty for the ali'i because of its shape and yellow color. When he wanted a special lei he would send his runners to fetch mamane flowers. 'A'ali'i can also be found at this height. The PISCES project site is within the Kualono.

Waoma'ukele. Waoma'ukele is the region named for the wet, soggy ground. This area was located in the rain belt of the island, especially on the ko'olau side of each island. The typical trees of this area are the very large koa, 'ohi'a, varieties of lobelia, and mamane.

Waoakua. Waoakua is the forested region below the waoma'ukele. This area is said to be occupied by spirits of the forest. Man seldom ventured into this area during ancestral times except when a particular kind of tree was needed and could not be found elsewhere. The large trees acquired from the waoakua and the waoma'ukele deserved substantial offerings. This is the region where the forest

had a greater variety of trees. Some of the trees found are kolea, ho'awa, kopiko, maile, maua, alani, koa, and 'ohi'a.

Waokanaka. Waokanaka is the forested region *makai* (toward the sea) of the waoakua. This area was frequented by native Hawaiians. They found wood and other materials for weapons, house construction, tools, surfboards, and canoe accessories. They harvested dye, collected medicine, collected bird feathers, gathered vegetation for leis, gathered vegetation for the kuahu, gathered material for making rope, and many other useful things for everyday living. The trees in the waoakua are also found in this area, but the trees of this area may be smaller. Other flora found in this area include pilo, hapu'u, holei, papala, hau kuahiwi, palapalai 'olapa, and mamaki.

Kula. Kula referred to the upland grassy plains. The plants of the kula included 'ilima, ma'o, 'ama'u, 'a'ali'i, 'uluhe, and pili.

Kahakai. Kahakai referred to the edge of the ocean. At the kahakai was found the niu, hala, kaunaoa, kamani, hau, milo, naupaka, lama, and alahe'e. All plants were recognized as useful to the Hawaiian (FHWA-CFLHD 1998, Vols. IV and V)."

In evaluating the effects of the Saddle Road Improvements project, which occupied many of the zones listed above, the Edith Kanakaole Foundation identified these resources and concepts as of sufficient importance to potentially affect the quality of life for native Hawaiians and their relationship to the environment and land.

- Importance of vegetation and the identity of the land sections.
- High cultural value of older or larger trees and kipuka which normally housed older trees.
- Priority to promote new growth through the non-disturbance of seed producing forest areas within the *waoma'ukele* and *waoakua*. Hawaiians did not penetrate these areas if the trees they needed were available elsewhere.
- Importance of food source and regenerative energy of the forest.
- Philosophy of "a life for a life." When it was necessary to cut a large tree from the high forest, an offering of a human sacrifice was made.
- Importance of *Waoma'ukele* as a good source of water, and for maintaining the richness of the rainforest.

Again, quoting Pualani Kanaka'ole Kanahele and Edward Kanahele:

"Native Hawaiians are people whose daily lives and culture are rooted in and integrated with the surrounding natural and biological world. They recognized and practiced respect for hierarchy or hiapo for man and land alike. The mountain is the sacred child of Wakea, and it is the source for the land. The mountains and land were genealogically connected to native Hawaiians through the original ancestor, Wakea and Papa. The mountains or land, water, and sky were a necessary part of the life cycle. The taro was regarded as an

older brother of the land and provided sustenance. The coral was also an older brother (of the sea) and was the means through which other food could be acquired. The hierarchical system assigns rank to man, god, and the elements of the environment. Within the hierarchical food system another set of rules apply. The older or larger trees are primary and most important. The other animals that use these trees as their residence or food source are secondary.

The lokahi system complements and maintains the well being of the whole entity. Everything is important because each has a function.

Water was and is necessary for all life forms. Laws for water and the use of water were formulated so all had exposure to water. Water that did not touch ground was highly prized. Such as the water in the lake on Mauna Kea and the water in the piko of the taro leaf. Water that moved underground or over land from the mountain to the sea was sometimes funneled into irrigation channels and fed the older brother kalo and was also treasured. The mountain and the waoma‘ukele attracted the atmospheric water” (FHWA-CFLHD 1998, Vols. IV and V).

The resources of high importance in the Saddle area that were determined to be important as part of the above analysis were the *mamane* forest, *kipuka*, prehistoric trails, and historic trails. The cultural value of *mamane/naio* forest and *kipuka* is associated with the age and size of the trees. Although it would not be asserted that the setting of the PISCES project site renders it without cultural value, as all places and all elements of the landscape are bound together into a whole, each part of which has a function, it is important to note that no *māmane* trees, *kipuka* or trails are present on or near the project site.

An interview with Henry Auwae conducted by Dr. Charles Langlas as part of the Saddle Road project’s Traditional Cultural Properties report is relevant to any study of traditional resources and practices in the Saddle region. Mr. Auwae’s knowledge of these sites may have been unique. He was the only one of informants recommended through contact and coordination with native Hawaiian organizations, which included former cowboys from Parker Ranch and Pu‘u O‘o Ranch, who professed knowledge of cultural sites in the area. Mr. Auwae attained his knowledge about ritual sites and burials from his great grandparents, who adopted him, and imparted their knowledge to him. When he was a boy, his great grandparents journeyed with him several times through the Saddle. His great grandmother was an expert healer (*kahuna la‘au lapa‘au*) who traveled to see people who were sick and to collect medicinal plants, and his great grandfather the last of a line of prophets (*kula*). In her role as a healer, his great grandmother. His great grandparents had specialist knowledge of ritual sites that they shared with Mr. Auwae when they traveled together. Although elderly at the time, he was gracious enough to be interviewed on five occasions as part of the Saddle Road project, and two helicopter trips were made to attempt to locate sites that he recalled from childhood visits or from other knowledge.

Mr. Auwae knew of two areas where people used to live and where there were Hawaiian burials, one on the west side and one in the Saddle. Mr. Auwae said there were Hawaiian graves in the

Keamuku area, near Waiki‘i Ranch, on the far western side of the Saddle. Mr. Auwae also knew of “villages” north of the present Saddle Road on the lower slopes of Mauna Kea, at an elevation where several springs existed, and he knew of graves in that area. He said there were formerly Hawaiian burials in the area of Bradshaw Army Airfield in the PTA, and to the southeast of Mauna Kea State Park in the PTA. Both areas were heavily bulldozed by the Army after World War II and he thought that nothing remained of the graves. With Mr. Auwae’s assistance, followed up by on the ground survey of each of the many original alternative corridors considered in the Saddle Road EIS, the Saddle Road Improvements project avoided impacting or approaching any burials. None of the five ritual sites that Mr. Auwae knew of could be definitely located because no stone remains of the sites were found. Mr. Auwae designated approximate locations for the sites, which were all far away from the proposed PISCES location.

Inspection of the half-acre PISCES site with the project team, which includes Native Hawaiians familiar with both the site and the type of resources and settings that are important in Hawaiian cultural practices, did not reveal the type of resources on the site that would be important. Although all of the landscapes in the Hawaiian Islands can be said to be linked together and thus have cultural significance, no gathering resources such as plant material or wood are present on this small site, and there are no *pu‘u*, springs, or other physical features that might have a role in cultural practice any association with legendary or divine beings.

#### *Consultation Specifically for PISCES Project Site*

As part of early consultation, a letter describing for the project and requesting input on site conditions and potential impacts was provided to the Office of Hawaiian Affairs and the State Historic Preservation Division, as well as all members of the PISCES Cultural Advisory Committee, which was set up by PISCES to ensure that their actions minimized impacts to cultural resources. Members include:

- Robert Lindsey
- Ahia Dye
- Lehua Veincent
- Frank Trusdell
- Kamaka Gunderson
- Koa Omphroy
- Kimo Pihana
- Nate Chang
- Ka‘iu Kimura
- Kalepa Baybayan

To date, there has been no response from OHA and SHPD. Although the cultural committee members have not yet provided any specific information relative to cultural sites or practices potentially present or impacted, and several voiced support for the project and its potential to improve educational opportunities, general concerns expressed include the following:

- Cumulative impacts related to other projects planned within the next five years
- Relation to other projects on Mauna Kea
- Assurances regarding cleanup after the project is completed

### **3.3.5 Impacts and Mitigation Measures**

The project should not have adverse impacts on any cultural resources or practices. The area does not appear to have a special cultural significance, and no gathering practices or resources are known from the site or nearby area. The project site will be blessed in a traditional Hawaiian ceremony to honor the land and ask permission for its use, and the site will be respectfully restored to its original condition at the end of the experiment. As discussed in Section 3.11, there are no other projects nearby with which cultural impacts would tend to accumulate.

## **3.5. Air Quality**

### **3.5.1 Definition of Resource**

Although the *Clean Air Act* (42 USC 85 parts 7401 et seq., 1999) is a federal law, States are generally responsible for implementing the Act. Each State is required by the EPA to develop a State Implementation Plan that contains strategies to achieve and maintain the National Ambient Air Quality Standards (NAAQS). NAAQS establish limits for six criteria pollutants including ozone, nitrogen dioxide, carbon monoxide, sulfur dioxide, lead, and breathable particulates (PM10, or particulate matter less than 10 microns in diameter). EPA has set national ambient air quality standards (NAAQS) for six of the following criteria pollutants; ozone (O<sub>3</sub>), particulate matter (PM 2.5 and 10), nitrogen dioxide (NO<sub>2</sub>), carbon monoxide (CO), sulfur dioxide (SO<sub>2</sub>), and lead (Pb). The entire state of Hawai‘i is classified as in attainment, meaning criteria air pollutants do not exceed the NAAQS. Areas that violate air quality standards are designated as nonattainment areas for the relevant pollutants. Areas that comply with air quality standards are designated as attainment areas for relevant pollutants.

### **3.5.2 Region of Influence**

The region of influence (ROI) for air quality is defined as the Saddle region, because prevailing winds could carry pollutants that might be generated from any project at this particular site throughout the entire Saddle region. A semi-persistent inversion layer at about 7,000-8,000 feet in altitude tends to limit effects to areas below this elevation. A sensitive receptor as far as air quality is concerned is present about seven miles to the southwest at the Mauna Loa Observatory (MLO), which is a premier atmospheric research facility that has been continuously monitoring and collecting data related to atmospheric change since the 1950s. The undisturbed air, remote location, and minimal influences of vegetation and human activity at MLO are ideal for monitoring constituents in the atmosphere that can cause climate change. The observatory is part of the National Oceanic and Atmospheric Administration (NOAA) - Earth System Research Laboratory - Global Monitoring Division.

### **3.5.3 Existing Conditions**

The entire state of Hawai‘i is classified as in attainment, meaning criteria air pollutants do not exceed the NAAQS. Local air quality is excellent and uninfluenced by human activities. Air pollution is mainly derived from volcanic emissions of sulfur dioxide, which convert into particulate sulfate and produce a volcanic haze (vog) that persistently blankets the Ka‘ū and Kona areas of the islands at lower elevations. The trade wind inversion generally keeps this area free of vog.

### **3.5.4 Impacts and Mitigation Measures**

Preparation of the project site will involve only very minor leveling with hand tools or a small loader/excavator, and therefore dust generation will be negligible. The generator and visiting service vehicles will produce very small quantities of engine pollutants, but these are negligible compared to the thousands of vehicles and other equipment with engines operating in the Saddle region. No mitigation measures are necessary, other than keeping all equipment in good working order.

## **3.6 Noise and Visual Resources**

### **3.6.1 Definition of Resource**

The acoustic environment is defined as sound levels related to wildlife habitat and human health and enjoyment, which can be affected by noise, defined as unwanted sound.

The visual environment includes scenic areas, vistas and viewplanes, whether at the project site or with which the project can potentially interact.

### **3.6.2 Region of Influence**

Sound from the type of activities proposed for the site would carry no more than a few hundred meters, and would generally be blocked from traveling east because of the ridge of cinder cones and prevailing easterly winds. The region of influence (ROI) for noise is defined as the area within 400 meters of the site.

The region of influence (ROI) for visual resources is defined as all parts of the Saddle region from which the project site is visible.

### **3.6.3 Existing Conditions**

No sensitive human or wildlife noise receptors are present within the noise ROI, which is completely occupied by lava with little or no vegetation.

There are currently no manmade structures at the project site, which has views of/is visible from the south slope of Mauna Kea, portions of the north slope of Mauna Loa, Mauna Loa Observatory, portions of Pohakuloa Training Area and Pu‘u Huluhulu, a commonly visited cinder cone on Saddle Road that offers sweeping view of the Saddle. Because of the project site’s position on the west side of the cinder cone ridge, it is not visible from points east, including the closest section of Mauna Loa Road.

No scenic resources, including important viewplanes or scenic sites recognized in the Natural Beauty chapter of the Hawai‘i County General Plan, are present at or near the project site.

### **3.6.4 Impacts and Mitigation Measures**

The project may involve occasional light generator noise, but because of the lack of sensitive receptors, but there will be no noise impacts to any sensitive receptors.

The proposed habitat and accessory structures will introduce a temporary manmade element into the landscape that will be easily visible to anyone directly on the former quarry site. From public viewpoints from Mauna Kea, Mauna Loa, and Mauna Loa Observatory and Pu‘u Huluhulu, the structures will be extremely difficult to see. From the closest vantage, two miles away on Mauna Loa Road, a 20-foot tall structure will have the prominence of the width of a typical pencil lead – about 1/20<sup>th</sup> of an inch – held at arm’s length. From Mauna Kea, 15 miles away, the object would appear just taller than the width of a human hair, which would likely be indiscernible against its background without binoculars. With coloring designed to blend into the cinder, the habitat will not likely be noticed from any public vantage point, and will have no scenic impacts. After the end of the experiment, the habitat and accessory structures will be removed and the site will be restored, permanently erasing any visual impact.

## **3.7 Socioeconomics and Land Use**

### **3.7.1 Definition of Resource**

Socioeconomic analyses can encompass investigations of population, income, employment, and housing conditions of a specific area. Because of the very minor nature of the project and the lack of nearby affected communities, the socioeconomic issues considered in this analysis are conformance with land use designations, education and recreation.

### **3.7.2 Region of Influence**

The region of influence (ROI) for socioeconomics and land use is defined as the Island of Hawai‘i, that will most directly experience the project’s presence and benefits.

### **3.7.3 Existing Conditions**

Population on the Big Island doubled from about 92,000 in 1980 to over 185,000 in 2010 (Hawai‘i DBEDT 2010). Although East Hawai‘i still has most of the island’s residents, much growth over the last 15 years has been concentrated in West Hawai‘i, where most tourist resorts and hotels are located. On any given day, visitors account for over 5 percent of the de facto population – and most are in West Hawai‘i.

The Saddle between Mauna Loa and Mauna Kea is nearly unoccupied, although there is a scattering of residences on Department of Hawaiian Home Lands pastoral lots in Humu‘ula, about 7 miles north of the project site (see Figure 1). The general area is used for recreation, primarily hunting in vegetated portions of the Mauna Loa and Upper Waiakea Forest Reserves. There is also limited hiking in this area of Hawai‘i Volcanoes National Park, a section of which is located about five miles south of the project site (see Figure 1). Military uses predominate in the area northwest, which is part of the U.S. Army’s Pohakuloa Training Area (see Figure 1).

### **3.7.4 Land Use Designations and Permits**

#### *Forest Reserve Designation and Special Use Permit*

The project site itself is within the Mauna Loa Forest Reserve. This portion of the Forest Reserve is in DLNR Hunting Unit E, where wild pig, sheep and goats may be taken by archery only, with no dogs permitted. It is open year-round on weekends and holidays, and bag limits apply. Bird hunting in season according to regulations is also allowed. Research activities such as the one proposed are allowed with a Special Use Permit from the Hawai‘i State Board of Land and Natural Resources (BLNR) pursuant to the State of Hawai‘i’s Forestry Rules at §13-104-18, Hawai‘i Administrative Rules. Special uses include activities such as meetings, weddings, concerts, shows, and other community events or activities and scientific collection of plants and animals. Permits are granted for activities considered compatible with the functions and purposes of a unit within a forest reserve. An application for a Special Use Permit is considered on its own merits, including its effect on the premises, facilities, and the public’s use and enjoyment of the forest reserve. As the project would not adversely affect the forest reserve, it would appear to meet the standards for granting of a Special Use Permit.

#### *Conservation District Use Permit*

All land in the State of Hawai‘i is classified into one of four land use categories – Urban, Rural, Agricultural, or Conservation – by the State Land Use Commission, pursuant to Chapter 205, HRS. The project site is classified within the State Land Use Conservation District, Resource Subzone. Any proposed use must undergo an examination for its consistency with the goals and rules of this district and subzone. The applicant will prepare a Conservation District Use Application (CDUA), to which this EA will be an appendix. The project consists of a temporary research project conducted by the University of Hawai‘i to collect data on human adaptation to a space analog environment. The action is therefore a *Data Collection Use* as defined in Section

13-5-22 (P-1, D-1), which is defined as “Data collection, research, education, and resource evaluation that involves permanent facilities or structures larger than 500 square feet or a land use causing significant ground disturbance or impact to a natural resource.”

The CDUA will be the formal application for a permit and evaluation of the consistency of the project with the criteria of the Conservation District permit process. Briefly, the following individual consistency criteria should be noted.

*1. The proposed land use is consistent with the purpose of the Conservation District;*

The purpose of the Conservation District is 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 action is consistent with this purpose, in that it will contribute to public welfare through education and research, without jeopardizing any natural resource.

*2. The proposed land use is consistent with the objectives of the subzone of the land on which the use will occur;*

The proposed action is consistent with the objectives of the Resource Subzone, which is to ensure, with proper management, the sustainable use of the natural resources of these areas. The action involves a properly managed use that ensures sustained use of the natural resources of the area by being located away from important natural resources and taking measures to avoid any impacts.

*3. The proposed land use complies with provisions and guidelines contained in Chapter 205A, Hawaii Revised Statutes (HRS), entitled "Coastal Zone Management," where applicable;*

The property is not within Special Management Area (SMA) and is not otherwise subject to the provision of the CZM regulatory process. The project is not inconsistent with the goals or objectives of the CZM program.

*4. The proposed land use will not cause substantial adverse impact to existing natural resources within the surrounding area, community or region;*

The proposed action will include mitigation measures to prevent soil erosion. The proposed project will have no adverse impacts to historic sites or to the scenic character of the area. No substantial adverse impact will occur to existing natural resources.

*5. The proposed land use, including buildings, structures and facilities, shall be compatible with the locality and surrounding areas, appropriate to the physical conditions and capabilities of the specific parcel or parcels;*

The proposed action is compatible with the former use as a cinder quarry and due to its very minor character is not incompatible with adjacent open space uses.

*6. The existing physical and environmental aspects of the land, such as natural beauty and open space characteristics, will be preserved or improved upon, whichever is applicable;*

The current site has already been modified for cinder quarrying, and the temporary project will not adversely alter any existing physical, environmental or open space characteristics.

*7. Subdivision of land will not be utilized to increase the intensity of land uses in the Conservation District;*

The proposed action does not involve or depend upon subdivision.

*8. The proposed land use will not be materially detrimental to the public health, safety and welfare.*

The proposed action will enhance the quality of higher education in Hawai'i and will have a beneficial effect upon public welfare.

#### *County Land Use Designations and Policies*

The County designates the site Conservation in the General Plan Land Use Pattern Allocation Guide Map (LUPAG), and the use is considered consistent with the LUPAG (see letter from Planning Department in Appendix 1a). It is not within the Special Management Area, which is meant to protect coastal resources.

According to the Planning Department (see letter in Appendix 1a), the project is consistent with County land use designations, and fulfills policies in the General Plan related to the economy:

2.3 (b) Encourage the expansion of the research and development industry by working with and supporting the University of Hawaii at Hilo and West Hawaii, the Natural Energy Laboratory at Hawaii Authority and other agencies' programs that support sustainable economic development in the County of Hawaii.

2.3 (f) Support all levels of educational, employment and training opportunities and institutions.

2.3 (i) Continue to encourage the research, development and implementation of advanced technologies and processes.

### **3.7.5 Impacts and Mitigation Measures**

The project would have no adverse effect on socioeconomics or land use. No displacement or effects to existing populations or land uses would occur. The project would benefit society by providing unique educational opportunities in the STEM (Science, Technology, Engineering and Mathematics) fields.

Gating the cinder road approximately 2,300 feet west of Mauna Loa Road will temporarily remove vehicular access to the site except for the project managers and those might absolutely require such access and who receive permission from the Division of Forestry and Wildlife, as discussed in Part 1. Because there are no known cultural or recreational uses of the cinder area, including hunting, this should not seriously inconvenience any parties, including hunters, who could access the surrounding area on foot, although game resource are extremely scarce in this unvegetated area. Once the experiment is complete, the gate will be removed and the access to this former cinder quarry could be restored.

The project appears to be is consistent with all land use designations, a finding which will be conclusively determined as part of the application for a DLNR-DOFAW Special Use Permit and a Conservation District Use Permit. Consultation with the County Department of Public Works and Planning Department after final design plans are complete will determine whether grading permits and building permits will be required.

## **3.8 Safety and Environmental Health**

### **3.8.1 Definition of Resource**

For the purposes of this EA, safety and environmental health refer to existing recognized environmental conditions (RECs) such as hazardous materials, toxic substances or hazardous conditions that have the potential to affect public health or safety.

### **3.8.2 Region of Influence**

The region of influence (ROI) for safety and environmental health is the approximately half-acre area directly affected by physical activities from the proposed project. The issue of water quality is discussed in Section 3.2, above.

### **3.8.3. Existing Conditions**

No Phase I Environmental Site Assessment was performed for the project site, but visual inspection of the site, which contains only compacted volcanic ash, indicates no obvious evidence of contamination or hazardous conditions. The quarrying activity that occurred previously involved simple excavation and is unlikely to have left any significant contamination issues.

### **3.8.4 Impacts and Mitigation Measures**

The project will not involve the use of hazardous materials or toxic substances, with the potential exception of small quantities of fuel and oil for a generator. The fueling area for the generator will be designed so that a small spill can be confined and cleaned up, and all refueling will be undertaken by trained professionals in conformance with all regulations and best practices.

### **3.9 Utilities**

No electricity, telephone, water supply or wastewater utilities are present in the area or needed for the project. There will be no impact on utilities.

Power will be supplied either by a fully self-contained power provider (“Power Tower”) equipped with data and communications hardware, and/or an ultra-quiet and efficient Winco PSS21 LPG-fueled generator or similar. On-site wastewater will be stored in 320 gallon “transport tanks” from Chemtainer Hawaii, which are low enough to fit under the habitat but which may also be located slightly downslope. Two tanks will be utilized, in order to always have one hooked up to the habitat while the other is transported to the wastewater plant for disposal and treatment. The project will generate wastewater at 300 to 350 gallons per week. Tanks will be pumped out by Kona Lua as needed, probably every 10 days or so. Each wastewater tank will be placed on a heavy duty 12’ x 12’ waterproof tarp laid over a square frame of 1"x 6" x 8' boards; the tarp and boards will form a shallow basin around the tank sufficient to contain any small spills.

### **3.10 Traffic and Transportation**

The site is accessed from Hilo and PISCES headquarters by the Saddle Road (State Route 200) a formerly substandard road that has been improved by the Federal Highway Administration (FHWA) and for most of its length represents the most modern highway on the island, and then Mauna Loa Road, a one-lane road used primarily by workers and suppliers at Mauna Loa Observatory (see Figure 1). Servicing the inhabitants of the habitat will require 1 to 2 trips per week, including supplying food and water and removing wastewater. This level of extra vehicular activity will have no effect on traffic on Saddle Road, with its approximately 2,000 vehicles per day (vpd) in 2012 (pers. comm. R. Terry with FHWA). Traffic on Mauna Loa Road is not metered but probably amounts to a few hundred vpd, at most. Vehicles traveling downhill on Mauna Loa Road are usually obliged to pull over when an uphill-traveling vehicle approaches. Every additional trip adds to the potential for such an encounter, but given the low number of trips, this will not significantly impact traffic on this road.

### **3.11 Cumulative Impacts**

#### **3.11.1 Planned and Reasonably Foreseeable Projects**

No construction or other projects involving an active land use are known to be occurring within a two-mile radius. Three to ten miles distant within Pohakuloa Training Area (PTA) there is a planned expansion of training facilities. In 2011, the U.S. Army published a Notice of Intent in the Federal Register that it plans to prepare a programmatic environmental impact statement (PEIS) to evaluate the impact of modernize training ranges, infrastructure, and support facilities at PTA. The project includes constructing and operating an Infantry Platoon Battle Area that would include an Infantry Platoon Battle Course, Live-fire Shootouse, and a Military Operations on Urban Terrain facility. None of these activities would interact in any way with the proposed HI-SEAS/PISCES project.

Ten miles north, also within PTA, a research exploratory well project is about to begin drilling (UH Hawai‘i Institute of Geophysics and Planetology 2012). This project will evaluate deep aquifers and assess the potential to develop this water resource for use by PTA, Hawaiian Home Lands and the Mauna Kea Observatories. This activity would not interact in any way with the proposed HI-SEAS/PISCES project.

A consortium of governments and institutions is planning the Thirty Meter Telescope (TMT), a large segmented mirror reflecting telescope to be built on the North Plateau of Mauna Kea (UHH 2010). This billion dollar project is expected to be built starting in the last half of the current decade and will involve traffic and construction impacts, both on Mauna Kea and at support facilities in Hilo. None of the TMT activities would interact in any way with the proposed HI-SEAS/PISCES project.

As discussed above, PISCES is an international research and education center dedicated to the development, verification and validation of new technologies needed for operations on the Moon, Mars and beyond. PISCES projects are centered on limited and carefully monitored sites mostly on the lower slopes of Mauna Kea. Although PISCES is ideally suited to manage the HI-SEAS experiment, and there is great synergy in the relationship with the HI-SEAS project, there does not appear to be any potential for interaction of adverse impacts that could occur at the HI-SEAS project site and other PISCES locations, which are about 10 miles away.

#### **3.11.2 Cumulative Impacts and Mitigation Measures**

Cumulative impacts result when implementation of several projects that individually have limited impacts combine to produce more severe impacts or conflicts in mitigation measures. The adverse effects of the project – minor and temporary disturbance to air quality, noise or visual quality– are very limited in severity, nature and geographic scale. As discussed above, the projects known to be occurring nearby will not generate impacts with which the very minor and temporary effects from the HI-SEAS/PISCES project would accumulate, and no cumulative impacts are foreseen.

## **PART 4: STATE OF HAWAI‘I FINDINGS**

Chapter 11-200-12, Hawai‘i Administrative Rules, outlines those factors agencies must consider when determining whether an Action has significant effects:

1. *The proposed project will not involve an irrevocable commitment or loss or destruction of any natural or cultural resources.* No valuable natural or cultural resources would be committed or lost. The site is unvegetated, with no water bodies, and there are no cultural resources present.
2. *The proposed project will not curtail the range of beneficial uses of the environment.* The proposed temporary project in no way curtails beneficial uses of the environment in this area, which will be restored to its original condition after use is complete.
3. *The proposed project will not conflict with the State's long-term environmental policies.* The State’s long-term environmental policies are set forth in Chapter 344, HRS. The broad goals of this policy are to conserve natural resources and enhance the quality of life. The proposed action does not adversely affect the environment and is highly beneficial for education. It is thus consistent with all elements of the State’s long-term environmental policies.
4. *The proposed project will not substantially affect the economic or social welfare of the community or State.* No adverse effects to the economic or social welfare will occur.
5. *The proposed project does not substantially affect public health in any detrimental way.* No effects to public health are anticipated.
6. *The proposed project will not involve substantial secondary impacts, such as population changes or effects on public facilities.* No adverse secondary effects are expected to result from the project, which is not significant enough to directly or indirectly tax public infrastructure or facilities.
7. *The proposed project will not involve a substantial degradation of environmental quality.* The proposed action is minor and is being regulated by permits to avoid environmental degradation, and thus would not contribute to environmental degradation.
8. *The proposed project will not substantially affect any rare, threatened or endangered species of flora or fauna or habitat.* The project site has no vegetation. Impacts to rare, threatened or endangered species of flora or fauna will be prevented by mitigation measures to avoid impacts to fledgling seabirds and prevent introduction of invasive species.
9. *The proposed project is not one which is individually limited but cumulatively may have considerable effect upon the environment or involves a commitment for larger actions.* The project does not interact with other activities in the region in such a way as to produce adverse cumulative effects or involve a commitment for larger actions.
10. *The proposed project will not detrimentally affect air or water quality or ambient noise levels.* Due to the character and density of the proposed action, no adverse effects on these resources would occur.
11. *The project does not affect nor would it likely to be damaged as a result of being located in environmentally sensitive area such as a flood plain, tsunami zone, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal area.* The project site, like

much of the Big Island, is subject to lava inundation, but due to the temporary nature of the project and the mobility of the structures being emplaced, there is little risk.

12. *The project will not substantially affect scenic vistas and viewplanes identified in county or state plans or studies.* No aspect of the proposed action would adversely impact scenic resources or viewplanes.
13. *The project will not require substantial energy consumption.* Although construction and operation of the habitat will require the use of energy, no major adverse effects to energy consumption would be expected, and there is no feasible way to undertake the project without energy consumption.

Based on evaluation of the environmental setting and impacts, the University of Hawai‘i at Manoa expects to determine that the proposed action will not have a significant effect upon the environment and is thus expected to issue a Finding of No Significant Impact (FONSI). This finding will be made in consideration of comments on the Draft EA.

## PART 5 REFERENCES

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- Wolfe, E.W., and J. Morris. 1996. *Geologic Map of the Island of Hawai'i*. USGS Misc. Investigations Series Map i-2524-A. Washington, D.C.: U.S. Geological Survey.

## **PART 6 PERSONS AND AGENCIES CONTACTED**

- Kamana‘opono Crabbe, CEO, Office of Hawaiian Affairs
- EPO Manager, Hawai‘i State Department of Health
- Russell Tsuji, Administrator, Hawai‘i State Land Division
- Pua Aiu, Administrator, State Historic Preservation Division
- Warren Lee, Director, Hawai‘i County Dept. Public Works
- Harry Kubojiri, Chief, Hawai‘i County Police Department
- Bobby Jean Leithead-Todd, Director, Hawai‘i County Planning Dept.
- Hawai‘i County Council
- Benedict Fuata, Director, Hawai‘i County Civil Defense Agency
- Darren Rosario, Chief, Hawai‘i County Fire Department
- Sierra Club, Moku Loa Group
- PISCES Cultural Advisory Committee:
  - Robert Lindsey
  - Ahia Dye
  - Lehua Veincent
  - Frank Trusdell
  - Kamaka Gunderson
  - Koa Omphroy
  - Kimo Pihana
  - Nate Chang
  - Ka‘iu Kimura
  - Kalepa Baybayan

## **PART 7 LIST OF PREPARERS**

Ron Terry, Ph.D., Geography  
20 years preparing EAs and EISs  
Geometrician Associates LLC

# **HI-SEAS/PISCES Mars Habitat Project**

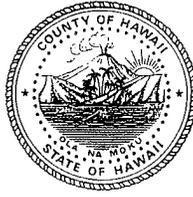
## **Environmental Assessment**

### **APPENDIX 1a**

#### **Comments in Response to Pre-Consultation**

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**William P. Kenoi**  
*Mayor*



**Harry S. Kubojiri**  
*Police Chief*

**Paul K. Ferreira**  
*Deputy Police Chief*

## **County of Hawai'i**

### **POLICE DEPARTMENT**

349 Kapiolani Street • Hilo, Hawai'i 96720-3998  
(808) 935-3311 • Fax (808) 961-8865

October 15, 2012

Mr. Ron Terry, Ph.D.  
Project Environmental Consultant  
Geometrician Associates  
P. O. Box 396  
Hilo, HI 96721

Dear Mr. Terry:

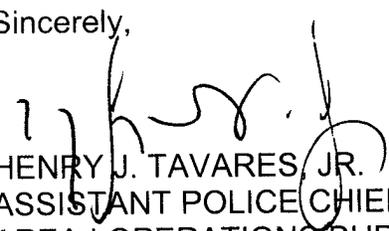
**SUBJECT: EARLY CONSULTATION FOR ENVIROMENTAL ASSESSMENT FOR  
PISCES HI-SEAS MARS HABITAT PROJECT IN STATE LAND USE  
CONSERVATION DISTRICT ON MAUNA LOA, TMK (3<sup>RD</sup>) 3-8-001:001,  
HUMU'ULA,HAMAKUA DISTRICT, ISLAND OF HAWAII**

Staff, upon reviewing the provided documents, does not anticipate any significant impact to traffic and/or other public safety concerns. We are not requesting a copy of the Draft EA when completed.

Thank you for allowing us the opportunity to comment.

If you have any questions, please contact Captain Richard Miyamoto, N. Hilo/Hamakua Patrol Commander, at 775-7533.

Sincerely,



HENRY J. TAVARES, JR.  
ASSISTANT POLICE CHIEF  
AREA I OPERATIONS BUREAU

RM:lli  
120616

Dear Ron:

I have read your statement. I think the statement works well. My questions and inquiries are thus:

1. Does your impact statement also include the cultural/environmental impact or is the cultural piece separate from your element?
2. Would you know if any other projects are planned for the same area in the next five years? is it part of the greater Mauna Kea plan?
3. What are the "clean-up processes" at the end of the project to ensure the carbon footprint is very minimal.

Thank you for the opportunity to write to you. Please let me know if I am totally off-center in this.

Again, mahalo,  
Kamaka...(Trudi)

Kamaka Mahi Gunderson  
Kulukuluua Coordinator - Title III  
I Ola Haloa  
Hawai'i Community College  
200 W. Kawili St.  
Hilo, HI 96720



STATE OF HAWAII  
DEPARTMENT OF HEALTH  
P. O. BOX 3378  
HONOLULU, HI 96801-3378

In reply, please refer to:  
File:

12-183  
Mars Habitat

October 15, 2012

Mr. Ron Terry  
Geometrician Associates, LLC  
P.O. Box 396  
Hilo, Hawaii 96721

Dear Mr. Terry:

**SUBJECT: Early Consultation for Environmental Assessment for PISCES HI-SEAS  
Mars Habitat Project in State Land Use Conservation District on Mauna Loa,  
TMK: (3) 3-8-001: 001, Humu`ula, Hamakua District, Island of Hawai`i**

The Department of Health (DOH), Environmental Planning Office (EPO), acknowledges receipt of your letter, dated October 8, 2012. Thank you for allowing us to review and comment on the subject document. The document was routed to the various branches of the Environmental Health Administration. We have no comments at this time, but reserve the right to future comments. We strongly recommend that you review all of the Standard Comments on our website: [www.hawaii.gov/health/environmental/env-planning/landuse/landuse.html](http://www.hawaii.gov/health/environmental/env-planning/landuse/landuse.html). Any comments specifically applicable to this application should be adhered to.

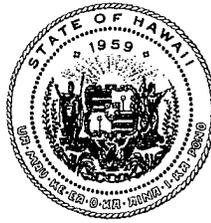
The United States Environmental Protection Agency (EPA) provides a wealth of information on their website including strategies to help protect our natural environment and build sustainable communities at: <http://water.epa.gov/infrastructure/sustain/>. The DOH encourages State and county planning departments, developers, planners, engineers and other interested parties to apply these strategies and environment principles whenever they plan or review new developments or redevelopments projects. We also ask you to share this information with others to increase community awareness on healthy, sustainable community design. If there are any questions about these comments please contact me.

Sincerely,

A handwritten signature in black ink, appearing to read "Laura Leialoha Phillips McIntyre".

Laura Leialoha Phillips McIntyre, AICP  
Environmental Planning Office Manager  
Environmental Health Administration  
Department of Health  
919 Ala Moana Blvd., Ste. 312  
Honolulu, Hawaii 96814  
Phone: 586-4337  
[laura.mcintyre@doh.hawaii.gov](mailto:laura.mcintyre@doh.hawaii.gov)

NEIL ABERCROMBIE  
GOVERNOR OF HAWAII



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES

OFFICE OF CONSERVATION AND COASTAL LANDS  
POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

WILLIAM J. AILA, JR.  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT

ESTHER KIA'AINA  
FIRST DEPUTY

WILLIAM M. TAM  
DEPUTY DIRECTOR - WATER

AQUATIC RESOURCES  
BOATING AND OCEAN RECREATION  
BUREAU OF CONVEYANCES  
COMMISSION ON WATER RESOURCE MANAGEMENT  
CONSERVATION AND COASTAL LANDS  
CONSERVATION AND RESOURCES ENFORCEMENT  
ENGINEERING

FORESTRY AND WILDLIFE  
HISTORIC PRESERVATION  
KAHOOLAWE ISLAND RESERVE COMMISSION  
LAND  
STATE PARKS

REF: OCCL: AJR

COR: HA-13-40

**MEMORANDUM:**

OCT 26 2012

**TO:** Russell Y. Tsuji, Administrator  
*Land Division*

**FROM:** Sam Lemmo, Administrator  
*Office of Conservation and Coastal Lands*

**RE:** **Early Consultation for Environmental Assessment for PICES HI-SEAS  
Mars Habitat Project**  
Humu'ula, North Hilo District, Island of Hawaii  
TMK: (3) 3-8-001:001

Dear Mr. Tsuji,

The Office of Conservation and Coastal Lands (OCCL) is in receipt of your memo dated *October 15, 2012* requesting an early consultation for the PICES HI-SEAS Mars Habitat Project Environmental Assessment (EA). For your information the subject parcel is located in the Conservation District Resource and Protective Subzones.

At this time the applicant is proposing to install a Mars Habitat Analog (MHA) in an area of less than 0.5 acres which will contain sleeping quarters, a kitchen, a computer lab and workspace and a bathroom to be used by a "crew" of six (6) persons. Waste disposal will be managed by utilizing on-site containment and periodic removal, and power will be supplied either by a fully self-contained power provider or an on-site gas powered generator. The MHA will be inhabited for four (4) month periods starting in 2013 and continuing until 2018, or as necessary.

According to Hawaii Administrative Rules (HAR) §13-5-22, P-1, **DATA COLLECTION (D-1)** *Data collection, research, education, and resource evaluation that involves permanent facilities or structures larger than 500 square feet or a land use causing significant ground disturbance or impact to a natural resource.* The proposed action will require the applicant to complete a Conservation District Use Application (CDUA) and submit it to the OCCL for review. Please be aware that this finding does not constitute approval of the proposal.

Pre-assessment comments:

- At this time the exact location of the project site cannot be determined; please provide coordinates to confirm the conservation district subzone designation;

- Please describe on-site waste-water & grey-water disposal, containment and removal;
- Please provide information on the storage, transfer and spill mitigation protocols for any fuel to be stored on site;
- Please describe the condition the site will be returned to post-project completion; and
- Provide an explanation of potential impacts to view-planes and scenic vistas.

If you have any questions regarding this correspondence please contact Alex. J. Roy of our OCCL staff at 808-587-0316 or via email at [alex.j.roy@hawaii.gov](mailto:alex.j.roy@hawaii.gov)

CC: *Chairperson  
HDLO  
Hawaii County Planning Department*

*Ron Terry  
c/o Geometrician Associates, Inc.  
P.O. Box 396, Hilo, HI 96721*

JEIL ADERCRUMBIE  
GOVERNOR OF HAWAII



WILLIAM J. AILA, JR.  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
LAND DIVISION

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

November 7, 2012

Geometrician Associates  
Attention: Mr. Ron Terry  
P.O. Box 396  
Hilo, Hawaii 96721

via email: [rterry@hawaii.ltr.com](mailto:rterry@hawaii.ltr.com)

Dear Mr. Terry:

SUBJECT: Early Consultation for Environmental Assessment for PISCES HI-SEAS Mars Habitat Project in State Conservation District on Mauna Loa, Geometrician Associates, LLC for Applicant, North Hilo, Hawaii; TMK: (3) 3-8-001:001

Thank you for the opportunity to review and comment on the subject matter. The Department of Land and Natural Resources' (DLNR) Land Division distributed or made available a copy of your report pertaining to the subject matter to DLNR Divisions for their review and comments.

At this time, enclosed are comments from (i) the Office of Conservation and Coastal Lands, and (ii) the Division of State Parks on the subject matter. Should you have any questions, please feel free to call Kevin Moore at (808) 587-0426. Thank you.

Sincerely,

A handwritten signature in black ink, appearing to read "Russell Y. Tsuji".

Russell Y. Tsuji  
Land Administrator

Enclosure(s)

CORR: HA 13-40

NEIL ABERCROMBIE  
GOVERNOR OF HAWAII

WILLIAM J. AILA, JR.  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT



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STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
LAND DIVISION  
POST OFFICE BOX 621  
HONOLULU, HAWAII 96809



October 15, 2012

MEMORANDUM

TO: **DLNR Agencies:**  
X Div. of Aquatic Resources  
   Div. of Boating & Ocean Recreation  
X Engineering Division  
X Div. of Forestry & Wildlife  
X Div. of State Parks  
   Commission on Water Resource Management  
X Office of Conservation & Coastal Lands  
X Land Division – Hawaii District  
X Historic Preservation

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CONSERVATION  
LANDS  
2012 OCT 16 A 8:09  
DEPT. OF LAND &  
NATURAL RESOURCES  
STATE OF HAWAII

FROM: *[Signature]* Russell Y. Tsuji, Land Administrator  
SUBJECT: Early Consultation for Environmental Assessment for PISCES HI-SEAS  
Mars Habitat Project in State Land Conservation District on Mauna Loa  
LOCATION: Humuula, North Hilo, Hawaii, TMK: (3) 3-8-001:001  
APPLICANT: Geometrician Associates, LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by November 5, 2012.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Kevin Moore at 587-0426. Thank you.

Attachments

*MEMO (2 pgs)*

- We have no objections.
- We have no comments.
- Comments are attached.

Signed: *[Signature]*  
Print name: ALEX ROY  
Date: 10-25-2012

cc: Central Files

NEIL ABERCROMBIE  
GOVERNOR OF HAWAII



WILLIAM J. AILA, JR.  
CHAIRPERSON  
BOARD OF LAND AND NATURAL RESOURCES  
COMMISSION ON WATER RESOURCE MANAGEMENT



STATE OF HAWAII  
DEPARTMENT OF LAND AND NATURAL RESOURCES  
LAND DIVISION

POST OFFICE BOX 621  
HONOLULU, HAWAII 96809

October 15, 2012

MEMORANDUM

TO:

**DLNR Agencies:**

- Div. of Aquatic Resources
- Div. of Boating & Ocean Recreation
- Engineering Division
- Div. of Forestry & Wildlife
- Div. of State Parks
- Commission on Water Resource Management
- Office of Conservation & Coastal Lands
- Land Division – Hawaii District
- Historic Preservation

RECEIVED  
 LAND DIVISION  
 2012 OCT 18 P 2:39  
 DEPT. OF LAND & NATURAL RESOURCES  
 STATE OF HAWAII

FROM:

Russell Y. Tsuji, Land Administrator

SUBJECT:

Early Consultation for Environmental Assessment for PISCES HI-SEAS Mars Habitat Project in State Land Conservation District on Mauna Loa

LOCATION:

Humuula, North Hilo, Hawaii, TMK: (3) 3-8-001:001

APPLICANT:

Geometrician Associates, LLC

Transmitted for your review and comment on the above referenced document. We would appreciate your comments on this document. Please submit any comments by November 5, 2012.

If no response is received by this date, we will assume your agency has no comments. If you have any questions about this request, please contact Kevin Moore at 587-0426. Thank you.

Attachments

- We have no objections.
- We have no comments.
- Comments are attached.

Signed: *David S. Berlin*  
 Print name: David S. Berlin  
 Date: 10/17/12

cc: Central Files

**William P. Kenoi**  
Mayor



**Darren J. Rosario**  
Fire Chief

**Renwick J. Victorino**  
Deputy Fire Chief

**County of Hawai'i**  
**HAWAI'I FIRE DEPARTMENT**  
25 Aupuni Street • Room 2501 • Hilo, Hawai'i 96720  
(808) 932-2900 • Fax (808) 932-2928

October 29, 2012

Mr. Ron Terry  
Geometrician Associates  
PO Box 396  
Hilo, HI 96721

Dear Mr. Terry,

**SUBJECT: PISCES HI-SEAS MARS HABITAT PROJECT IN STATE  
LAND USE CONSERVATION DISTRICT ON MAUNA LOA  
TMK: (3<sup>RD</sup>) 3-8-001:001, HUMU'ULA, HAMAKUA DISTRICT**

---

The Hawai'i Fire Department does not have any comments to offer at this time regarding the above-referenced Early Conservation for Environmental Assessment.

Thank you for the opportunity to comment.

Sincerely,

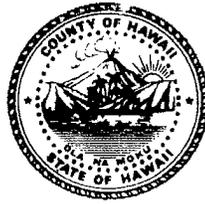
A handwritten signature in black ink, appearing to read "D. Rosario".

**DARREN J. ROSARIO**  
Fire Chief

RP:lc



William P. Kenoi  
*Mayor*



BJ Leithead Todd  
*Director*

Margaret K. Masunaga  
*Deputy*

West Hawai'i Office  
74-5044 Ane Keohokalole Hwy  
Kailua-Kona, Hawai'i 96740  
Phone (808) 323-4770  
Fax (808) 327-3563

**County of Hawai'i**  
**PLANNING DEPARTMENT**

East Hawai'i Office  
101 Pauahi Street, Suite 3  
Hilo, Hawai'i 96720  
Phone (808) 961-8288  
Fax (808) 961-8742

November 13, 2012

Mr. Ron Terry  
Geometrician Associates, LLC  
P.O. Box 396  
Hilo, HI 96721

Dear Mr. Terry:

**Subject: Pre-Consultation for Draft Environmental Assessment**  
**Project: PISCES HI-SEAS Mars Habitat Project**  
**TMK: (3) 3-8-001:001; Humu'ula, North Hilo, Hawai'i**

Thank you for your letter dated October 8, 2012, requesting comments from this office regarding the preparation of a Draft Environmental Assessment (DEA) for the subject project.

The Department of Information and Computer Sciences at the University of Hawai'i at Manoa is developing a research program that uses realistic planetary-surface habitat under strong operational conditions to understand and address the risks of long-term human space exploration. The project would transport and install a "habitat" within an area of less than half an acre. The habitat will be a small, self-contained unit with sleeping quarters, a kitchen, a computer and lab workspace, and a bathroom. All wastewater and biological waste will be contained for regular servicing and removal.

The subject property consists of 52,981.699 acres. There is no County zoning for the project site. The project site is located in the State Land Use Conservation District. In addition, according to the County of Hawai'i General Plan 2005 (amended December 2006), it is designated as Conservation by the Land Use Pattern Allocation Guide. Although, the entire island of Hawai'i is within the Coastal Zone Management Area, the subject area is not located within the Special Management Area.

Mr. Ron Terry  
Geometrician Associates, LLC  
November 13, 2012  
Page 2

Many of the County of Hawai'i General Plan 2005 (amended December 2006) Goals and Policies related to the Economy are relevant to this EA:

- 2.3 (b) Encourage the expansion of the research and development industry by working with and supporting the university of Hawai'i at Hilo and West Hawai'i, the Natural Energy Laboratory at Hawai'i Authority and other agencies' programs that support sustainable economic development on the County of Hawai'i.
- 2.3 (f) Support all levels of educational, employment and training opportunities and institutions.
- 2.3 (i) Continue to encourage the research, development and implementation of advanced technologies and processes.

The project site is located in the Hāmākua Community Development Plan (CDP) planning area. The Hāmākua CDP has not yet been adopted and is currently in the planning process. However, should it be adopted prior to the preparation of the Draft EA, please include a discussion about the project in relationship to the objectives, goals, and policies of the Hāmākua CDP.

We have no further comments to offer, at this time. However, please keep us informed and provide our department with a copy of the Draft Environmental Assessment for our review and comment.

If you have any questions or if you need further assistance, please feel free to contact Bethany Morrison of this office at 961-8138.

Sincerely,



*BJ* BJ LEITHEAD TODD  
Planning Director

BJM:

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# **HI-SEAS/PISCES Mars Habitat Project**

## **Environmental Assessment**

### **APPENDIX 2 Arthropod Survey**

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SUMMARY OF ARTHROPOD SURVEY WITHIN A PROPOSED OUTER PLANET  
HUMAN HABITAT SIMULATION (PISCES) ON MAUNA LOA, HAWAII,  
OCTOBER 15, 2012

Technical Report Prepared for Ron Terry in Association with a PISCES Human Habitat  
Simulation EA for University of Hawaii, Hilo

Prepared by Jesse Eiben  
University of Hawaii at Manoa Entomology Program  
October 29, 2012

## SUMMARY OF FINDINGS

I conducted a short duration arthropod assessment at the proposed site of an experimental human habitat space dwelling simulation being developed by the PISCES program at UH Hilo. Ron Terry is preparing an environmental assessment of the site, and he accompanied me during the arthropod survey. I have extensive experience in studying the alpine environments of Hawaii, informed by my studies detailing the life history and habitat characteristics of the wekiu bug, *Nysius wekiuicola*, and developing arthropod diversity monitoring protocols on Mauna Kea, HI.

The site of the proposed PISCES human dwelling is comprised of mostly fine rock tephra and scoria apparently ejected from the adjacent cinder cone during relatively recent volcanic activity. We surveyed a small area (at most 0.5 acre) of vehicle impacted cinder and the surrounding intact pahoehoe lava flow for arthropods. Our methods were general, and included placing 10 vials (7 dram open plastic vials) baited with attractants for ants and other scavengers (baits were peanut butter, jelly, and sliced turkey deli meat), visual surface scanning for arthropod movement and subsequent capture or identification, focused visual searches for arthropods in different substrates (under rocks, in small lava-caves, in cinder tephra), and inspection of any observed plants for associated arthropods.

We observed six species of arthropods during the two hour morning survey, and evidence of two moth larvae. None of the insects or arthropods observed appeared to be introduced invasive species (except for some evidence of aphids on *Vaccinium reticulatum*). No ants were observed. There was very little vegetation within the proposed physical footprint of any buildings. The vegetation observed were generally species commonly found in similar substrates throughout Mauna Kea and Mauna Loa and included some mosses, ferns (*Pellaea ternifolia*), lichens of various forms under and on the sides of rocks, *Dubautia scabra*, *Leptecophylla tameiamae* and *V. reticulatum*. Therefore, impacts to arthropods strictly associated with a plant type will not be a major concern if the proposed construction project occurs. Free ranging predators and scavengers found in the substrates are also not likely to have their populations affected by disturbance in a small physical footprint (0.25-0.5 acre). The arthropods found during this survey are generally broadly distributed throughout the aa and pahoehoe lava habitat types wherever their preferred microhabitat is present.

## CONCLUSION AND RECOMMENDATIONS

The substrate type and plant community found at the PISCES study site are not unique to the site, and are broadly distributed at the same elevation band throughout Mauna Loa. The small amount of plant and arthropod diversity found at the site appears to be unimpacted by introduced species. Because the site is quite small, and human induced impacts will remain contained in a relatively small area, the direct impacts will be insubstantial. However, great care should be taken to limit the introduction of new species into this relatively pristine and intact high elevation ecosystem. The lack of the presence of ants (all of which are introduced in the Hawaiian Islands) at this elevation is a condition that should be preserved by limiting introduction potential, and eliminating any ant colonies found. The impacts of ants, if introduced by construction or human use, will have vast effects on the ecosystem not limited to the proposed PISCES study site. Additionally, any introduction of new invasive weeds will hasten the alteration of the arthropod community by potentially allowing new insects that may compete or predate upon the naturally occurring fauna. Finally, because the area of the proposed site is very small, environmentally harsh (little soil, extreme daily temperature and moisture fluctuations) and currently hosts limited biodiversity, identification and control of newly introduced species by human means can be efficient and inexpensive. The relative ease of keeping the surrounding ecosystem free of newly introduced species and thus intact as it presently exists should be a priority that can be met with basic preventive and control methods for introduced species.

Table 1. Arthropod Species List

<b>Habitat Type</b>	<b>Arthropod Order</b>	<b>Family</b>	<b>Species</b>
Pahoehoe rocks  (Photo 1)	Lepidoptera	Cosmopteridgidae	<i>Hyposmocoma</i> sp. (‘burrito type’)
	<b>Species notes:</b> <ul style="list-style-type: none"> <li>• Endemic</li> <li>• Distribution unknown, likely common in substrate type</li> </ul>		
Pahoehoe rocks  (Photo 2)	Araneae	Lycosidae (Wolf spiders)	<i>Lycosa</i> nr. <i>hawaiiensis</i>
	<b>Species notes:</b> <ul style="list-style-type: none"> <li>• Endemic</li> <li>• Distribution unknown, likely common in substrate type</li> </ul>		
Pahoehoe rocks in small lava tunnel  (Photo 3)	Lepidoptera	Likely Noctuidae	??? Likely <i>Agrotis</i> or <i>Peridroma</i> sp.
	<b>Species notes:</b> <ul style="list-style-type: none"> <li>• Unknown origin, likely endemic</li> <li>• Evidence (frass) found in rock depression indicative of caterpillar feeding</li> </ul>		
<i>Vaccinium reticulatum</i> Ohelo plant	Psocoptera	Psocidae (Bark lice)	<i>Ptycta</i> sp.
	<b>Species notes:</b> <ul style="list-style-type: none"> <li>• Endemic</li> <li>• Diverse genus (50+species) is found widely in many habits associated with variety of plants</li> </ul>		
<i>Vaccinium reticulatum</i> Ohelo plant, and in ant survey vials	Hemiptera	Lygaeidae (Seed bugs)	<i>Nysius lichenicola</i>
	<b>Species notes:</b> <ul style="list-style-type: none"> <li>• Endemic</li> <li>• Found commonly at high elevations on Ohelo and other host plants</li> </ul>		
<i>Vaccinium reticulatum</i> Ohelo plant	Lepidoptera	UNKNOWN	
	<b>Species notes:</b> <ul style="list-style-type: none"> <li>• Unknown</li> <li>• Found evidence (frass and webbing) of caterpillar feeding on fallen Ohelo leaves</li> </ul>		
<i>Vaccinium reticulatum</i> Ohelo plant	Hymenoptera	Bethylidae	<i>Sierola</i> sp.
	<b>Species notes:</b> <ul style="list-style-type: none"> <li>• Endemic</li> <li>• Very speciose genus (likely many hundreds of species, ~180 described), arthropod parasitoids</li> </ul>		
<i>Dubautia scabra</i>	Hymenoptera	Vespidae	<i>Nesodynerus</i> sp.
	<b>Species notes:</b> <ul style="list-style-type: none"> <li>• Endemic</li> <li>• Ground nesting mud-wasps that feed on microlepidoptera.</li> </ul>		



Photo 1. *Hyposmocoma* sp. web/dirt case



Photo 2. *Lycosa* sp. spider skin-molt



Photo 3. Lepidoptera frass. Likely Noctuid caterpillar feeding on lichens