DATE

MEMORANDUM

TO: Keith Kawaoka, Acting Director
Office of Environmental Quality Control

FROM: Suzanne D. Case, Chairperson
Board of Land and Natural Resources

SUBJECT: Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA/AFONSI)
Caltech Submillimeter Observatory Decommissioning
Hāmākua District, Island of Hawai‘i
Tax Map Keys: (3)4-4-015:009(portion)

With this memorandum, the State of Hawai‘i Department of Land and Natural Resources (DLNR) requests the subject Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA/AFONSI) for the decommissioning of the Caltech Submillimeter Observatory be published in the next issue of the Office of Environmental Quality Control's (OEQC) periodic bulletin, *The Environmental Notice*.

The required publication forms and files, including an electronic copy of the DEA/AFONSI in pdf format, have been provided to the OEQC online submission platform. Concurrently with the electronic filing, and as required by HAR §11-200.1-5(e)(1)(B), paper copies of the DEA/AFONSI have been submitted to the ____ Library and with the Hawai‘i Documents Center.

Pursuant to HAR §11-200.1-20(b), publication of the DEA/AFONSI in *The Environmental Notice* initiates a 30-day public comment period for the public to provide comments regarding potential effects of the proposed action. Public comments should be submitted to Planning Solutions, Inc. (PSI) with copies to the DLNR-Office of Conservation and Coastal Lands.

Should there be any questions, contact Sam Lemmo of the Office of Conservation and Coastal Lands at 587-0377.

DATE

SUBJECT: Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA/AFONSI)
Caltech Submillimeter Observatory Decommissioning
Hāmākua District, Island of Hawaiʻi
Tax Map Keys: (3)4-4-015:009(portion)

Dear Participant

On behalf of the California Institute of Technology (Caltech) and the Department of Land and Natural Resources (DLNR), Planning Solutions, Inc. transmits to you the subject DEA/AFONSI. The document discloses the potential environmental effects of the proposed action, the decommissioning of the Caltech Submillimeter Observatory (CSO). The use of State land and the need for a Conservation District Use Permit (CDUP) subjects this action to the environmental review requirements of Chapter 343, Hawaiʻi Revised Statutes.

Please download your copy of the Draft EA here: LINK

The State Office of Environmental Quality Control (OEQC) has indicated it will publish an announcement of availability for the subject DEA/AFONSI in the DATE edition of *The Environmental Notice* (TEN). The DEA/AFONSI and information concerning a companion Conservation District Use Application (CDUA) will also be available online at http://oeqc2.doh.hawaii.gov via the TEN.

Caltech and DLNR invite you to review the DEA/AFONSI and provide your comments to:

Mākena White
Planning Solutions, Inc.
711 Kapiolani Boulevard, Suite 950
Honolulu, HI 96813
makena@psi-hi.com

The OEQC's deadline for comments on the subject Draft EA is DATE.

Please contact me at 808-550-4538 should there be any questions about this letter or the Draft EA. Thank you for your participation in this environmental review process.

Sincerely,

Mākena White on Sunil Golwala

cc: Sunil Golwala, Caltech (electronic only)
Michael Cain, DLNR (electronic only)

From: webmaster@hawaii.gov
To: HI Office of Environmental Quality Control
Subject: New online submission for The Environmental Notice
Date: TBD

Action Name: Caltech Submillimeter Observatory Decommissioning

Type of Document/Determination: Draft Environmental Assessment and Anticipated Finding of No Significant Impact (DEA/AFONSI)

HRS 343-5(a) Trigger(s):

- (1) Propose the use of state or county lands or the use of state or county funds
- (2) Propose any use within any land classified as a conservation district

Judicial district: Hāmākua, Hawai'i

Tax Map Key(s) (TMK(s)): (3)4-4-015:009(portion)

Action type: Applicant

Other required permits and approvals:

- HRS §6-E Historic Preservation Review
- Others

Discretionary consent required:

- Conservation District Use Permit

Approving agency: State of Hawai'i, Department of Land and Natural Resources

Agency contact name: Sam Lemmo

Agency contact email (for info about the action): sam.j.lemmo@hawaii.gov

Email address or URL for receiving comments: makena@psi-hi.com

Agency contact phone: (808) 587-0377

Agency address: DLNR-Office of Conservation and Coastal Lands; 1151 Punchbowl Street, Room 132; Honolulu, HI 96813; United States

Applicant: California Institute of Technology (Caltech)

Applicant contact name: Sunil Golwala

Applicant contact email: golwala@caltech.edu

Applicant contact phone: (626) 395-6608

Applicant address: Mail Code 367-17; California Institute of Technology; Pasadena, CA 91125; United States

Was this submittal prepared by a consultant: Yes

Consultant: Planning Solutions, Inc.

Consultant contact name: Mākena White, AICP

Consultant contact email: makena@psi-hi.com

Consultant contact phone: (808) 550-4538

Consultant address: 700 Kapiʻolani Boulevard Suite 950; Honolulu, HI 96813; United States

Action summary: The proposed action consists of (*i*) the Board of Land and Natural Resources (BLNR) awarding the California Institute of Technology (Caltech) a Conservation District Use Permit (CDUP) for the decommissioning of the Caltech Submillimeter Observatory (CSO) located in the summit region of Maunakea, and (*ii*) Caltech implementing the decommissioning of the CSO, which is located on State-owned land, as described in the Environmental Assessment (EA). Specifically, Caltech proposes to completely remove its facilities and fully restore the CSO Site. The CSO Site would be returned to its pre-construction condition to the greatest extent practicable so that it resembles the surrounding lava flow landscape and is suitable for native flora and fauna. The impacts of the proposed project on natural resources and the cultural landscape are expected to be beneficial.

Reasons support determination: The DLNR-Office of Conservation and Coastal Lands is providing an Anticipated Finding of No Significant Impact, based on the analysis of significance criteria provided in Chapter 6 of the Draft Environmental Assessment.

Attached documents (signed agency letter & EA/EIS): FILE NAMES

Action Location Map: FILE NAME

Authorized individual: Michael Cain

Authorization: The above named authorized individual hereby certifies that he/she has the authority to make this submission.

INTERNAL DRAFT

DRAFT ENVIRONMENTAL ASSESSMENT & ANTICIPATED FINDING OF NO SIGNIFICANT IMPACT, CALTECH SUBMILLIMETER OBSERVATORY DECOMMISSIONING

PREPARED FOR:

California Institute of Technology

PREPARED BY:

PLANNING SOLUTIONS

MARCH 31, 2021

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LIST OF ACRONYMS

AA	Archaeological Assessment
ACM	Asbestos-containing material
AIS	Archaeological Inventory Survey
AFONSI	Anticipated Finding of No Significant Impact
AMP	Archaeological Monitoring Plan
bgs	Below ground surface
BLNR	Board of Land and Natural Resources
BMP	Best Management Practice
BSA	Biological Setting Analysis
CAA	Clean Air Act
CAB	Clean Air Branch
CDP	Community Development Plan
CFHT	Canada-France-Hawai‘i Telescope
CFR	Code of Federal Regulations
CDUA	Conservation District Use Application
CDUP	Conservation District Use Permit
CIA	Cultural Impact Assessment
CMP	Comprehensive Management Plan
CMS	Center for Maunakea Stewardship
CS	Caltech’s Sublease
CSO	Caltech Submillimeter Observatory
CWRM	Commission on Water Resource Management
CZM	Coastal Zone Management
DEM	Department of Environmental Management
DKI	Daniel K. Inouye Highway
DLNR	Department of Land and Natural Resources
DP	Decommissioning Plan
EA	Environmental Assessment
EIS	Environmental Impact Statement
EMS	Emergency medical services
EPA	Environmental Protection Agency
ESA	Environmental Site Assessment
FEA	Final Environmental Assessment
FONSI	Finding of No Significant Impact
GP	Hawai‘i County General Plan
HAR	Hawai‘i Administrative Rules
HCDP	Hāmākua Community Development Plan

HCFD	Hawaiʻi County Fire Department
HCPD	Hawaiʻi County Police Department
HDOH	Hawaiʻi State Department of Health
HDOH-WB	Planning and Design Section, Wastewater Branch
HDOH-ES	Environmental Services
HDOT	State of Hawaiʻi, Department of Transportation
HEPA	Hawaiʻi Environmental Policy Act
HIOSH	Hawaiʻi Occupational Safety and Health Division
HRS	Hawaiʻi Revised Statutes
HSDP	Hawaiian Scientific Drilling Project
HVAC	Heating, ventilation, and cooling
IfA	University of Hawaiʻi at Mānoa Institute for Astronomy
IPCC	Intergovernmental Panel on Climate Change
ISMP	Invasive Species Management Plan
JCMT	James Clerk Maxwell Telescope
LBP	Lead-based paint
LCP	Lead-containing paint
LEI	Lehua Environmental Inc.
MCL	Maximum contaminant level
MEP	Mechanical, Electrical, and Plumbing
mgd	Million gallons per day
MKMB	Mauna Kea Management Board
MKOs	Maunakea Observatories
MKSR	Mauna Kea Science Reserve
MKSS	Mauna Kea Observatory Support Services
ML	Master Lease
MMIS	Modified Mercalli Intensity Scale
MP	Master Plan
msl	Mean sea level
NAAQS	National Ambient Air Quality Standards
NAR	Natural Area Reserve
NFPA	National Fire Prevention Association
NHPA	National Historic Preservation Act
NHRP	National Register of Historic Places
NHS	National Highway System
NOI	Notice of Intent
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places

OCCL	Office of Conservation and Coastal Lands
OEQC	Office of Environmental Quality Control
OHA	Office of Hawaiian Affairs
OMKM	Office of Mauna Kea Management
OSDA	Operating and Site Development Agreement
OSHA	Occupational Safety and Health Division
PHRI	Paul H. Rosendahl, Ph.D., Inc
PTA	Pōhakuloa Training Area
PWS	Public water systems
RCRA	Resource Conservation and Recovery Act
REC	Recognized environmental conditions
SAAQS	State Ambient Air Quality Standards
SDP	Site Decommissioning Plan
SDRP	Site Deconstruction and Removal Plan
SHPD	State Historic Preservation Division
SIHP	State Inventory of Historic Places
SOP	Standard Operating Procedure
SRGII	Sustainable Resources Group International, Inc.
SRP	Site Restoration Plan
SWD	Solid Waste Division
SWPPP	Storm Water Pollution Prevent Plan
TCP	Traditional Cultural Property
TMK	Tax Map Key
TMP	Transportation Management Plan
TMT	Thirty-Meter Telescope
UH	University of Hawai‘i
USFWS	U.S. Fish & Wildlife Service
USGS	U.S. Geological Survey
VIS	Visitor Information Station
VPD	Vehicles per day
WSU	Washington State University
XRF	X-ray fluorescence

Chapter 1: INTRODUCTION

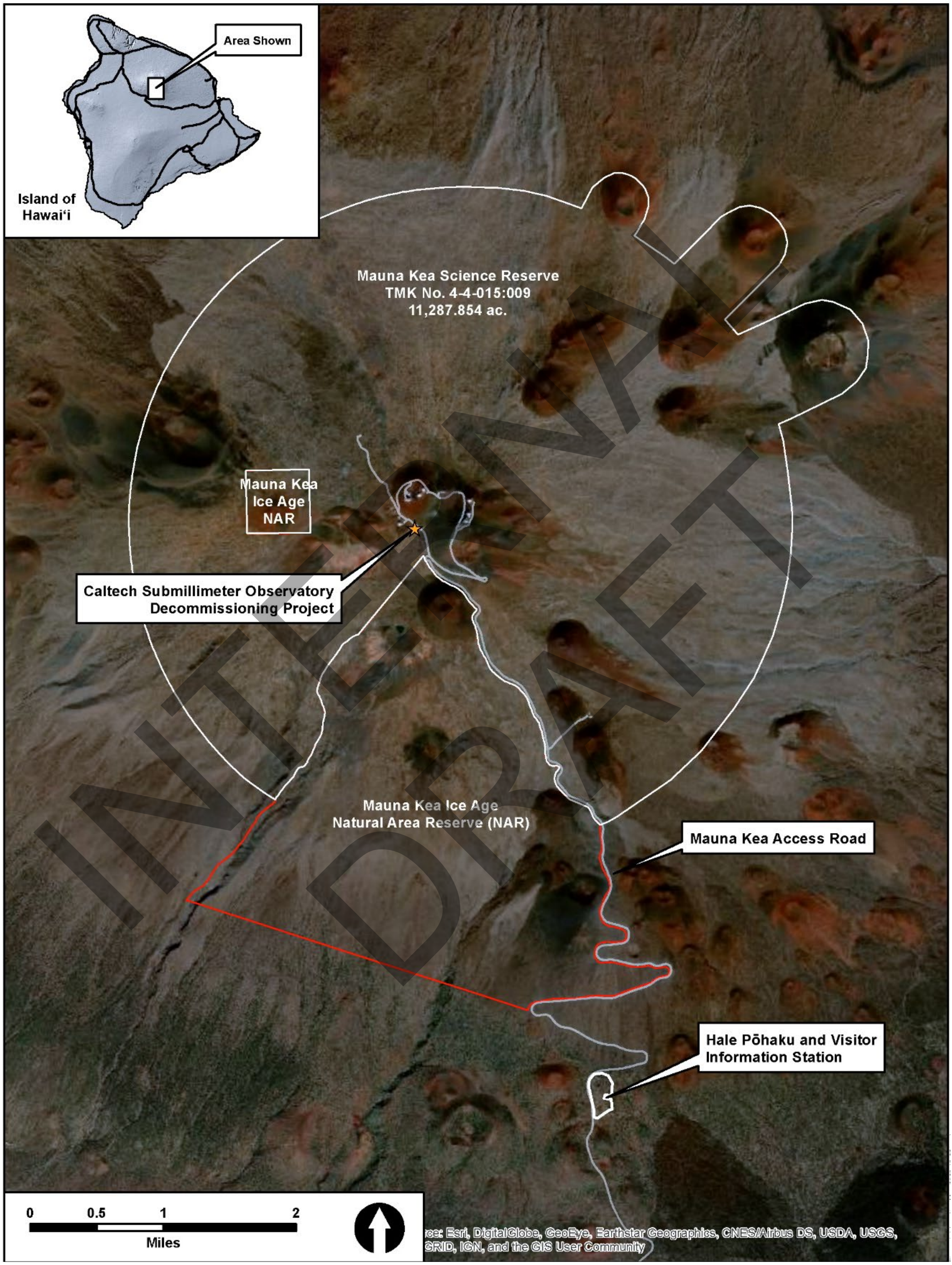
The Caltech Submillimeter Observatory (CSO) facility is located on a small portion of TMK No. 4-4-015:009, which is known as the Mauna Kea Science Reserve (MKSR), near the summit of Maunakea in the Hāmākua District on the Island of Hawaiʻi (see Figure 1-1). This facility is owned and operated by the California Institute of Technology (henceforth referred to as "Caltech") on land subleased from the University of Hawaiʻi (UH), which leases the MKSR from the State of Hawaiʻi, Department of Land and Natural Resources (DLNR). The "CSO Site" is defined as the sublease area and other minor adjacent areas that were disturbed during the original construction or will be disturbed during the decommissioning of the CSO (Figure 1-2). The CSO Site is roughly 1.3 acres.

CSO is a 10.4-meter (34 foot) diameter telescope that was engaged in astronomical observations in the terahertz radiation band (submillimeter wavelengths) from its first light in 1986 until it ceased operation 29 years later on September 8, 2015. Caltech formally tendered its Notice of Intent (NOI) to decommission the CSO to the UH Office of Mauna Kea Management (OMKM, now the Center for Maunakea Stewardship or CMS) on November 18, 2015, which was the first step in the decommissioning planning process. The current state of the CSO facility is shown in Figure 1-3.

The OMKM (now transitioning to CMS) manages the MKSR according to the terms of the Board of Land and Natural Resources (BLNR)-approved *Comprehensive Management Plan* (CMP, 2009). One component of the CMP is the *Decommissioning Plan for the Mauna Kea Observatories* (DP, 2010). The DP provides a framework for observatories on Maunakea, to ensure that the DLNR as landowner, the UH as Lessee and permittee, and the observatories as sublessees all have clear expectations of the observatory decommissioning process and can plan appropriately for it. In principle, the DP: (*i*) defines decommissioning and the steps necessary to achieving it; (*ii*) outlines the terms of decommissioning contained in UH's Master Lease and existing subleases; (*iii*) provides information on financial planning for decommissioning; and (*iv*) offers guidance for the practical course of action needed to implement decommissioning.

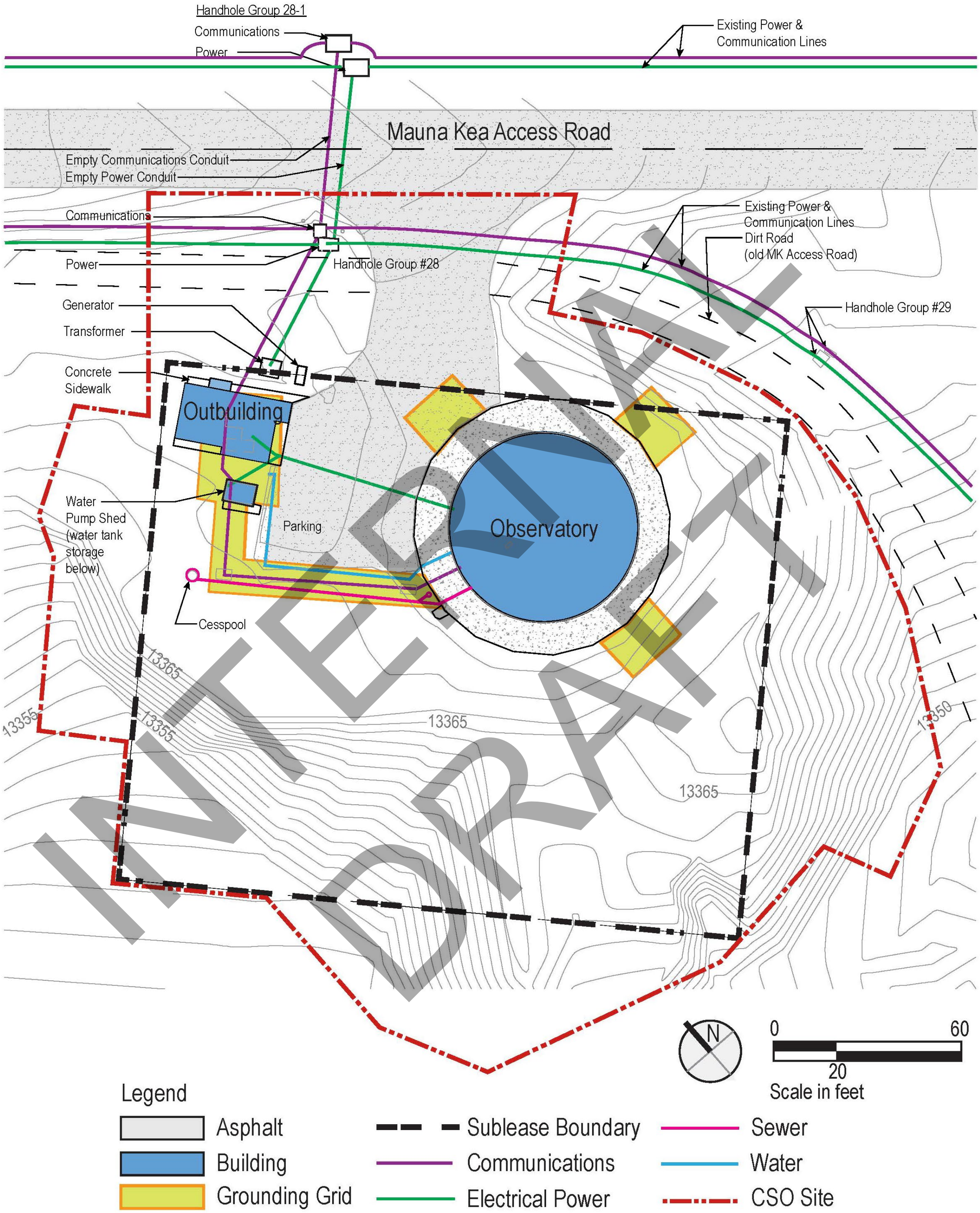
In addition, the CMP and DP both stipulate a series of management actions related to site recycling, decommissioning, demolition, and restoration activities by the observatories, including Caltech. The specific CMP management actions that apply are SR-1 and SR-2. SR-1 requires that the observatories develop detailed plans to recycle or demolish facilities; SR-2 requires that the observatories develop site restoration plans in association with decommissioning. Caltech is complying with these requirements for the CSO through the development of the Site Decommissioning Plan (SDP), which is attached in Appendix A, and this Environmental Assessment (EA).

Figure 1-1 Location of CSO in MKSR



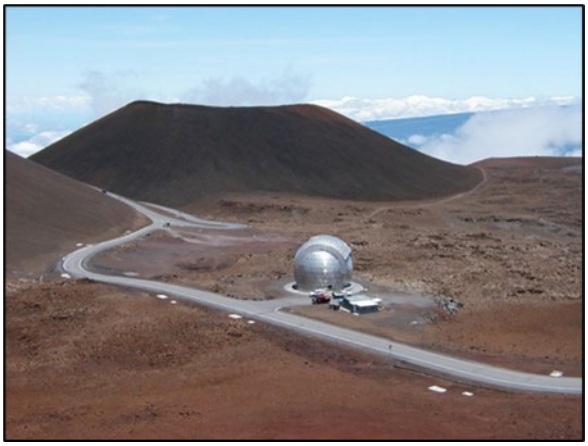
Source: Planning Solutions, Inc. (2020)

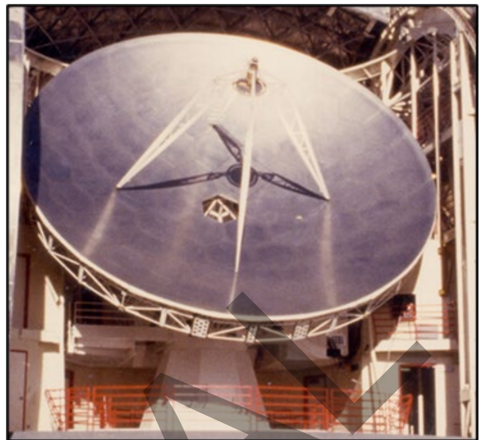
Figure 1-2 Extent of CSO Site and Existing Layout



Source: M3 Engineering and Technology (2020)

Figure 1-3 Caltech Submillimeter Observatory





The CSO stands beside the Mauna Kea Access Road. The CSO with dome open.
Source: Caltech (2019)

1.1 OVERVIEW OF THE PROPOSED ACTION

Caltech's proposed action is the decommissioning of the CSO facility pursuant to its *Site Decommissioning Plan for the Caltech Submillimeter Observatory* (SDP, see Appendix A). The SDP was prepared pursuant to the DP and describes the two primary components of decommissioning: (*i*) removal of the improvements within the CSO Site, and (*ii*) restoration of the CSO Site, as closely as practicable, to its pre-construction condition. The decommissioning is also described in detail in Chapter 2.

Because the CSO Site is located in the State of Hawai'i's Conservation District, a Conservation District Use Permit (CDUP) is required before the decommissioning can begin. The approval of a CDUP is an action by the State of Hawai'i. Typically, demolition of existing structures in the Conservation District are addressed under Hawai'i Administrative Rules (HAR) §13-5-22, wherein, "demolition, removal, or minor alteration of existing structures, facilities, land, and equipment," requires a Site Plan Approval by the DLNR, Office of Conservation and Coastal Lands (OCCL). Site Plan Approvals are typically administrative approvals, signed by the Chair of DLNR or a designated representative, and do not require preparation of an Environmental Assessment (EA). However, OCCL, in a letter to OMKM (now CMS) dated February 19, 2016 (Ref. No. HA-16-118), stated that decommissioning of the CSO would require a Conservation District Use Application (CDUA) to be reviewed and approved, subject to conditions, by the BLNR and an EA. This EA, which has been prepared according to the requirements of Hawai'i Revised Statutes (HRS) Chapter 343 and its implementing regulations contained in HAR §11-200.1 is intended to fulfill that requirement and inform the BLNR's decision-making on the CDUA.

1.2 PURPOSE OF THE PROPOSED ACTION

The purpose of the CSO Decommissioning project is to enable Caltech to conclude its use of the site and surrender its sublease while satisfying its obligations, via subleases and other agreements, to UH and the State of Hawai'i related to the CSO facility through the permitting and then implementation of the preferred alternative in this EA (Chapter 2) and the SDP (Appendix A).

1.3 NEED FOR THE PROPOSED ACTION

The proposed action is needed in order for Caltech to vacate the CSO Site and, per the terms and conditions of its sublease agreement, relinquish its sublease to UH. *The Sublease Agreement among the California Institute of Technology, the University of Hawaii, and the State of Hawaii, Department of Land and Natural Resources, Sublease H09176* (CSO Sublease, 1983) offers four options on termination or expiration of the sublease:

1. Sale to UH.
2. Surrender with concurrence of UH.
3. Sale to a third party acceptable to UH.
4. Remove the property and restore the site to even grade at the expense of Caltech.

Consistent with the guidance contained in the DP (2010) and with its own NOI, Caltech has prepared an SDP which states that Caltech's intent and preferred alternative is complete removal of structures and infrastructure on the CSO Site and full restoration of the CSO Site (i.e., consistent with the fourth option for termination of the lease, plus additional restoration) followed by surrender of the sublease to UH.

1.4 PURPOSE OF THIS ENVIRONMENTAL ASSESSMENT

The purpose of this EA is to provide detailed information and analysis to inform relevant organizations, agencies, and individuals regarding the potential impacts of implementation of the SDP and its decommissioning alternatives, including the preferred alternative of complete removal of all aboveground and underground structures and infrastructure and full restoration of the CSO Site. It is also intended to fulfill the requirement by OCCL that Caltech prepare an EA, meeting all of the content and process requirements of HRS, Chapter 343 and its implementing regulations contained in HAR §11-200.1, in support of its CDUA for the decommissioning process.

1.5 PERMITS AND APPROVALS

In addition to the requirement imposed by OCCL for a CDUP issued by the BLNR noted in Section 1.1, the proposed action will require several other permits and approvals. The permits and approvals required for the CSO Decommissioning Project which have been identified to date are summarized in Table 1.2 below.

Table 1.1 Permits and Approvals

Permit or Approval	*Approving Agency*
Conservation District Use Permit	Board of Land and Natural Resources
HRS §6E Historic Preservation Review	State Historic Preservation Division
State Highways Permit	Hawaiʻi Department of Transportation
Construction Permit	County of Hawaiʻi Department of Public Works
Grading Permit	County of Hawaiʻi Department of Public Works
Right of Entry	Board of Land and Natural Resources
Source: Compiled by Planning Solutions, Inc. (2020)	

1.6 ORGANIZATION OF THE ENVIRONMENTAL ASSESSMENT

The remainder of this EA is organized as follows:

- Chapter 2 describes the proposed action in detail.
- Chapter 3 outlines the alternatives analyzed in this EA, as well as other alternatives that were initially considered but ultimately rejected, from further evaluation.
- Chapter 4 describes the existing environment and analyzes the potential impacts on natural, cultural, and socioeconomic resources. It also outlines strategies for minimizing and mitigating unavoidable adverse effects.
- Chapter 5 discusses the consistency of the proposed action with relevant plans, policies, and controls at local, regional, state, and federal levels.
- Chapter 6 provides the justification for the determination of a Finding of No Significant Impact (FONSI) by considering each individual significance criterion with respect to the proposed action.
- Chapter 7 summarizes the parties consulted during the preparation of this EA.

Chapter 2: DESCRIPTION OF PROPOSED ACTION

2.1 DESCRIPTION OF THE PROPOSED ACTION

The proposed action and preferred alternative consist of (*i*) BLNR awarding Caltech a CDUP for the decommissioning of the CSO as described in this chapter, and (*ii*) Caltech then implementing the decommissioning of the CSO as described in this chapter. The decommissioning of the CSO is described in detail in the SDP included in Appendix A and this chapter and would broadly consist of the following:

- Removal of all aboveground and belowground CSO components within the roughly 1.3 acre CSO Site (Figure 1-2), including, but not limited to, the observatory, outbuilding, foundations, cesspool, utilities, and grounding grid.
- Site restoration of the CSO Site as follows:
    - The topography would be returned to its pre-construction condition to the greatest extent possible. This would be achieved by removing fill placed on the lava flow during construction to the greatest extent possible. Cavities in the lava flow, where excavation occurred during construction (e.g., the cesspool), would be filled with a portion of the fill placed on the lava flow during construction, which is native to Maunakea.
    - The habitat would be restored to accommodate arthropod fauna to the greatest extent possible. In areas where cavities in the lava flow have been filled, rocks would be piled instead of attempting to recreate the flow. This would return the entire CSO Site to a condition consistent with the surrounding environment.
- Caltech would provide funds to UH to support the future decommissioning of shared infrastructure. Shared infrastructure consists of utility improvements shared by multiple Maunakea observatories and other uses. Such infrastructure cannot be removed until all uses that it serves have been decommissioned.
- Monitoring to characterize the effectiveness of restoration efforts would occur for three years.

Upon completion of the removal, restoration, and funding elements, Caltech would surrender its sublease to UH. The remainder of this chapter describes: (*i*) the observatory infrastructure present on the CSO Site; (*ii*) the methods that would be used to implement the proposed action, and (*iii*) implementation schedule and budget.

2.1.1 DESCRIPTION OF EXISTING FACILITIES

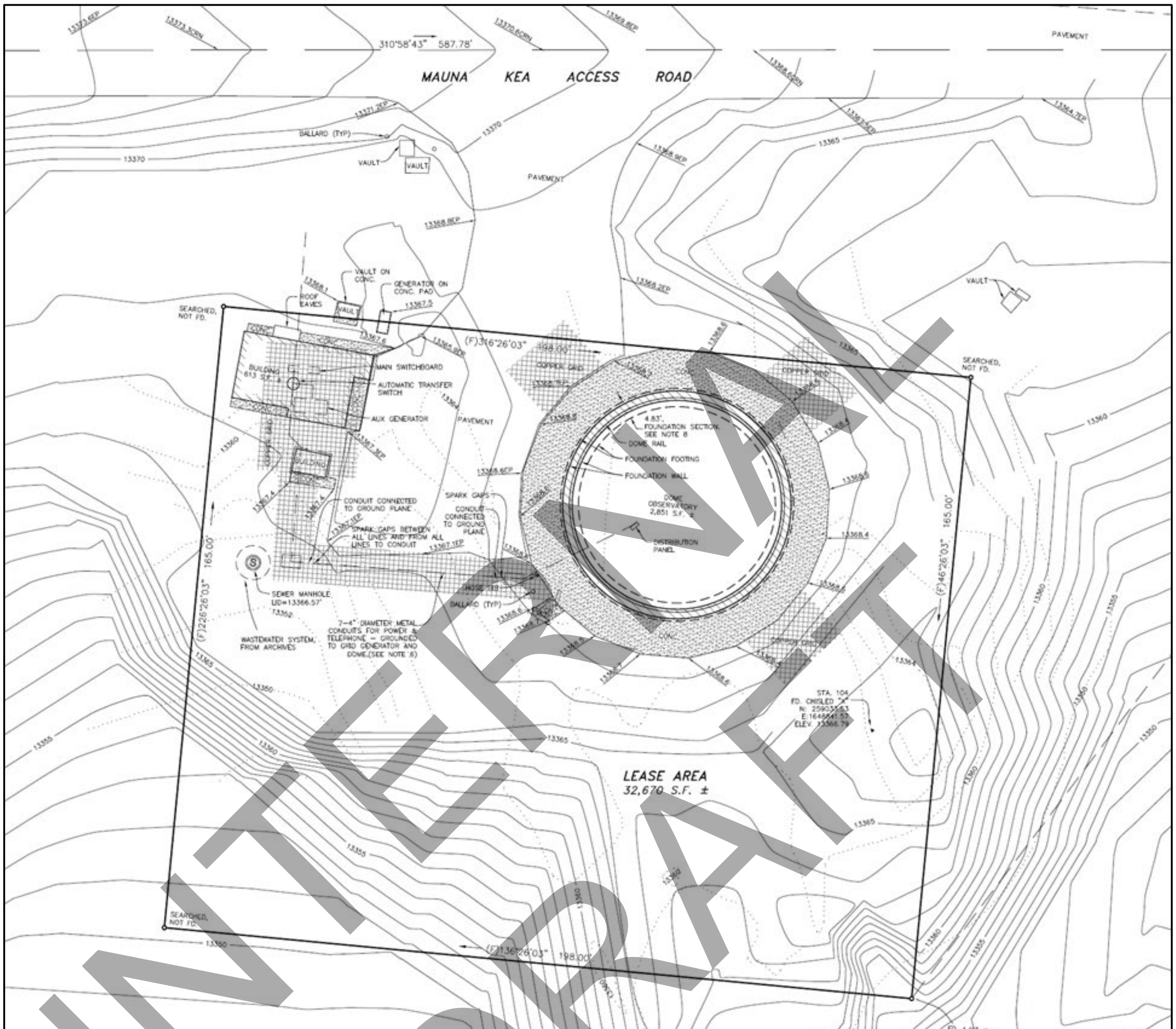
Construction of the CSO began in 1983 and was completed in 1986; the observatory closed 29 years later on September 8, 2015. The telescope, enclosed in a corotating dome, consists of a 10.4 meter (34 feet) diameter radio telescope with a reflector constructed of aluminum panels supported by a tubular steel truss. The weight of the reflector is 10,500 pounds and is attached to a dual-axis steel mounting structure that allows the reflector to be pointed in any skyward direction. The approximate total weight of the telescope is 43 tons (86,000 pounds).

The corotating dome is a steel structure clad with aluminum sheets. It is approximately hemispherical, 60 feet in diameter and 52 feet high. It has a two-shutter bay door that opens to expose the telescope to the sky. To allow it to follow the motion of the telescope, the entire dome structure rotates on a rail. Inside the dome, there are several laboratories and other rooms on three levels with various equipment and furnishings. The approximate total weight of the dome is 150 tons (300,000 pounds). Together, the telescope and dome rest on a concrete foundation, surrounded by a sidewalk, with an overall diameter of approximately 80 feet.

Fifty feet to the north of the CSO is a utility outbuilding (see Figure 1-2). This is a single-story building with metal framing, built on a concrete slab, with an adjoining concrete sidewalk. The original outbuilding houses the main electrical switchgear for the CSO; it was also used as an occasional workshop and for storage. The outbuilding was extended in 1990, and that extension currently stores emergency equipment used by the Maunakea Rangers. Adjacent to the outbuilding is a transformer in a metal cabinet and a backup electrical generator. Both are mounted on a concrete pad. The backup generator is fueled with propane from portable tanks stored in the outbuilding. All interconnecting fuel lines are underground.

Other on- or below-grade infrastructure at the CSO Site include a: (*i*) water tank; (*ii*) water pump housed in a shed mounted on a concrete pad; (*iii*) cesspool with a manhole for access; (*iv*) small concrete pad adjacent to the dome with plumbing fixtures for the water tank and cesspool; (*v*) ¾-inch copper water line to the tank; (*vi*) 4-inch sewer line to the cesspool; (*vii*) electrical lines between the Hawaiian Electric service point, the transformer, the outbuilding, the generator, and the dome; (*viii*) conduits for communications cables; between connection boxes near the access road, the outbuilding, and the dome; and (*ix*) copper grid for electrical grounding. Finally, the parking area between the dome and the outbuilding is paved with asphalt, which interconnects the CSO Site to the adjacent branch of the Mauna Kea Access Drive. There are also four ½-inch diameter survey markers at the four corners of the sublease area, and a fifth benchmark near the center of the CSO Site. Figure 2-1 provides a detailed plan view of existing facilities on the CSO Site.

Figure 2-1 Plan View of Existing Facilities on the CSO Site

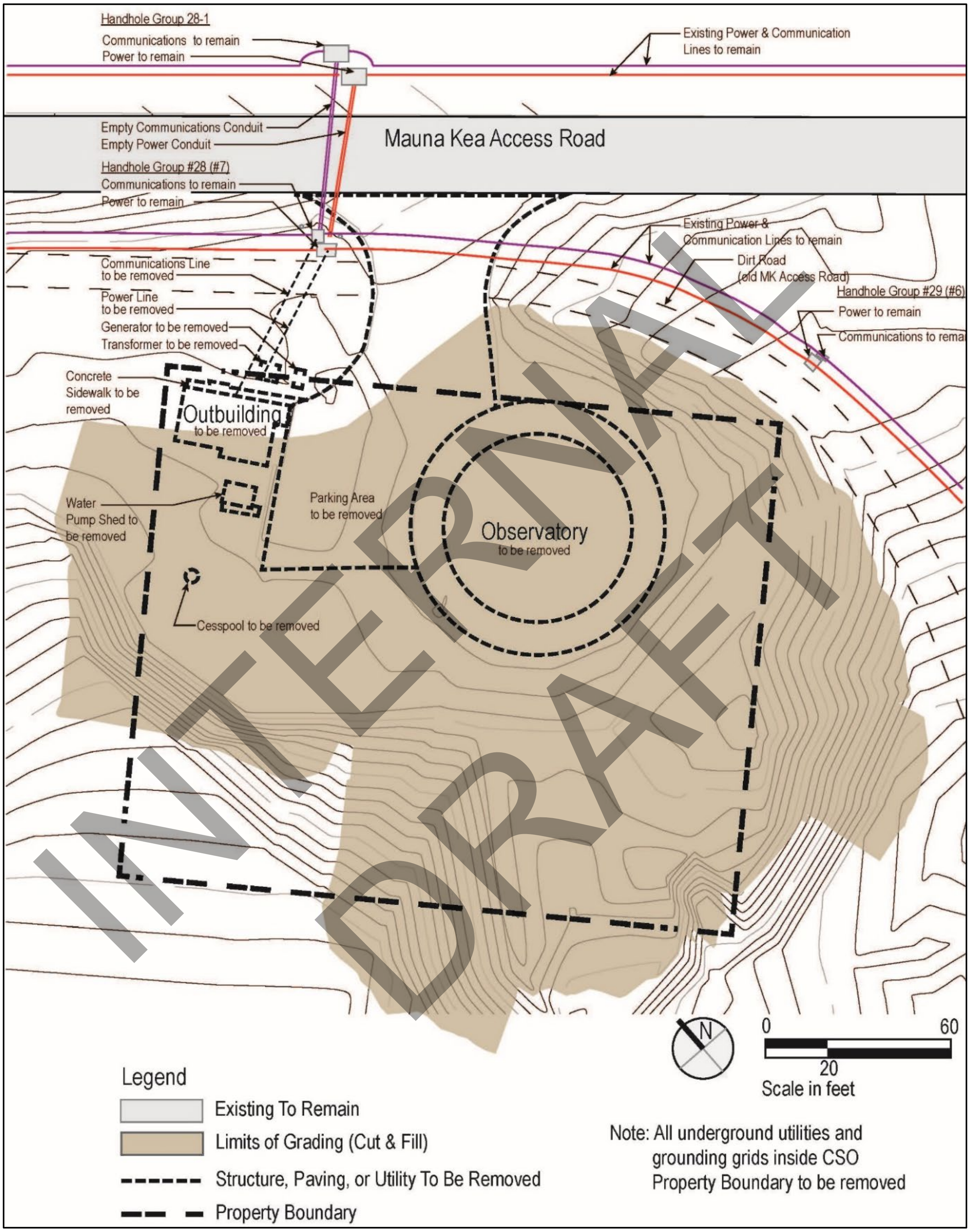


Source: dlb & Associates (2020)

2.1.2 CSO DECONSTRUCTION AND REMOVAL METHODOLOGY

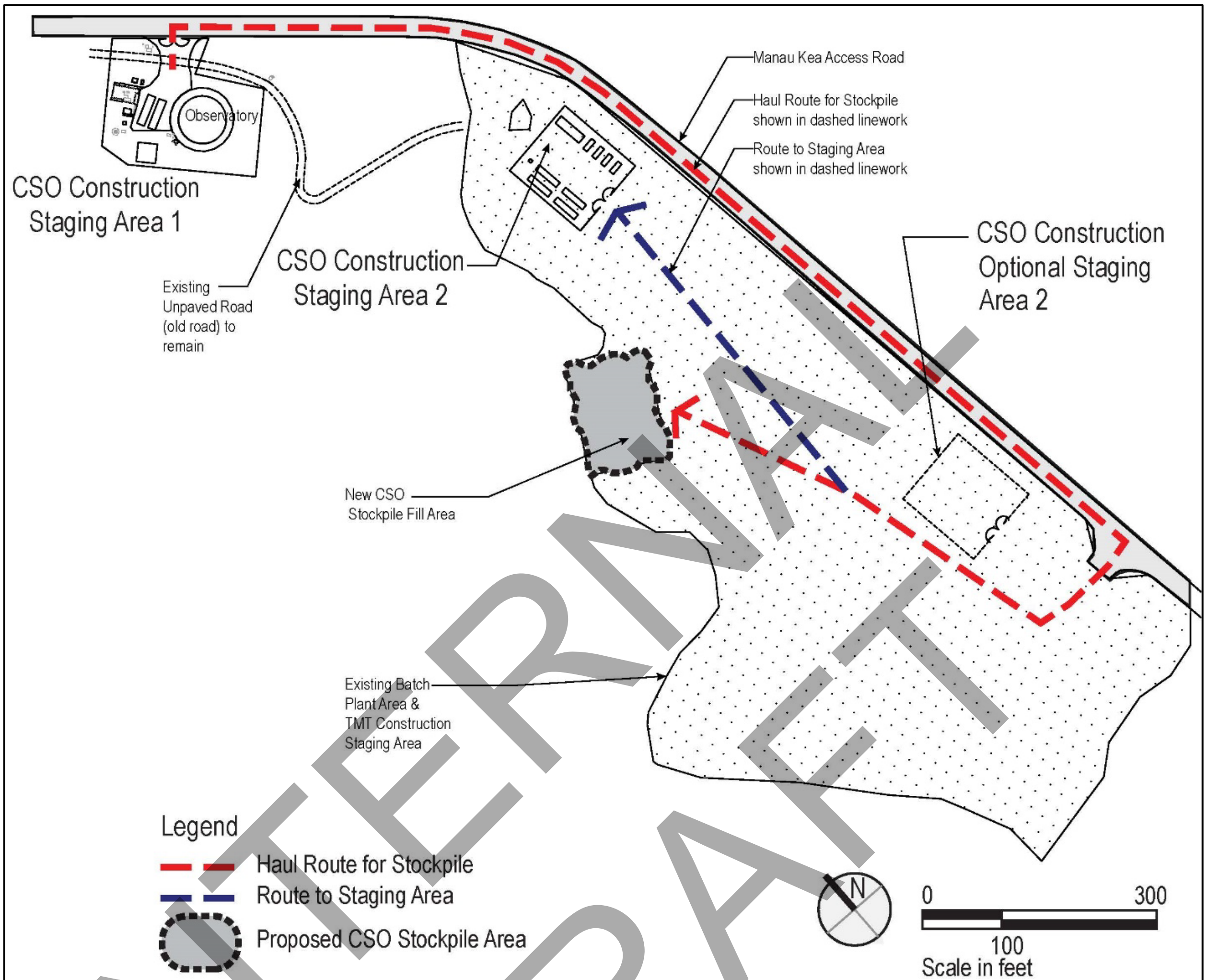
The following subsections outline the deconstruction and removal activities required to implement the proposed action. The deconstruction and removal process is laid out in detail and includes numerous precautions and protocols for safe and sensitive work by the contractor. Figure 2-2 illustrates the scope of work. Figure 2-3 provides a plan view of deconstruction staging.

Figure 2-2 ALT-2 Scope of Work



Source: M3 Engineering and Technology (2020)

Figure 2-3 Conceptual Plan View of Overall Deconstruction Staging



Source: M3 Engineering and Technology (2020)

2.1.2.1 ***Best Management Practices and Monitoring***

All general contractors, subcontractors, and suppliers will be required to adhere to: (*i*) Best Management Practices (BMPs); (*ii*) permit conditions; and (*iii*) all applicable federal, state, and county statutes, regulations, and standards. The principal purpose of these BMPs and other commitments is to identify the safety, environmental, and resource protection requirements and constraints related to these activities. The BMPs will include measures to comply with applicable aspects of the CMP and other guidance. The CMP management actions that directly apply to the proposed project are the Construction Guidelines in Section 7.3.2 and summarized in Table 7-12 of the CMP. The construction guideline management actions are designated with codes C-1 through C-9 and are summarized in Table 2.1 along with where the requirements are addressed in this EA.

Table 2.1 BMPs Required by the CMP (2009)

CMP Management Action No.	***Management Action Description in CMP Table 7-12***	***Where Addressed in this EA***
C-1	General requirement: Require an independent construction monitor who has oversight and authority to ensure that all aspects of ground-based work comply with protocols and permit requirements.	Section 2.1.2.1.2
C-2	BMP: Require use of *Best Management Practices Plan for Construction Practices*.	Section 2.1.2.1.3
C-3	BMP: Develop, prior to construction, a rock movement plan.	Appendix I
C-4	BMP: Require contractors to provide information from construction activities to CMS for input into CMS information database.	Section 2.1.2.1.4
C-5	BMP: Require on-site monitors (e.g., archaeologist, cultural resources specialist, entomologist) during construction, as determined by the appropriate agency.	Section 2.1.2.1.2
C-6	BMP: Conduct required archaeological monitoring during construction projects per SHPD-approved plan.	Section 2.1.2.1.2
C-7	BMP: Education regarding historical and cultural significance.	Section 2.1.2.1.1
C-8	BMP: Education regarding environment, ecology, and natural resources.	Section 2.1.2.1.1
C-9	BMP: Inspection of construction materials.	Section 2.1.2.1.3

Source: Office Mauna Kea Management, *Comprehensive Management Plan* (2009)

2.1.2.1.1 Education and Training

As the CMP management actions C-7 and C-8 require, all project personnel, monitors, contractors, and subcontractors will receive an educational orientation regarding the historic, cultural, and natural resources present in the summit region of Maunakea. Each individual will be required to complete the orientation prior to proceeding above Halepōhaku. It is anticipated that this orientation will be provided via the orientation video available on-line at: http://www.malamamaunakea.org/about-us/maunakea-orientation when the project begins. Because the proposed project is anticipated to take less than a year to complete, each person will only need to complete the orientation once. Should the project take more than a year to complete for a currently unexpected reason, each person will complete the orientation at least once a year.

Contractor and subcontractor personnel will receive additional information from the independent, archaeological, cultural, and invasive species monitors regarding the resources present, the protections they are afforded, and ways to reduce impacts to them when specific tasks are undertaken. These refreshers will be provided at weekly tailgate meetings or as warranted.

2.1.2.1.2 Construction Monitors

As the CMP management actions C-1, C-5, and C-6 require, several monitors will oversee the proposed project and have the authority to: (*i*) ensure that all aspects of the ground-based work comply with protocols and permit requirements, and (*ii*) stop activities if protocols and permit requirements are not being followed, unknown resources are encountered, or impacts to resources may occur. The monitors will consist of the following:

- *Decommissioning Manager*. A fulltime decommissioning manager, independent of the general contractor, will act as an independent construction monitor. Consistent with

CMP management action C-1, the decommissioning manager will ensure that BMPs and other commitments are being implemented throughout the decommissioning process. The decommissioning manager will work with archaeological, cultural, and invasive species monitors required at varying times during deconstruction.

- *Archaeological Monitor*. As recommended in the Archaeological Assessment (AA) prepared for the proposed project (ASM, 2018) and per CMP management action C-6, an Archaeological Monitoring Plan (AMP) will be prepared in accordance with HAR Chapter 13-279 and approved by SHPD prior to deconstruction activities starting. A draft of the AMP is included in Appendix J. Per the AMP and CMP management actions C-5 and C-6, the archaeological monitor will be present during ground-altering activity (e.g., digging trenches, removal of underground foundations and utilities, and removal of existing fill material).
- *Cultural Monitor*. As recommended in the Cultural Impact Assessment (CIA) prepared for the proposed project (ASM, 2020) and per CMP management action C-5, a cultural monitor will be present during ground-altering activity. The AMP (Appendix J) includes a cultural component. At the discretion of the selected cultural monitor, a more detailed cultural monitoring plan may be developed.
- *Invasive Species Monitor*. As recommended in the Biological Setting Analysis (SRGII, 2019) and per CMP management action C-5, an invasive species monitor will conduct monthly surveys for non-native species throughout the deconstruction process in order to identify any such introductions and formulate a response if necessary. Invasive species monitoring will address other components of the invasive species prevention and control program, such as vehicle and material inspections, throughout the deconstruction process. A draft Invasive Species Monitoring Plan that incorporates recommendations in the BSA is included in Appendix I.

All third-party construction monitors will participate in regularly scheduled deconstruction meetings led by the general contractor to keep abreast of the progress of deconstruction activities and schedule monitoring efforts. The independent monitors will interface with the general contractor to confirm that deconstruction activities follow the established protocols. It is also anticipated that each of the monitors will contribute to the project's worker orientation program. Among other benefits, archaeological and cultural monitoring will help to ensure that natural, archeological, historic, or cultural resources are not negatively impacted during site decommissioning.

2.1.2.1.3 Best Management Practices

As the CMP management actions C-2 and C-9 require, the proposed project will implement a Best Management Practices Plan that covers a range of topics and incorporates sustainable practices. The plan will include BMPs for:

- Water use
- Vehicle use, ride sharing, and traffic
- Material and waste management, including spill prevention
- Disturbance of ground surface and dust generation

- Erosion and water quality measures
- Invasive species prevention and control program
- Safety and accident prevention
- Inspection of equipment and materials

A draft of the Best Management Practices Plan is provided in Appendix I. All BMPs will be implemented during both the deconstruction and removal phase and the site restoration phase.

2.1.2.1.4 Coordination and Reporting

Beyond the requirements of CMP management action C-4, Caltech will conduct regular communications with CMS and other parties. This will be achieved through construction meetings and notices and other tools. Caltech believes this will increase the likelihood that the project is successfully completed in a safe and environmentally sensitive manner while maintaining normal public access to the mountain. The lines of communications will include: (*i*) the general contractor, (*ii*) CMS' decommissioning manager, (*iii*) third party monitors, (*iv*) CMS, (*v*) Maunakea Rangers, and (*vi*) representatives of the other observatories.

In addition, the project will provide to CMS all field logs, laboratory analyses (if any), and other construction documents that contain information on the biotic and abiotic environmental variables at the CSO Site.

2.1.2.2 ***Deconstruction Mobilization and Staging***

Prior to commencement of deconstruction, proper installation of support infrastructure and procedures will promote safe and efficient conduct. The initial phase of deconstruction will consist of:

- The installation of temporary construction fencing around the perimeter of the work and staging areas.
- Implementation of BMPs, including the placement of dust and erosion control barriers at appropriate locations established in the Storm Water Pollution Prevention Plan (SWPPP), which will be a component of the National Pollutant Discharge Elimination System (NPDES) general construction permit. The BMPs outlined in the SWPPP will not use any biological material or non-native rock or cinder. BMPs will be maintained and the SWPPP updated as appropriate throughout the deconstruction period.
- Installation of portable office trailers and portable toilets within the nearby Batch Plant at CSO Construction Staging Area 2 and a portable toilet at the CSO Site (i.e., Staging Area 1).

The temporary construction fencing is intended to visually define the spatial extent of deconstruction activity and to limit access to the CSO Site and staging areas to authorized individuals only. The perimeter fencing can be expanded or contracted, within established limits, during the course of the decommissioning process as the work area changes in extent. This fencing will also serve dust and erosion control functions. The requirement for fencing will be included in the deconstruction specifications distributed as part of the bidding process for general contracting firms. These specifications will require that the general contractor provide calculations for securing the fencing against wind loads at the project site as determined by the applicable building code.

As originally constructed, the CSO facilities were primarily built on or in fill from other locations on Maunakea. The fill will be removed and transported to an approved alternative location in the “Batch Plant” area (Section 2.1.2.16). Appropriate BMPs related to dust and erosion control will be prioritized from the outset. Figure 2-3 depicts the planned staging and haul routes during deconstruction. All vehicle and foot traffic will follow that route along the Mauna Kea Access Road; the dirt road will not be utilized.

As shown in Figure 2-3, the staging will be partitioned into three areas:

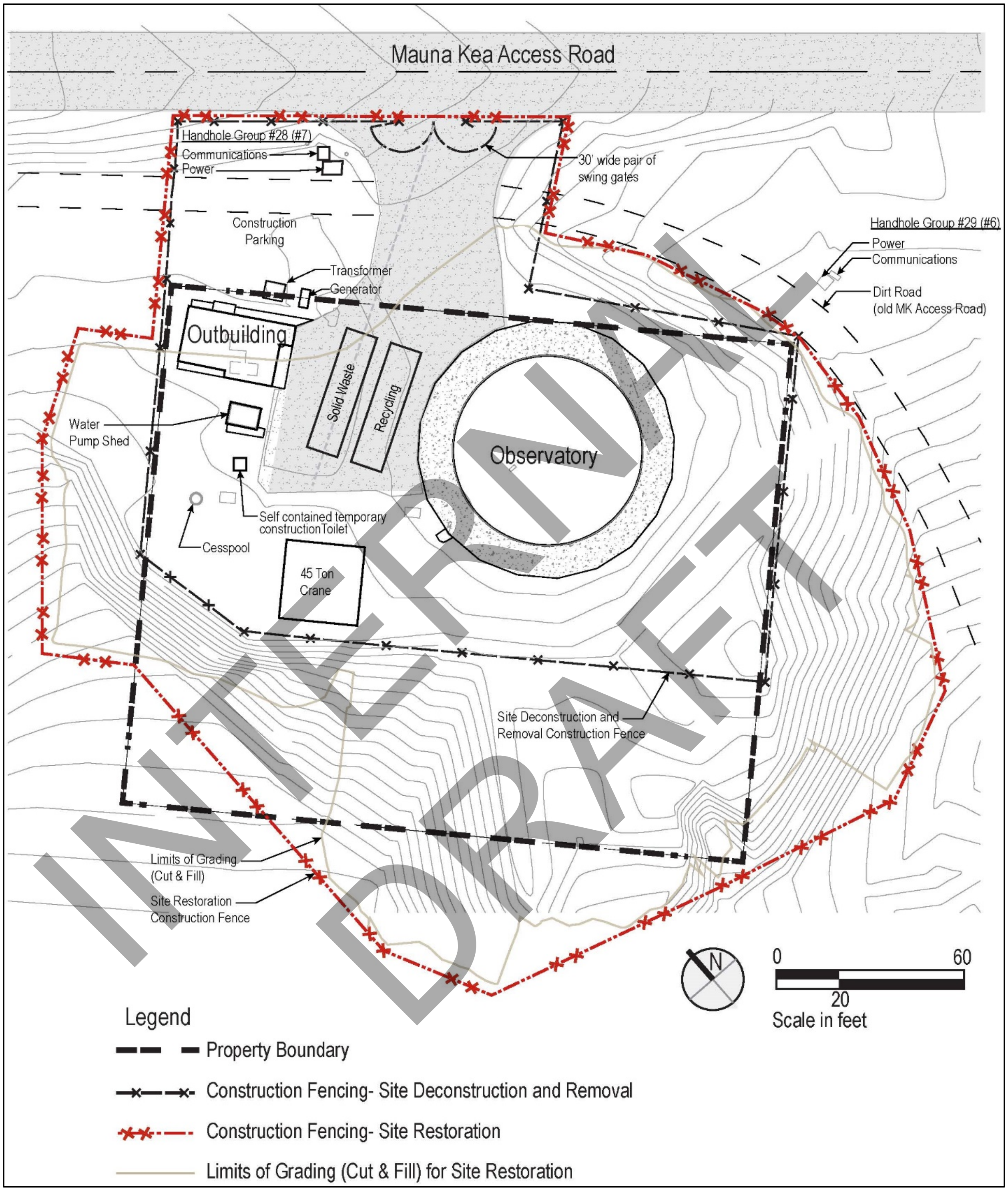
1. Staging Area 1 on the CSO Site;
2. Staging Area 2 within the Batch Plant adjacent to the Mauna Kea Access Road, it will be roughly 110 by 120 feet and roughly 0.3 acre; and
3. The 135 by 100 foot, roughly 0.3 acre, CSO fill stockpiling area also within the Batch Plant.

Figure 2-4 depicts a conceptual plan view of the Staging Area 1 on the CSO Site; Figure 2-5 provides a conceptual plan view of Staging Area 2. No grading of the Batch Plant will be required prior to establishing the staging areas. Once temporary construction fencing is emplaced, additional dust and erosion control BMPs will be placed around the perimeter of the CSO Site and Staging Areas 1 and 2.

An office trailer will be stationed at Staging Area 2 throughout the decommissioning process (see Figure 2-4). The trailer will be provided by the general contractor, with space provided for an independent decommissioning manager on-site daily. It will also afford adequate space for third-party archaeological, cultural, and invasive species monitors who will be present, as appropriate, during the site deconstruction and restoration phases of the project (see Section 2.1.2.1.2).

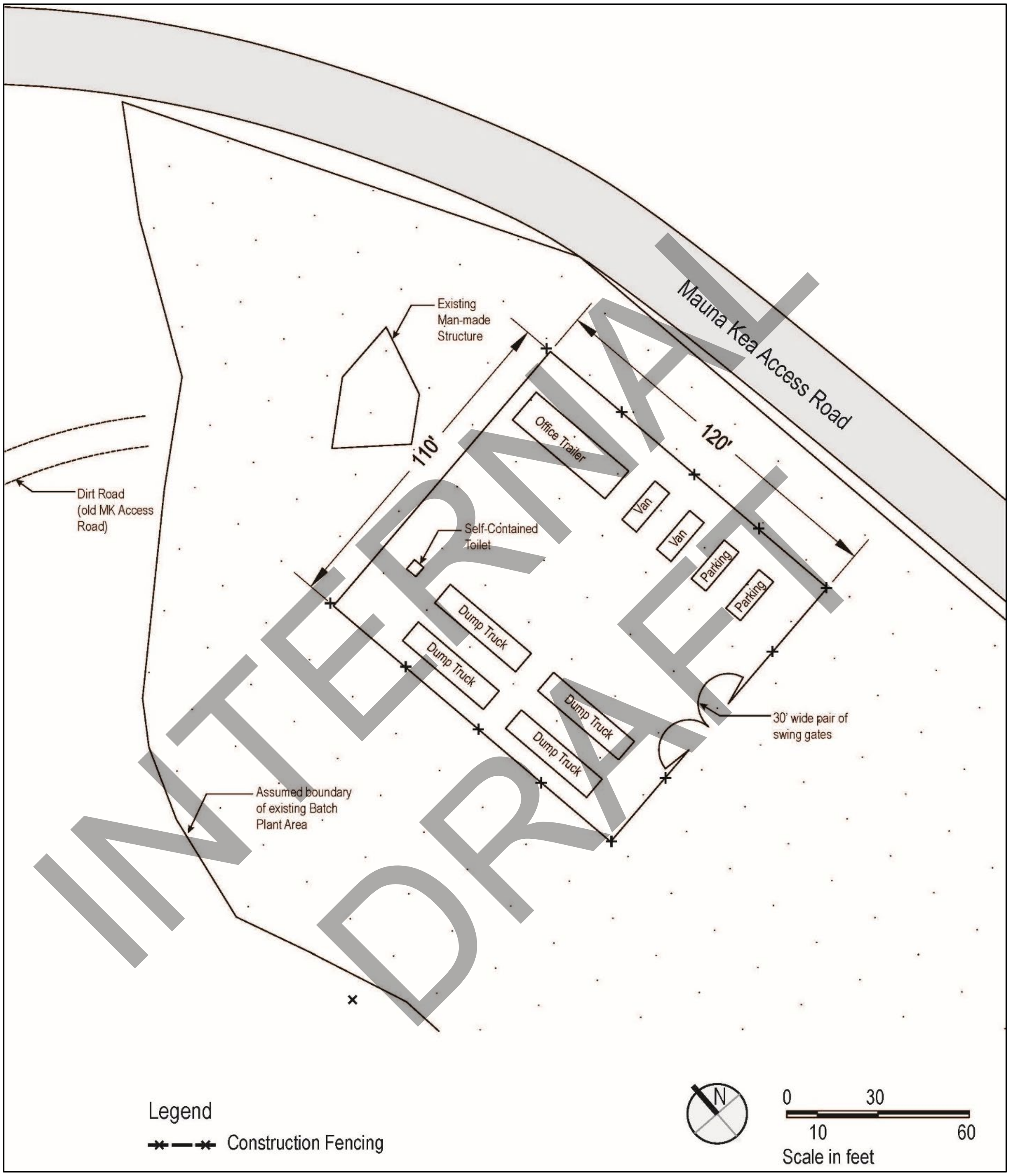
Temporary power interconnections, provided by Hawaiian Electric, for all deconstruction activities will also be put in place during mobilization and staging. Electrical power will be drawn from the closest remaining power source. For the CSO Site, the nearest available power source will be handhole group 28 (see Figure 2-4). There may be a period during which on-site generators supply power at the CSO Site and Staging Area 2. Water for deconstruction purposes will be provided via the existing tank and pump (see Figure 1-2) before being removed during latter stages of the deconstruction and removal process and/or a temporary aboveground water tank at Staging Area 2. Self-contained toilet facilities will be provided in the construction supervision trailer or through the use of portable toilets temporarily stationed on the CSO Site and Staging Area 2.

Figure 2-4 Plan View of Deconstruction Staging Area 1



Source: M3 Engineering and Technology (2020)

Figure 2-5 Conceptual Plan View of Deconstruction Staging Area 2



Source: M3 Engineering and Technology (2020)

2.1.2.3 ***Demolition Preparation and Fire Prevention***

Once the site has been secured and staged, the first deconstruction task will be to prepare the existing structures for demolition. All power and plumbing lines serving the observatory will be taken out of service by deenergizing or capping the lines, respectively, at the nearest point of remaining service. For the proposed action, this will be at the Handhole No. 28. Caltech anticipates that this modest task can be carried out in a single day with a limited crew of subcontractors.

The Hawaiʻi County Fire Department (HCFD) is the primary agency responsible for fire prevention, fire control, and emergency medical services in the County of Hawaiʻi. Caltech has been in communication with the HCFD regarding the CSO decommissioning and will continue to coordinate with them during its implementation. The National Fire Prevention Association's (NFPA) NFPA 241: Standard for Safeguarding Construction, Alteration, and Demolition Operations (2004) notes:

> *"A.5.4.1 Failure to remove scrap and trash accumulations provides fuel for the rapid expansion of a fire that might otherwise be confined to a small area. These accumulations also provide a convenient fuel source for malicious fires."*

The HCFD has indicated that during deconstruction, Caltech and its contractors may stage trailers to sort and deposit aluminum, steel, and deconstruction waste on-site. Caltech anticipates using roll-off trailers or similar container that can be securely covered, brought to the site, and stationed there during demolition. The contractor will be responsible for sorting and depositing deconstruction waste in the appropriate on-site container. HCFD has also stated that:

- Up to four locations may be designated on-site for deconstruction material sorting and collection, and that up to three roll-off trailers may be used, as appropriate, at any time during deconstruction.
- A truck may deliver an empty roll-off container up to a designated open location and haul away the full container while still complying with the total limit of three roll-off containers noted above.
- Recyclable material and deconstruction waste will be properly separated at all times during the deconstruction process.

2.1.2.4 ***Lead Paint and Mold***

Between January 22 and 23, 2019, Lehua Environmental Inc. (LEI) performed site reconnaissance to identify and inventory: (*i*) asbestos-containing material (ACM), (*ii*) lead-containing paint (LCP), (*iii*) lead-based paint (LBP), and (*iv*) mold-impacted areas of the CSO Site. This survey is provided in the SDP included in Appendix A.

LEI recommended the following:

1. Manage and/or remove and dispose of hazardous and regulated materials in accordance with applicable local, state, and federal regulations, prior to renovation and/or demolition activities that may disturb these materials.
2. Remove and dispose of all loose and flaking (i.e., poor condition) LCP and LBP that may be disturbed during renovation/demolition activities in accordance with applicable local, state, and federal regulations.

3. Spot remove and dispose of LCP and LBP in areas that have the potential to become airborne or otherwise create dust (e.g., from sanding, drilling, friction, etc.) during renovation/demolition activities.
4. Any remediation and demolition contractor(s) must take appropriate measures to comply with applicable Environmental Protection Agency (EPA), Occupational Safety and Health Administration (OSHA) and Hawaiʻi Occupational Safety and Health Division (HIOSH) regulations pertaining to the handling of lead-containing materials and worker protection. Note that OSHA and HIOSH regulate activities that disturb paint which contain any detectable concentration of lead and that detectable levels of lead in the paint were found throughout the CSO Site.
5. Have air monitoring conducted for airborne lead by qualified personnel during any lead paint disturbance and general renovation activities of areas that were determined to contain this contaminant.
6. Conduct multi-incremental sampling of soils surrounding the CSO Site prior to and after any exterior lead paint disturbance activities.
7. Previously water damaged ceiling tiles located throughout the CSO Site should be removed. These tiles may be identified by water staining and/or discoloration.

Caltech will direct appropriately trained personnel to implement all seven recommendations prior to starting demolition of the buildings. The fifth and sixth recommendations will also be implemented during certain tasks outlined below, through structure demolition (Section 2.1.2.9), as deemed appropriate by trained personnel after the first five recommendations have been completed as part of this task.

2.1.2.5 ***Telescope Demolition***

Caltech has been and continues to actively pursue the possibility of reusing the existing CSO telescope for further scientific research at an astronomical site other than Maunakea. If this effort is successful, the removal of the telescope will occur prior to the deconstruction activities presented in this EA. However, at the time this EA was prepared, no candidate site for relocation had yet been funded. If no relocation is funded prior to deconstruction, demolishing and removing the telescope will occur as part of the decommissioning of the CSO Site. The steel telescope structure will be cut using cutting torches and saws into transportable pieces and recycled as scrap material. All the support equipment that remained on-site is specific to the CSO telescope and will be disposed of appropriately if the telescope is subject to demolition.

2.1.2.6 ***Mechanical, Electrical, and Plumbing (MEP) Demolition***

General demolition work will begin with the removal of interior building components. The demolition of observatory mechanical, electrical, and plumbing (MEP) building systems will be first and will include removal of all power, lighting, water, waste, and communication lines integrated throughout the observatory facility and outbuildings.

Removing these "guts" of the facility will be mostly performed by means of individuals utilizing various handheld cutting equipment. All MEP material removed from the facility will be placed in the appropriate on-site container to be trucked off-site to the designated landfill or recycled.

2.1.2.7 ***Partition/Built-In Demolition***

To complete the interior demolition and prepare for the removal of the outer shell itself, all interior partitions, ceilings, and built-in units will be disconnected from the structure and removed. Working within the tightly confined shell of the observatory structure will require that the majority of interior demolition work be done by means of individuals utilizing appropriate cutting equipment. All material is to be considered waste and placed in the appropriate on-site container for later removal off-site to the designated landfill.

2.1.2.8 ***Skin Removal***

The enclosure skin of the outer shell of the observatory consists of individual thin triangular aluminum panels fastened to the supporting steel tube structure (see Figure 2-6). During deconstruction, the panels of the skin will be cut into manageable pieces using saws and cutting torches, and removed with the use of a crane and lift.

Figure 2-6 Photograph of CSO's Aluminum Panel Skin

Source: Caltech (2020)

It is anticipated that the individual facets will be removed on a one-by-one basis rather than through simultaneous removal of multiple panels by multiple workers. All aluminum panels are considered recyclable material and will be placed in the appropriate on-site container for removal off-site to the designated recycling center.

2.1.2.9 ***Structure Demolition***

With the building interiors, including MEP, and exterior skin removed, the structural skeleton of the observatory will be ready for dismantling (see Figure 2-7). The dismantling process will be performed with a manlift for cutting steel members into manageable pieces using cutting torches and saws and a crane for lifting these pieces from the structure to a flatbed truck for removal off-site. All steel deconstruction waste is planned to be recycled.

2.1.2.10 ***Paving Removal***

To prepare for subsurface demolition and removal work, the existing paving will be removed. Demolished paving will be loaded onto a dump truck for removal to a designated off-site landfill.

Figure 2-7 Photograph of Internal Structure During Construction

Source: Caltech (1985)

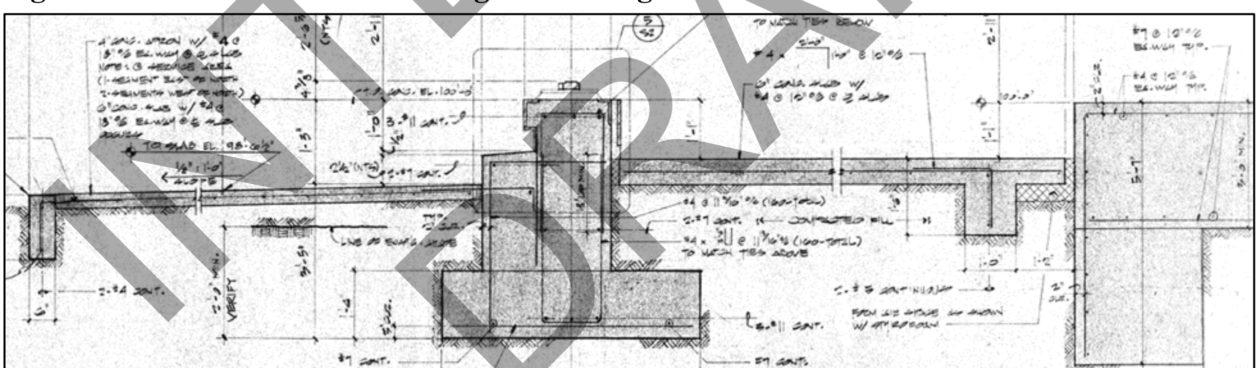
2.1.2.11 ***Foundation and Grounding Grid Removal***

The CSO does not have a basement level and the structural footings underpinning the observatory consist of shallow spread footings. For this reason, total foundation removal is included in all alternatives. The CSO's foundations can be seen in Figure 2-8 and Figure 2-9, with the latter showing how the depth and thickness of the foundation varies from the center to the apron.

Figure 2-8 Photograph of Foundation During Construction

Source: Caltech (1985)

Figure 2-9 Cross-Section Drawing Illustrating a Portion of CSO's Foundation



Source: H. Robert Hogan & Associated, *CSO Foundation Plan* (1983)

The reinforced concrete foundation will be broken or cut, removed from the ground, and placed in roll-off bins. The portions of the grounding grid near the CSO foundation will be removed during this phase. All material removed will be designated as deconstruction waste material and will be removed from the CSO Site and transported to an approved landfill, with the exception of recyclable material such as copper piping or grounding mats, which will be transported to a designated recycling center.

2.1.2.12 ***Cesspool***

As part of the decommissioning of the CSO Site, the cesspool will be closed. Caltech, in preparation for this closure, has consulted with the State of Hawaiʻi Department of Health, Planning and Design Section, Wastewater Branch (HDOH-WB), to identify alternative courses of action for closure and backfilling of the cesspool. As part of this consultation, HDOH-WB provided information from *General Backfilling Scenarios for an Injection-Well Cesspool* (2004), summarized as follows:

- Backfilling and permanently abandoning an injection-well cesspool constitutes an injection well closure.
- Prior to any method of backfilling, each injection-well cesspool should be cleared to its original constructed depth, and all sediments, sludge, and organic materials in the cesspool should be removed and disposed of properly.
- Backfilling with a cement mixture or flowable fill may stop short of reaching the ground surface in order to accommodate topsoil, landscaping, grading, underground utilities, or foundation considerations.
- All backfilling methods should not leave behind a depression in the ground. The final ground surface should be shaped or graded to prevent tripping or falling, as well as water ponding.
- An official injection well closure indicates that the injection well has been cleaned out and permanently filled and sealed with an inert material having stability and physical strength.

Because backfilling the cesspool with cement would permanently leave CSO infrastructure material on-site, contrary to its stated intention to totally remove all infrastructure and fully restore the site, CSO has explored other options for closure of the cesspool that would return the area more closely to its pre-construction condition. On March 1, 2018, Caltech representatives met with Sanitarian Amy Cook of HDOH's Environmental Services Division to discuss options for the closure of the CSO cesspool, including whether excavation below the cesspool was warranted or if fill from the CSO Site, rather than cement, was an acceptable fill alternative. In that meeting, HDOH-ES acknowledged Caltech's intention to remove all manmade structures from the site and stated that they were not aware of any instances of excavating below or beyond a cesspool base, except to enlarge a cesspool. In addition, HDOH-ES indicated that use of natural material from the CSO Site to fill the cavity left by removal of the cesspool was acceptable. (Amy Cook, pers. comm., March 1, 2018).

Based on its consultation with HDOH-WB and HDOH-ES, for all action alternatives Caltech now plans to: (*i*) pump out all sludge remnants in the cesspool, (*ii*) test the sludge for potential contaminants and dispose of it properly, (*iii*) trench around the outer perimeter of the concrete cesspool cylinder to its depth; (*iv*) remove the concrete cesspool structure and dispose of it properly; and then (*v*) use structural fill from the CSO Site[1] to fill the void to a depth even with the surrounding native lava flow surface and compact the fill during the backfilling process to

[1] This structural fill to be used is the fill placed on the lava flow during CSO construction and is native to Maunakea (Intera, 2019).

minimize settling in the future. CSO will continue to coordinate with the HDOH and comply with the instructions provided by it during closure of the cesspool.

2.1.2.13 ***Phase II Environmental Site Assessment (ESA)***

It is believed that small hydraulic fluid leaks may have occurred at the CSO Site when it was being built in 1984, and a small hydraulic fluid release was reported and addressed in 2009. These leaks, response actions taken to date, and other relevant information were identified in the *Phase I Environmental Site Assessment* (ESA), which is provided in Appendix B of the SDP (Appendix A), and is summarized in Section 3.2.1 of the SDP.

Per DP guidance, a *Phase II Sampling and Analysis Plan* (Phase II SAP) was prepared to address the findings of the Phase I ESA. The Phase II SAP is provided in Appendix C of the SDP (Appendix A), and is summarized in Section 3.3 of the SDP.

Following removal of the underground concrete slab (see Section 2.1.2.11) and cesspool (Section 2.1.2.12), Caltech will perform sampling and analysis per the Phase II SAP, which is attached to the SDP (Appendix A). The actions outlined in the Phase II SAP will address the past hydraulic fluid release. Contaminated soil, if any, would be removed and disposed of properly based on the results of sampling outlined in the Phase II SAP.

2.1.2.14 ***Outbuilding and Secondary Aboveground Infrastructure***

Under the proposed action, the outbuilding, a smaller nearby building housing a water pump, a generator mounted on a concrete pad, a transformer mounted on a concrete pad, and all other secondary aboveground infrastructure will be removed.

All building materials, including concrete pads and slabs, will be deconstructed and placed in roll-off bins. All material removed will be designated as deconstruction waste material and will be removed from the CSO Site and transported to an approved landfill, with the exception of recyclable material such as copper piping, if any, which will be transported to a designated recycling center.

2.1.2.15 ***Remaining Underground Infrastructure***

Underground improvements to be demolished include: (*i*) utility lines, (*ii*) water tank, and (*iii*) remaining grounding grid and other ancillary subsurface infrastructure. Under the proposed action, all the utility conduits from handhole group #28, which provides service to CSO and throughout the CSO Site will be removed. In concert with these activities, the remaining grounding grid will be removed.

All building materials, including conduit and tank, will be removed from the ground and placed in roll-off bins. All material removed will be designated as deconstruction waste material and will be removed from the CSO Site and transported to an approved landfill, with the exception of recyclable material such as copper piping and wire (including the grounding grid), which will be transported to a designated recycling center.

2.1.2.16 ***Backfill and Finish Grading***

Following the removal of all infrastructure, removal of remaining fill material will take place using heavy, medium, and small equipment and hand tools. The temporary construction fencing will be repositioned (Figure 2-4) to surround the site restoration work area prior to this fill removal activity. As the fill is removed, a quantity of roughly five cubic yards of fine ash material and small rocks, consistent with the size and material of the rocks scattered in the nearby undisturbed areas, will be segregated using a screen or similar method and stockpiled on site or at the staging area until needed for restoring the arthropod habitat (Section 2.1.3). The stockpiles left at the Batch Plant will be approximately five feet in height and cover an area of approximately 100′ x 135′ (Figure 2-3) and tightly arrayed in overlapping piles.

No fill or aggregate material will be imported from a non-Maunakea source to the CSO Site or Staging Area 2.

Once all the excess fill material has been removed, the reserved fine ash and small rocks will be layered on top of summit-native rock to leave a visual appearance consistent with the original condition of the Site. Because the CSO Site is located on a lava flow, it will not be possible to fully reconstruct the preexisting flow in excavated areas. Rather, restoration will use rocks and fill, compacting as necessary for long-term stability, to return those areas to a natural condition consistent with the surrounding topography.

2.1.2.17 ***Demobilization***

Upon completion of the backfill and the site restoration processes (see Section 2.1.2.16 and 2.1.3) that can be completed with the temporary construction fence in place, the general contractor will remove the fencing, soil erosion and dust control BMPs, and other items from the CSO Site for its final restoration.

2.1.3 SITE RESTORATION METHODOLOGY

Once deconstruction and removal of the CSO is complete, site restoration will take place, per the guidance of Caltech's *Site Restoration Plan* (SRP), a component of their SDP (Caltech, 2021; see Appendix A), which was prepared to comply with the DP's guidance:

> *"The purpose of a Site Restoration Plan is to present specific targets for site restoration and to describe the methodology for restoring disturbed areas after the demolition/construction activities described in the Site Deconstruction and Removal Plan are completed. Each SRP shall be specific to the site and consider cultural, biological, and physical aspects of site restoration. Each SRP shall include a provision for effectiveness monitoring to characterize success and/or failure of restoration efforts."*

It also goes on to provide definitions for three levels—minimal, moderate, and full—of site restoration which can be considered; Caltech, as part of its proposed action, will implement full restoration of the former CSO Site. Full restoration entails returning the CSO Site as closely as possible to its pre-construction condition, including topography and arthropod habitat. Figure 2-10 depicts the condition of the CSO Site prior to the facility's construction in the 1980s.

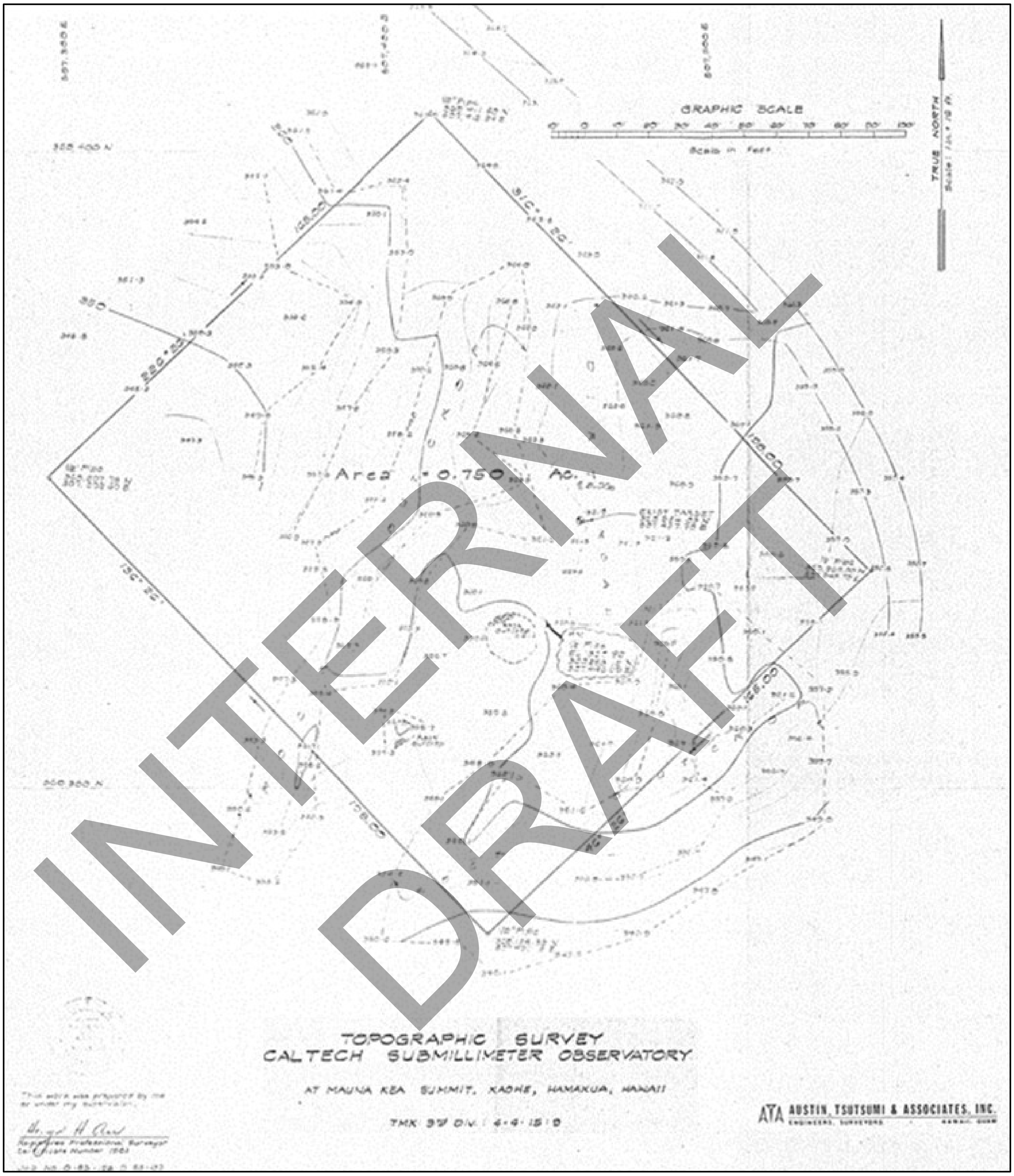
Figure 2-10 CSO Site Prior to Construction

Note: The “CIT” label refers to the California Institute of Technology and identifies the CSO Site.

Source: Caltech (1985)

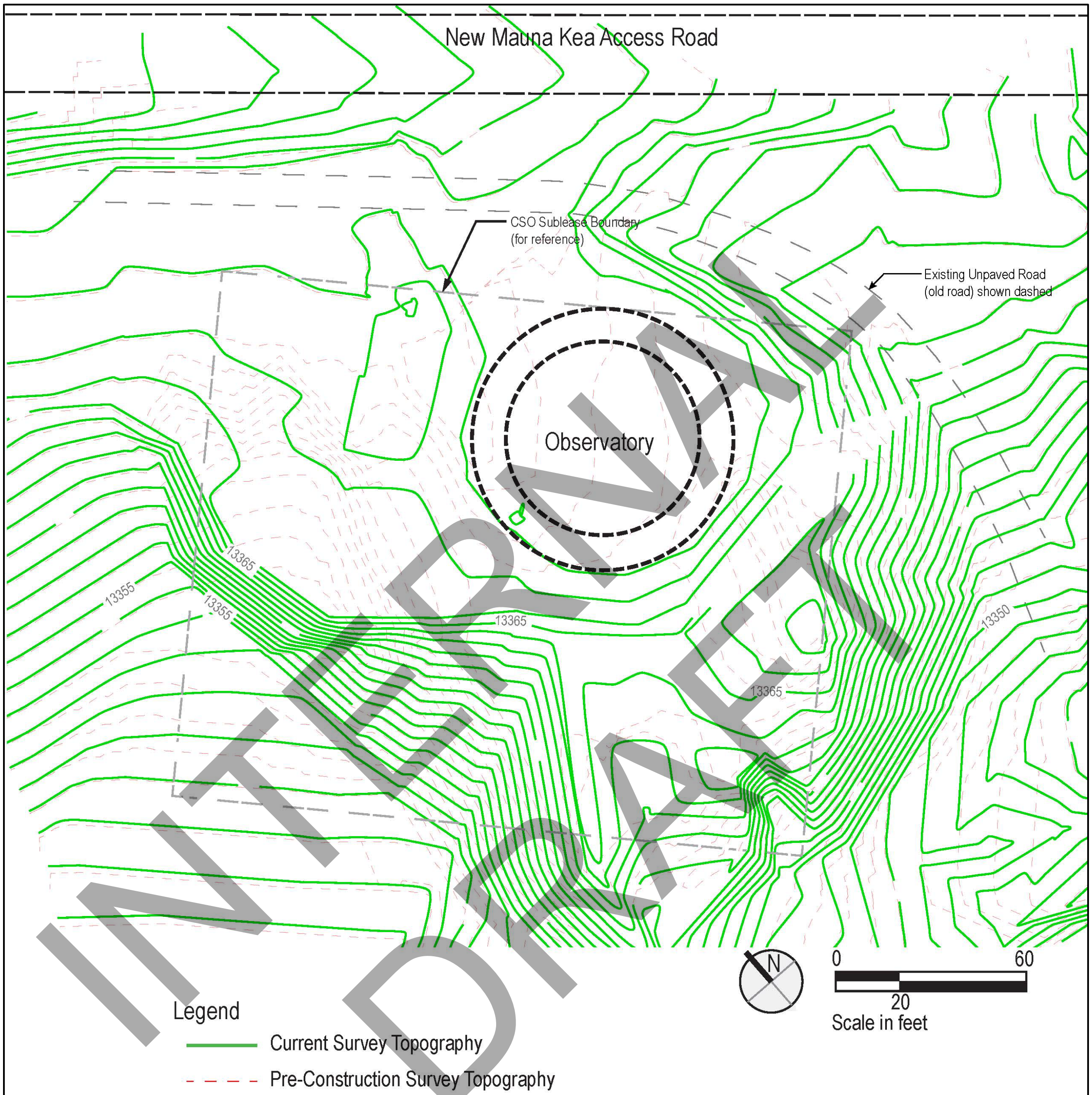
Austin, Tsutsumi & Associates, Inc, undertook a pre-construction site topographical survey, presumably prepared in 1982-1983 and noted as received January 21, 1983; the survey is provided in Figure 2-11. M3 Engineering and Technology, Caltech’s decommissioning planning contractor, digitized this prior survey and overlaid it with an updated site survey performed by dlb & Associates in 2016 (see Figure 2-12), with corrections for relative calibrations, to determine topographical discrepancies between the two and to calculate cut and fill requirements.

Figure 2-11 Pre-Construction Topographical Survey of Site (1982)



Source: Austin, Tsutsumi & Associates, Inc (1982)

Figure 2-12 Comparison of Pre-Construction and 2016 Topographical Surveys



This figure reproduces information not legible in the 1982 pre-construction topographical conducted by Austin, Tsutsumi and Associates, Inc.
Source: dlb & Associates (2016)

A comparison of the two surveys indicates that:

- Pre-construction grading and excavation cut approximately 495 cu. yds. of material from the site and filled with approximately 2,830 cu. yds. material, yielding a net fill of 2,335 cu. yds.;
- The maximum depth of the fill is about 10 feet, on the downhill side of the facility;
- The deepest foundation, under the telescope, is about 4 feet below grade and entirely in fill; and

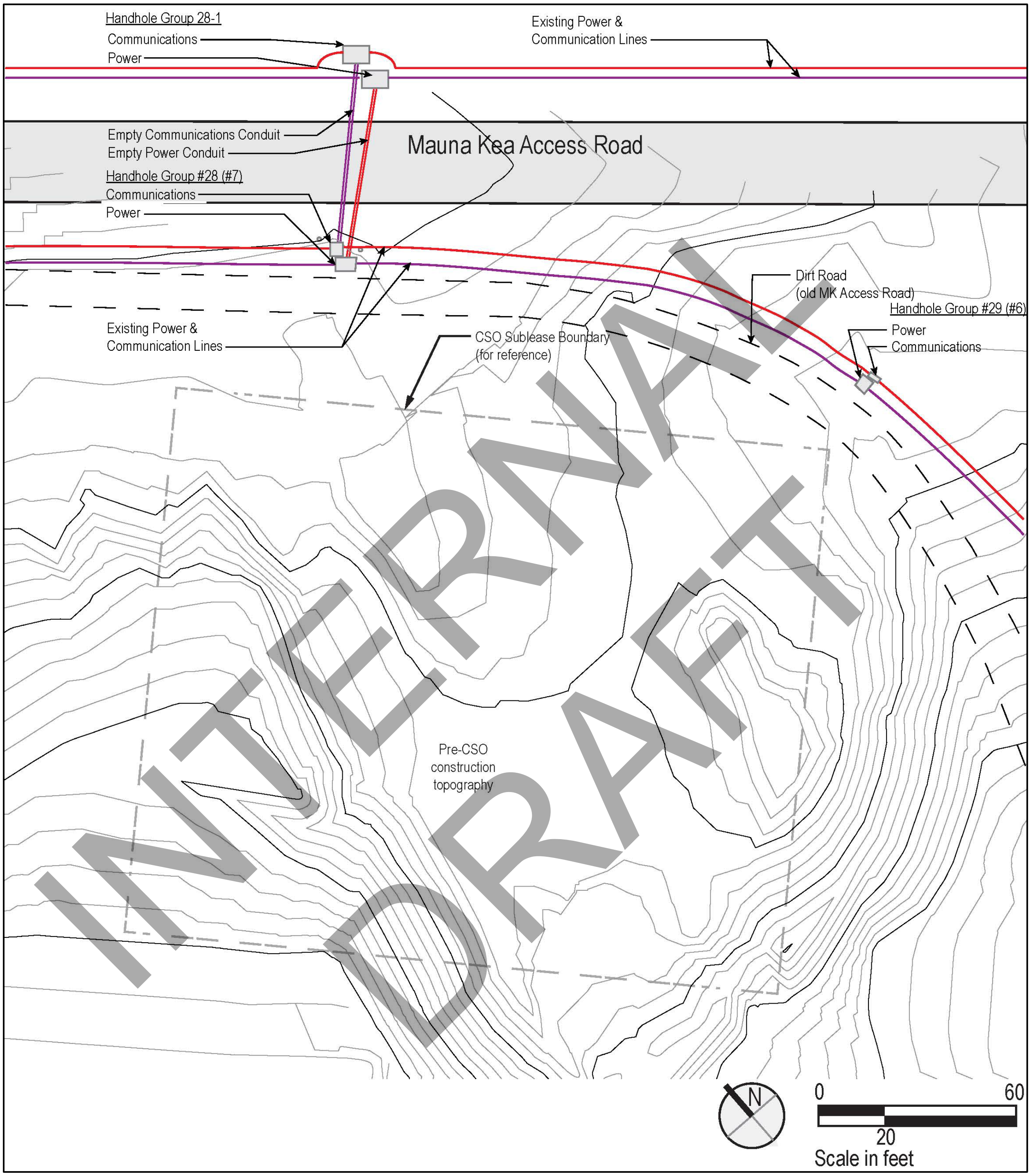
- The cesspool extends approximately 13.5 feet below grade, with the upper 9 feet in fill and the lower 4.5 feet in the pre-construction topography.

Because restoration of the pre-construction topography would primarily require removal of fill from the site, with only modest excavation and backfill for the cesspool, there appear to be no engineering obstacles to full restoration of the pre-construction topography.

Following removal of fill placed on the site during construction and grading (see Section 2.1.2.16) to restore topography, active arthropod habitat restoration will consist of scattering fine ash material and small rocks stockpiled during fill removal using medium to small equipment (e.g., a mini loader) and hand tools in an attempt to provide the naturalistic appearance and niche habitat for native species of plants and arthropods.

Figure 2-13 illustrates the anticipate CSO Site conditions post site restoration.

Figure 2-13 ALT-2 Post-Decommissioning Site Conditions



Source: M3 Engineering and Technology (2020)

2.1.4 FUNDING OF FUTURE SHARED INFRASTRUCTURE REMOVAL

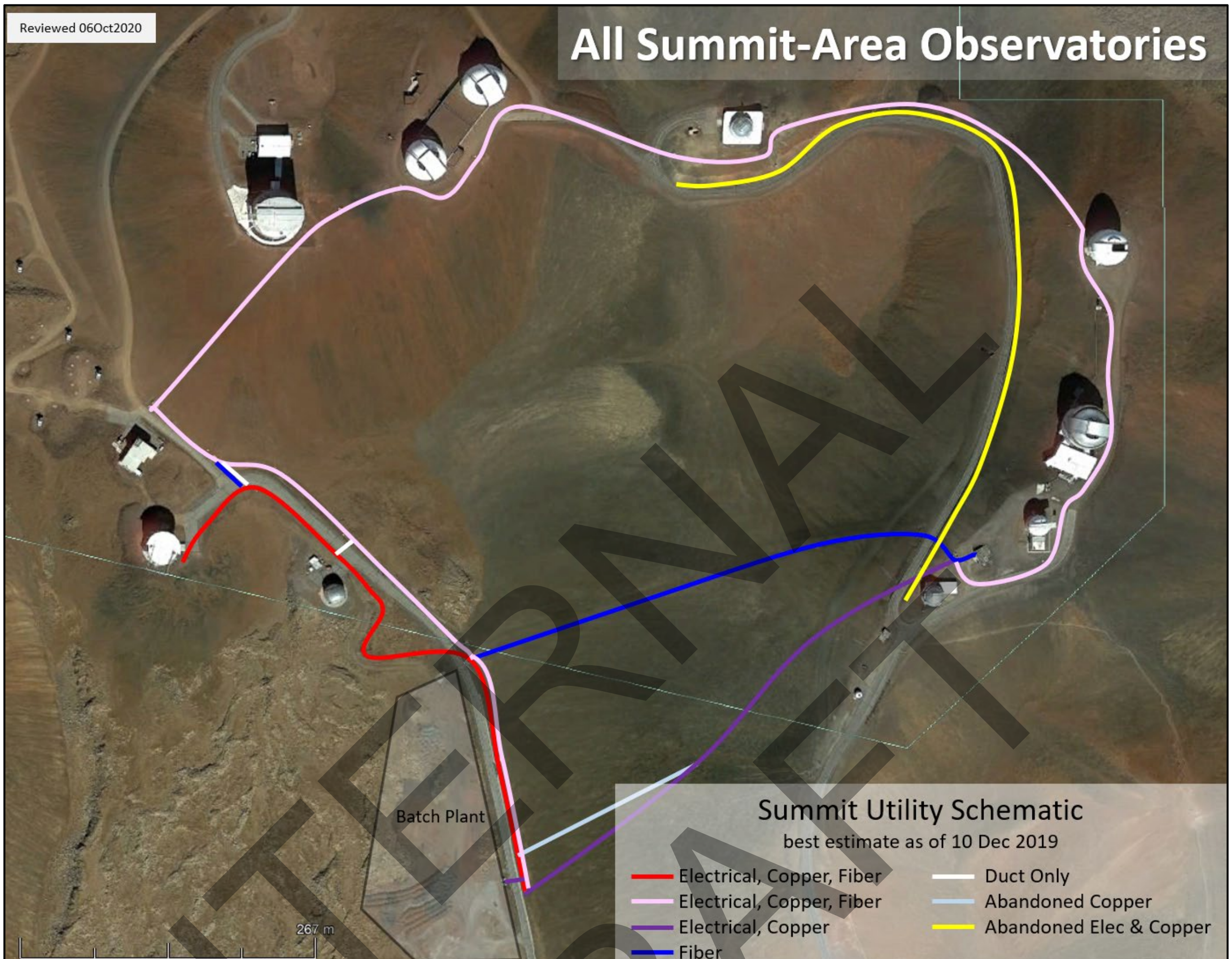
Infrastructure within the MKSR that CSO relies on and is shared with other uses in the summit region cannot be decommissioned until the other uses that rely on it also cease. Therefore, Caltech will not remove those shared facilities as part of the proposed action, but will provide funds to UH so that they can be decommissioned at a later date. The only shared infrastructure within the CSO Site is: (*i*) the electric and communication utilities along the dirt road (former Mauna Kea Access Road) that extend from near the Batch Plant, through handhole group #28, to JCMT; and (*ii*) the empty conduits that extend from handhole group #28, under the Mauna Kea Access Road, to handhole group 28.1 (Figure 2-13 and Figure 2-14).

Caltech would provide funds to UH for the future decommissioning of the shared infrastructure based on a weighted pro-rata share of the facilities it has utilized. Caltech has been assessed by UH to have a pro-rata interest in the following:

- The electrical and communication service that extends from near the lower portion of the Batch Plant, through handhole group #28, and on to JCMT (red line on Figure 2-14).
- The empty conduit between handhole group #28 and #28.1 (white line on Figure 2-14).
- Electric line from the lower portion of the Batch Plant to east side of Mauna Kea Access Road (short purple line on Figure 2-14).
- Communication service that extends from near the lower portion of the Batch Plant to near the upper part of the Batch Plant (a roughly 700 linear foot section of the pink line on Figure 2-14).
- Communication service that extends from near the upper portion of the Batch Plant to near the UH 2.2 observatory and "summit lunch room" (blue line on Figure 2-14).

In 2020 UH estimated that CSO's weighted pro-rata share to decommission the shared infrastructure was roughly $525,000. Caltech will provide an inflation-adjusted sum equivalent to this 2020 estimate to UH prior to the termination of its sublease.

Figure 2-14 Shared Infrastructure in the MKSR



Source: University of Hawai'i (2020)

2.1.5 Restoration Effectiveness Monitoring

Caltech will fund and ensure that restoration effectiveness monitoring is conducted for a period of three years post project completion.[2] The principle goal of the monitoring is to assess the recolonization of the restored habitat by native biota already established in the area, including arthropod species. A secondary goal of the monitoring is to evaluate the presence of invasive arthropod species in the area. The monitoring will be conducted as outlined in Appendix H.

2.2 PRELIMINARY SCHEDULE FOR THE PROPOSED ACTION

Caltech fully intends to complete all phases of the decommissioning process, including deconstruction and site restoration, as expeditiously as practical. The major project-related tasks, and their preliminary schedule for completion, are presented in Table 2.2 below.

[2] A monitoring period of three years is required per the *Decommissioning Plan for the Maunakea Observatories* (SRGII 2010).

Table 2.2 Preliminary Schedule for the Proposed Action

Task	***Estimated Start Date***	***Estimated Completion Date***
Pre-Assessment Scoping	11/8/2017	5/1/2018
Site Surveys	5/1/2018	7/31/2019
Site Decommissioning Planning	8/1/2019	12/2021
Environmental Assessment and Conservation District User Permit	11/15/2020	12/2021
Other Permitting, Construction Bidding, and Contractor Selection	Winter 2022	Spring 2022
Deconstruction and Removal	Summer 2022	Fall 2022
Site Restoration	Fall 2022	Winter 2022
Shared Infrastructure Funding	2022	2022
Surrender of CSO Sublease	n/a	Early 2023
Restoration Monitoring	2023	2025
Source: M3 Engineering and Technology (2020)		

2.3 PROJECT BUDGET

Caltech is responsible for the decommissioning of the CSO. Caltech will cover all decommissioning costs from their general funds; no federal funds would be involved in the decommissioning. The estimated total cost of the proposed action is summarized in Table 2.3.

Table 2.3 Estimated Project Budget

Item	***Cost***
Deconstruction and Restoration	
Material	n/a
Labor	$1,134,420
Other Direct	$622,750
Contractor Costs	$924,310
Contingency	$807,180
Shared Infrastructure	$525,380
Restoration Monitoring	$20,000
TOTAL	**$4,034,040**
Source: M3 Engineering and Technology (2020)	

Chapter 3: PROJECT ALTERNATIVES

3.1 FRAMEWORK FOR CONSIDERATION OF ALTERNATIVES

Title 11, Chapter 200.1, HAR contains the HDOH environmental review rules. HAR §11-200.1-9 deals with applicant actions such as the CSO Decommissioning Project. It requires that, for actions not exempt, the applicant must consider the environmental factors and available alternatives and disclose those in an EA or Environmental Impact Statement (EIS). HAR §11-200.1-18 establishes the process for the preparation and content of an EA. Among the requirements listed, HAR §11-200.1-18(d)(7) requires the identification and analysis of impacts of alternatives considered during project planning.

In accordance with those requirements, Caltech has considered a number of alternatives before determining that the proposed action described in Chapter 2 is its preferred alternative, allowing it to meet its purpose and need as defined in Sections 1.2 and 1.3. As can be seen in those sections, Caltech's purpose is to comply with the DP, as well as the end-of-sublease conditions identified in the sublease between Caltech and UH for the CSO.

The *Sublease Agreement among the California Institute of Technology, the University of Hawaii, and the State of Hawaii, Department of Land and Natural Resources, Sublease H09176* (CSO Sublease 1983) offers four options on termination or expiration of the sublease:

1. Sale to UH.
2. Surrender with concurrence of UH.
3. Sale to a third party acceptable to UH.
4. Remove the property and restore the site to even grade at the expense of Caltech.

Caltech is also committed to addressing applicable CMP management actions, specifically those detailed in the DP. The DP:

- Outlines two removal options: (*i*) complete (or total or full) removal, and (*ii*) infrastructure capping.
- Outlines three restoration levels: (*i*) minimal, (*ii*) moderate, and (*iii*) full (or total).
- States that, "For decision making purposes, the starting point for determining the scope and extent of removal shall be total removal," and, "The starting point for determining the level to which a site is to be restored shall be total restoration to the pre-construction condition."

The preferred alternative, detailed in Chapter 2, consists of complete removal and full restoration. Thus, it is consistent with, but goes beyond, option 4 in the sublease and is the same as the "starting point" for decision-making identified in the DP.

3.2 IDENTIFICATION OF FEASIBLE ALTERNATIVES

This section identifies a long list of potential alternatives based on the sublease conditions, the scenarios contained in the DP, as well as the specific examples of alternatives recommended for inclusion in EAs and EISs contained in HAR § 11-200.1-24.

Of the four end-of-sublease options outlined in the CSO Sublease, only the fourth, removal and restoration, is considered feasible because: (*i*) UH has indicated they are not interested in purchasing the property in its entirety from Caltech, (*ii*) no third party has indicated an interest in buying the property in its entirety from Caltech, and (*iii*) although UH has not explicitly stated it, Caltech assumes that UH would not approve the surrender of the property in its entirety.[3]

Per the DP (2010), Table 3.1 summarizes the options for removal and levels of site restoration that can be considered.

Table 3.1 Summary of Infrastructure Removal and Restoration Options

Task	*Level*	*Description*
Deconstruction and Removal	Infrastructure Capping	Infrastructure capping (also referred to as "partial removal") involves removal of aboveground facilities, with or without utilities, and leaves all or part of the underground portion of the facility in place. Under this option, varying degrees of infrastructure removal and capping can be considered.
	Complete Removal	Complete infrastructure removal (also referred to as "total removal" or "full removal") involves removal of the entire facility, including underground utilities, pilings, and foundation to the extent practicable under normal engineering deconstruction practices.
Site Restoration	Minimal	Minimal restoration is the removal of all man-made materials and grading of the site, leaving the area in safe condition.
	Moderate	Moderate restoration goes beyond minimal to include enhancing the physical habitat structure to benefit the native arthropod community.
	Full	Full restoration (also referred to as "total restoration") would return the site to its original pre-construction topography, as well as restoring arthropod habitat.
Source: Office of Mauna Kea Management, Decommissioning Plan (2010)		

On behalf of Caltech, M3 Engineering and Technology (M3), which specializes in observatory engineering and architecture, has evaluated the feasibility of complete infrastructure removal and full restoration of the CSO Site. M3's analysis indicated, with a high level of confidence, that complete removal of all infrastructure and full restoration of the site is feasible, and they have developed a plan to do so. As a result of this finding, the full range of removal and restoration alternatives may be considered technically feasible, from complete infrastructure removal and full restoration at one end of the spectrum (i.e., the "starting point" identified in the DP and the preferred alternative in Chapter 2) to infrastructure capping and minimal restoration at the other end. Table 3.2 presents a matrix of the potential alternatives for removal and restoration which are, in theory, possible.

[3] Surrendering is akin to the No Action alternative (ALT-1), except that it requires UH's approval.

Table 3.2 Matrix of Feasible Potential Alternatives

Removal	*Restoration*
No Action	No Action
Complete Removal	Full Restoration
Complete Removal	Moderate Restoration
Complete Removal	Minimal Restoration
Infrastructure Capping	Full Restoration
Infrastructure Capping	Moderate Restoration
Infrastructure Capping	Minimal Restoration
Source: Compiled by Planning Solutions, Inc. (2020)	

Section 3.3 details the reasonable alternatives that Caltech has determined merit full consideration and analysis in this EA. Section 3.4 discusses those alternatives that were considered during preliminary planning for the CSO Decommissioning Project but were ultimately rejected from further consideration.

3.3 ALTERNATIVES FOR DETAILED CONSIDERATION

From the full range of feasible alternatives shown in Table 3.2, Caltech further reduced this range of options to a reasonable set of alternatives for detailed consideration in this EA.

3.3.1 ALT-1: No Action

Under the "No Action" Alternative (henceforth, "ALT-1") nothing would change from the existing state of the site. No effort would be made to remove the improvements and infrastructure (the observatory, outbuilding, driveway, foundation, cesspool, utilities, etc.) and no effort would be made to restore any part of the site.

The No Action Alternative does not address the purpose and need for the CSO Decommissioning Project. It is considered here pursuant to the content recommendations contained in HRS Chapter 343 and to provide a baseline for comparison and contrast with the action alternatives.

3.3.2 ALT-2: Complete Facility and Infrastructure Removal with Full Restoration

This alternative (henceforth, "ALT-2" or "preferred alternative") represents Caltech's preferred alternative and is the proposed action detailed in Chapter 2 and is only summarized here for completeness. ALT-2 is consistent with the purpose (see Section 1.2), the project need (Section 1.3), and Caltech's intent as stated in the NOI. Under this alternative, Caltech would commit to the following:

- Complete removal of the CSO observatory, outbuilding, and all other above- and underground facilities, using the methods described in Section 2.1.2;
- Full restoration of the CSO Site to its pre-construction condition to the greatest extent practicable using the methods described in Section 2.1.2.16, including: removal of construction fill except where needed to fill cavities in the lava substrate caused by infrastructure removal; and, restoration of arthropod habitat;

- Restoration monitoring to characterize success or failure of physical, biological, and cultural restoration efforts; and
- Providing funds to UH to support the planned, future decommissioning of shared infrastructure.

Figure 2-2 illustrates the scope of work for ALT-2; Figure 2-13 illustrates the anticipated site conditions following implementation of ALT-2's removal and restoration activities.

3.3.3 ALT-3: Complete Facility and Infrastructure Removal with Moderate Restoration

This alternative (henceforth, "ALT-3") addresses a potential circumstance under which Caltech embarks with the intent to implement ALT-2, but, due to unanticipated factors that only become evident after removal and restoration operations commence, determines that full restoration of the CSO Site is not possible. If such unanticipated factors or conditions are encountered, Caltech would coordinate with construction monitors (Section 2.1.2.1), CMS, and the Institute for Astronomy (IfA). Caltech, in consultation with CMS and IfA, would select the appropriate course of action.[4]

Under this alternative, Caltech would apply for a CDUP to implement ALT-2, receive such a permit before the start of work, and begin deconstruction and restoration with the intent of completing the work per ALT-2, including full restoration. ALT-3 does not start with an intent to conduct moderate restoration, but because full restoration across the entire CSO Site would not be achievable, the level of restoration would be considered moderate (see Table 3.1). Even though only moderate restoration would be achieved on a portion of the CSO Site, Caltech would perform full restoration over the maximum extent of the site achievable. For example, if 40 percent of the CSO Site cannot be fully restored for some currently unknown reason, Caltech would conduct moderate restoration on that 40 percent and full restoration over the remaining 60 percent.

Under ALT-3, Caltech would intend to implement ALT-2 but complete the following:

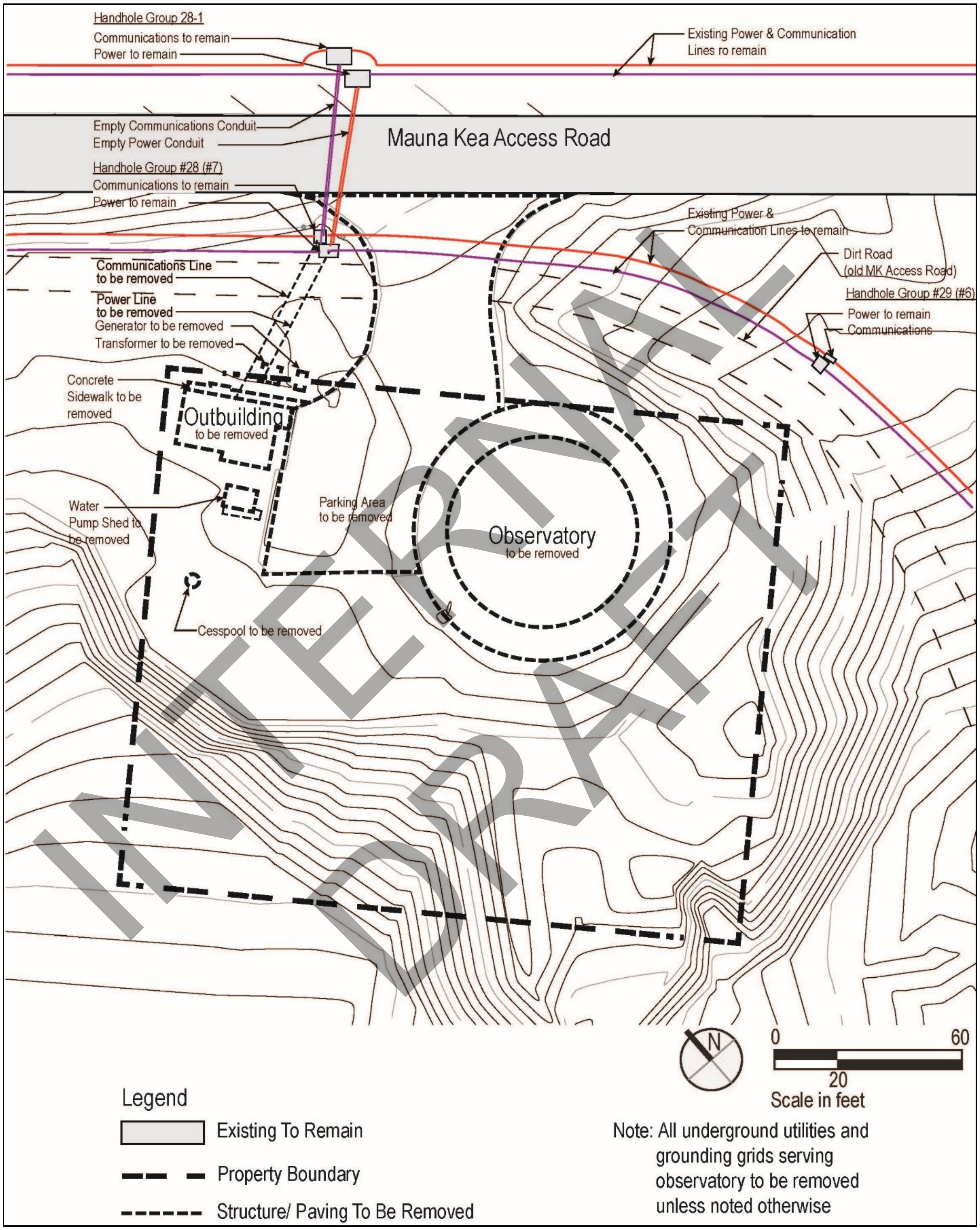
- Complete removal of the CSO observatory, outbuilding, and all other above- and underground facilities, using the methods described in Section 2.1.2;
- Full restoration of the portion of the CSO Site, if any, to the greatest extent practicable to its pre-construction topography using the methods described in Section 2.1.3;
- Moderate restoration of the remaining portion of the CSO Site that could not be fully restored, including (*i*) grading the area in a safe condition, but without matching the pre-construction topography, and (*ii*) restoring arthropod habitat to the greatest extent possible;
- Restoration monitoring to characterize success or failure of physical, biological, and cultural restoration efforts; and

[4] The appropriate course of action will depend on the factor or condition encountered. Possible courses of action include, but are not limited to, (*i*) identifying a remedy that allows for complete removal and full restoration, (*ii*) implementing ALT-3, or (*iii*) implementing ALT-4.

- Providing funds to UH to support the planned, future decommissioning of shared infrastructure.

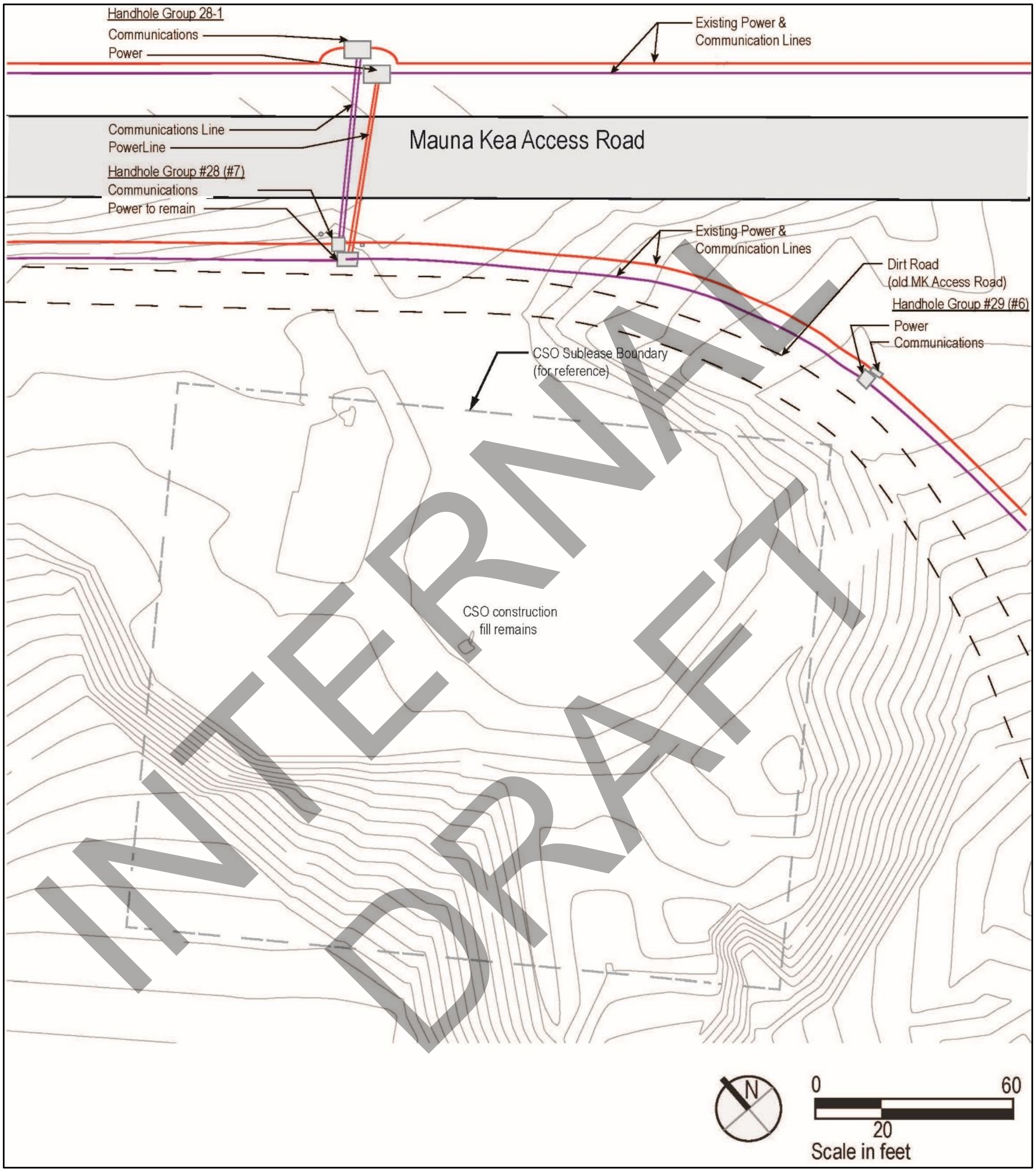
Figure 3-1 illustrates the scope of work for ALT-3, which is identical to the ALT-2 scope of work. Figure 3-2 illustrates one possible site condition following implementation of ALT-3's removal and restoration activities; it illustrates moderate restoration (i.e., no topographic restoration) across the entire CSO Site.

Figure 3-1 ALT-3 Scope of Work



Source: M3 Engineering and Technology (2020)

Figure 3-2 ALT-3 Post-Decommissioning Site Conditions Example



Source: M3 Engineering and Technology (2020)

3.3.4 ALT-4: Facility Removal, Infrastructure Capping, and Moderate Restoration

This alternative (henceforth, "ALT-4") addresses a potential circumstance under which Caltech embarks on its intention to implement ALT-2, but due to unanticipated factors that only become evident after removal and restoration operations commence, complete removal and full restoration of the CSO Site is not possible. Similar to ALT-3, if such unanticipated factors or conditions are encountered during deconstruction activities, Caltech would coordinate with construction monitors (Section 2.1.2.1), CMS, and the IfA. Caltech, in consultation with CMS and IfA, would select the appropriate course of action.[5]

Under ALT-4, Caltech would apply for a CDUP to implement ALT-2, receive such a permit before the start of work, and begin deconstruction with the intent of completing the work per ALT-2, including full restoration. ALT-4 does not start with an intent to conduct cap infrastructure and conduct moderate restoration, but because complete removal would not be achievable, the removal would be considered "infrastructure capping," and because full restoration across the entire CSO Site would not be achievable, the restoration would be considered moderate (see Table 3.1). Even though some infrastructure would be capped and left in place, Caltech would remove infrastructure to the maximum extent practicable. Similarly, even though only moderate restoration would be achieved on a portion of the CSO Site, Caltech would perform full restoration over as much of the site as possible.

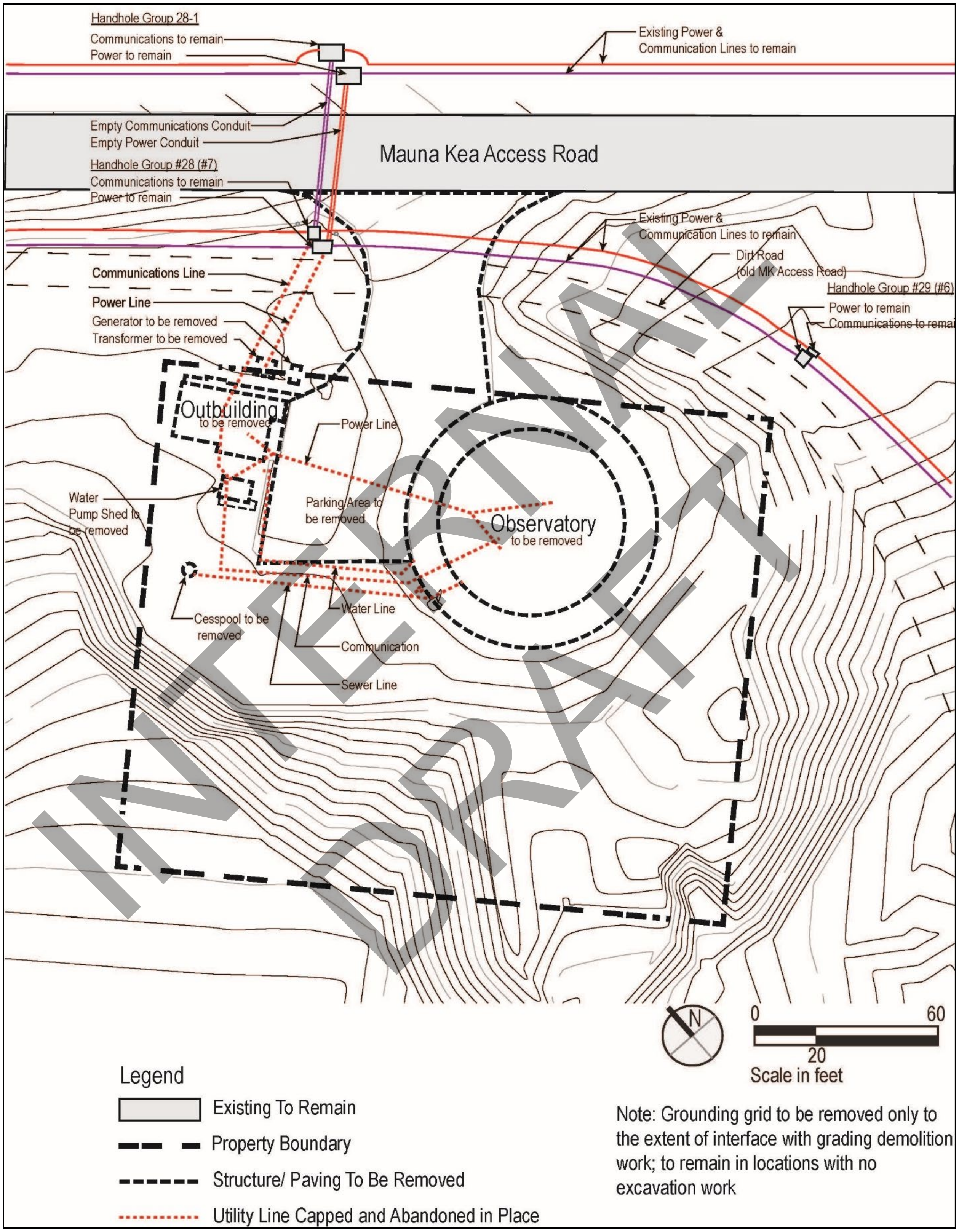
Under ALT-4, Caltech would intend to implement ALT-2 but complete the following:

- Complete removal of the CSO observatory, outbuilding, and all other aboveground facilities, using the methods described in Section 2.1.2;
- Removal of the CSO observatory and outbuilding foundations, cesspool, and other underground infrastructure to the maximum extent achievable, using the methods described in Section 2.1.2, but some portions would be capped and not removed;
- Full restoration of as much of the CSO Site as possible to its pre-construction condition to the greatest extent practicable, using the methods described in Section 2.1.3;
- Moderate restoration of the remaining portion of the CSO Site that could not be fully restored, including (*i*) grading and leaving the area in a safe condition, but without matching the pre-construction topography, and (*ii*) restoring arthropod habitat to the greatest extent practicable;
- Restoration monitoring to characterize success or failure of physical, biological, and cultural restoration efforts; and
- Providing funds to UH to support the planned, future decommissioning of shared infrastructure.

Figure 3-3 illustrates an example of the scope of work for ALT-4. Readers should note that it is only an example because it is not known which infrastructure components would not be removable due to unanticipated factors. Figure 3-4 illustrates one possible site condition following implementation of ALT-4's removal and restoration activities; it illustrates some infrastructure capped and left in place and moderate restoration (i.e., no topographic restoration) across the entire CSO Site.

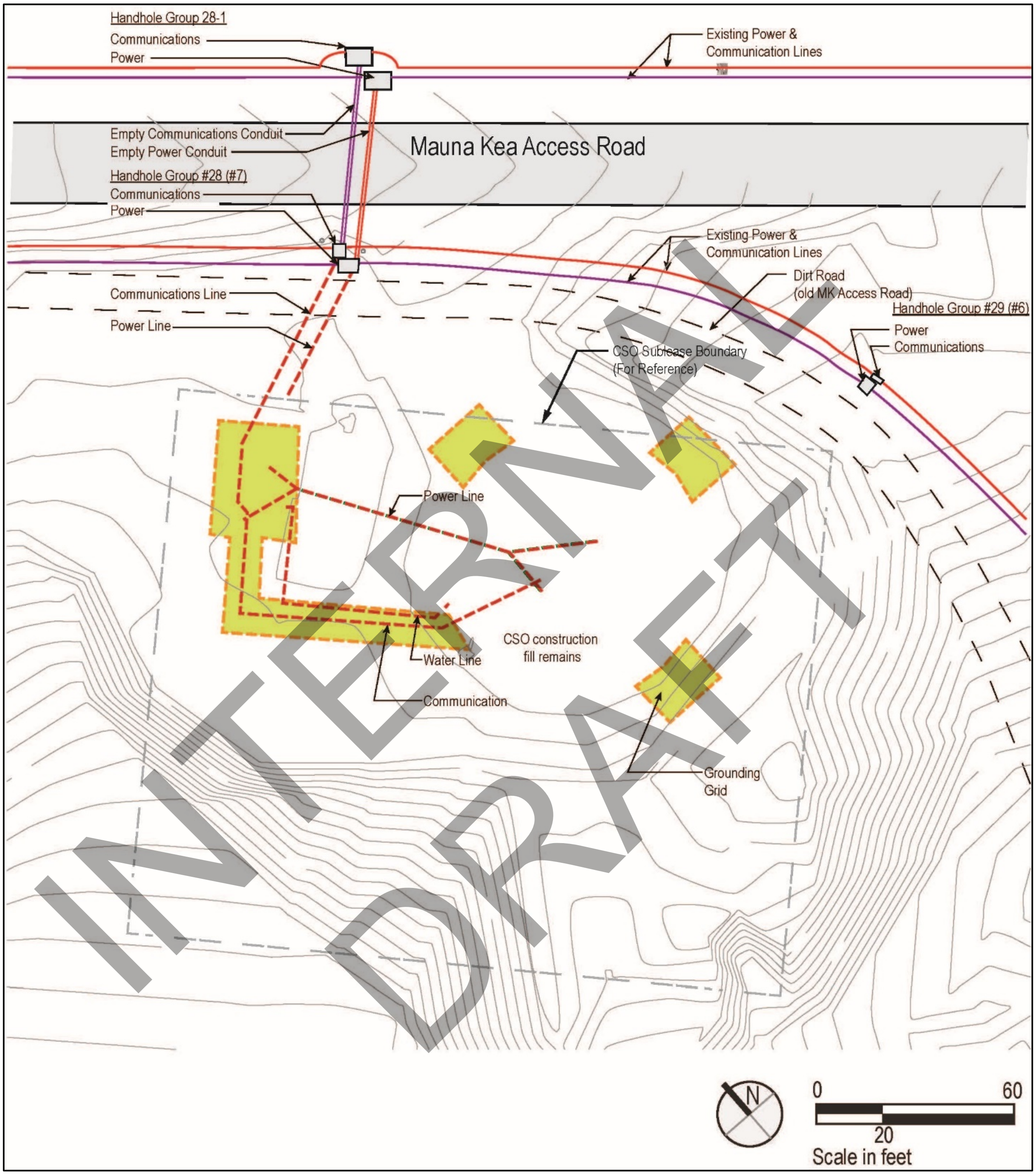
[5] The appropriate course of action will depend on the factor or condition encountered. Possible courses of action include, but are not limited to, (*i*) identifying a remedy that allows for complete removal and full restoration, (*ii*) implementing ALT-3, or (*iii*) implementing ALT-4.

Figure 3-3 ALT-4 Scope of Work Example



Source: M3 Engineering and Technology (2020)

Figure 3-4 ALT-4 Post-Decommissioning Site Conditions Example



Source: M3 Engineering and Technology (2020)

3.4 ALTERNATIVES CONSIDERED BUT REJECTED

3.4.1 REDUCED SCALE ALTERNATIVE

Several alternatives were considered feasible (see Section 3.2) but ultimately were screened out and are not analyzed in detail in this EA. The reduced scale alternatives fall into this group and include alternatives that involved the retention and repurposing of the outbuilding on the CSO Site and/or reductions in the level of facility removal and site restoration. Briefly, they were:

- Starting with the intent to conduct complete facility and infrastructure removal with moderate restoration.
- Complete facility and infrastructure removal with minimal restoration (this alternative most closely parallels the CSO Sublease fourth option).
- Starting with the intent to conduct infrastructure capping with moderate restoration.
- Infrastructure capping with minimal restoration.
- Partial facility removal (outbuilding retention), infrastructure capping, and full restoration over about 80% of the CSO Site.
- Partial facility removal (outbuilding retention), infrastructure capping, and moderate restoration over about 80 percent of the Site.
- Partial facility removal (outbuilding retention), infrastructure capping, and minimal restoration over about 80 percent of the Site.

These alternatives were screened out because, although they address the purpose and need to varying degrees, they are not consistent with Caltech's intent, as clearly stated in the NOI that was reviewed and accepted by UH and DLNR. In addition, early consultation with stakeholders regarding the inclusion of these potential alternatives indicated limited support for or interest in them.

Specific to the three alternatives that envisioned retention of the outbuilding to support safety-related goals in the CMP (i.e., those that include "partial facility removal"), UH has indicated that they believe those CMP goals can be satisfied through other management actions. Contributing factors to the screening out of alternatives that included outbuilding retention included (*i*) the outbuilding never had and is inappropriate to retrofit with restroom or water facilities, and (*ii*) the outbuilding was designed to house specific equipment, not for human occupancy. Furthermore, technical assessments developed during the planning of the CSO Decommissioning Project indicate that the benefits of the proposed action would be notably curtailed if the outbuilding were retained.

In view of the foregoing, Caltech has concluded that a reduced scale alternative to the proposed action is not desirable and has eliminated the listed potential alternatives from further evaluation in this EA.

3.4.2 DELAYED ACTION ALTERNATIVE

HAR §11-200.1 recommends the consideration of a variety of alternatives, including those of a substantially different nature than the proposed action, to include alternative locations, scales, and timing. Despite this, Caltech believes that a delayed action alternative may be dismissed out of hand because it would prolong adverse cultural, biological, physical, and financial impacts without any scientific benefit. This is particularly true because CSO suspended operations on September 8, 2015, and no entity has expressed a desire to restart scientific operations. Delay would in fact inflate the negative cultural impact by continuing to incur that impact without any countervailing benefit(s). Therefore, although Caltech could theoretically delay action until near the end of its sublease agreement, which is valid through 2033, they have determined that a delayed action alternative is not a viable option and eliminated it from further consideration in this EA.

3.4.3 Alternative Location

HAR §11-200.1 recommends the consideration of alternative locations. Such alternatives are not germane to the proposed project because the CSO is located at a single discrete location and the proposed decommissioning can only take place at that location.

Caltech has developed a partnership to move the telescope only (i.e., not the enclosure, outbuilding, or any other infrastructure) and has been actively engaged in identifying funding for this purpose. It is not certain funds will be obtained in time, and so the telescope may be removed and disposed of instead.. More importantly, while operating the CSO telescope at an alternative location would reduce the scale of Caltech's facilities on Maunakea, it would not address: (*i*) Caltech's responsibility to remove its remaining facilities and restore the site; or (*ii*) meet the terms laid out in its NOI. For these reasons, Caltech has determined that an alternative location is not a reasonable option and therefore eliminated it from further consideration in this EA.

Chapter 4: EXISTING ENVIRONMENT, POTENTIAL IMPACTS, AND MITIGATION

This chapter describes the potential environmental effects of the CSO decommissioning alternatives (ALT-1, ALT-2, ALT-3, and ALT-4), described in Chapter 2 and Chapter 3. This chapter is organized by resource category (e.g., water quality, air quality, noise, etc.). The discussion under each topic includes: (*i*) an overview of existing conditions on the project site; (*ii*) the potential environmental impacts that may occur as a result of implementation of one or more of the alternatives considered in this EA; and, where appropriate (*iii*) any mitigation measures that Caltech will take to avoid, minimize, or mitigate potential adverse effects. The scale of the discussion and analysis is commensurate with the potential for impacts. Where appropriate, the larger environmental context (e.g., Hāmākua District) is discussed, and in other cases the focus is narrower (e.g., the CSO Site). The discussion of impacts also distinguishes between short-term impacts (e.g., those occurring when equipment and personnel are actively implementing the deconstruction and restoration) and those that may result over the long-term as a result of the CSO Decommissioning Project. As the proposed project will not result in the development of any new facilities or long-term operations, most of the discussion focuses on short-term, “construction phase” impacts.

4.1 ARCHAEOLOGY

4.1.1 CONTEXT

At the request of Caltech, ASM Affiliates conducted an archaeological survey for the CSO Decommissioning Project on Maunakea. The resulting report, *An Archaeological Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Maunakea, TMK: (3) 4-4-015:009 (por.), Ka‘ohe Ahupua‘a, Hāmākua District, Island of Hawai‘i* (ASM 2018), provided the basis for the information and analysis in the following subsections and is provided in Appendix B. Although the CSO Site was included in a prior State Historic Preservation Division (SHPD)-accepted Archaeological Inventory Survey (AIS) (McCoy et al. 2010), the current Archaeological Assessment (AA) was conducted to account for the passage of time, to validate the findings of the prior AIS, and to identify any new find spots[6] that might be present.

The current study includes:

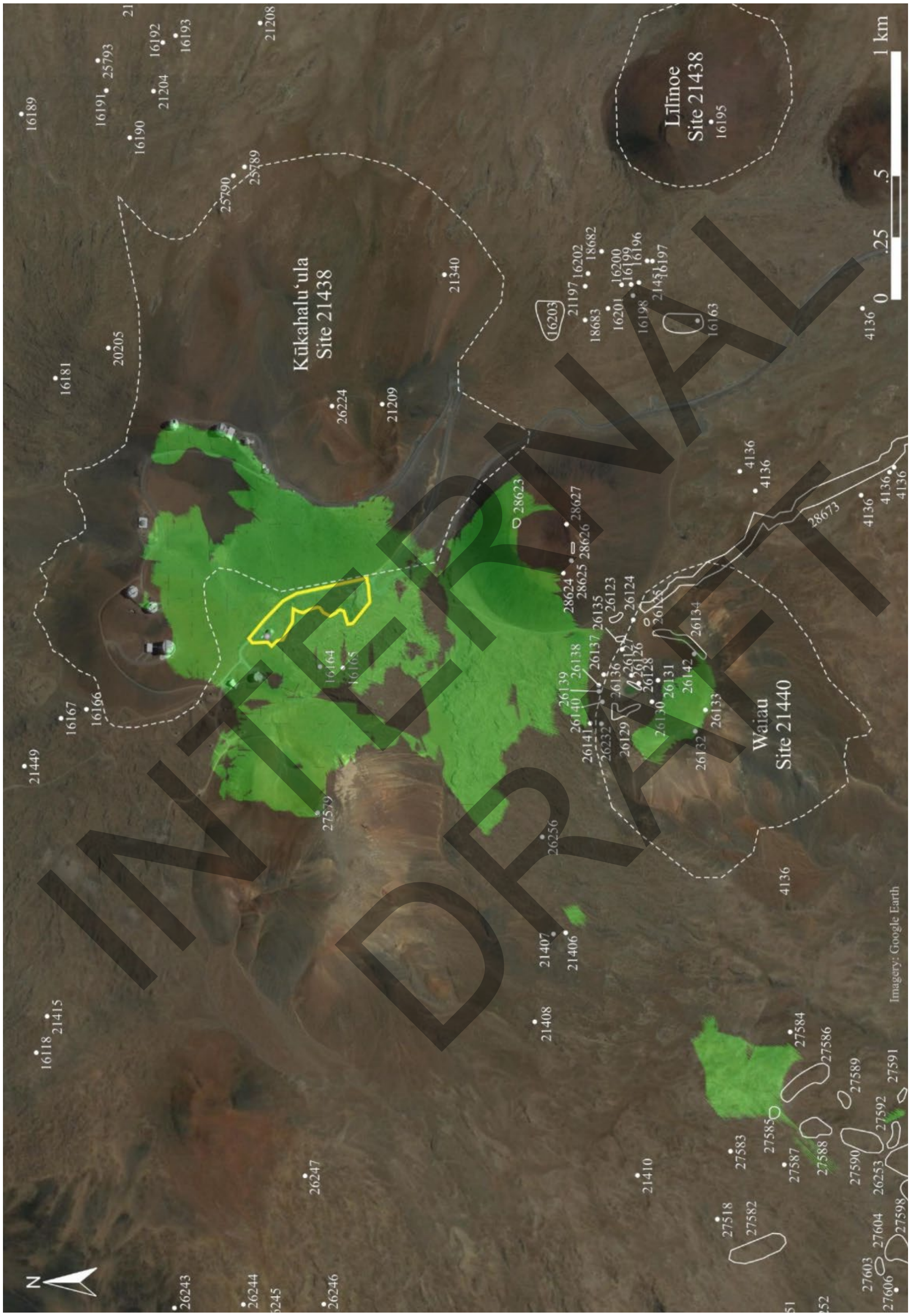
- A “direct effects study area” where ground disturbance may be anticipated to occur during the decommissioning process. This includes the CSO Site, the Batch Plant, and adjacent roads and is outlined in yellow on Figure 4-1 and Figure 4-2. The entire direct effects study area has previously been disturbed by construction activities.
- A larger “visual effects study area” that includes the viewshed of the CSO facility and is shown as green shading Figure 4-2. It includes large areas of undisturbed land as well as roads and observatories.

[6] ASM Affiliates Archaeological Assessment defines “find spots” as “anthropogenic features that are either obviously modern (e.g., camp sites with tin cans, pieces of glass and other modern material culture items), or features that cannot be classified with any level of confidence as historic sites because of their uncertain age and function (e.g., a pile of stones on a boulder) (McCoy 1999).” See Sec 4.1.2.1 for further discussion.

Figure 4-1 CSO Decommissioning Project Direct Effect Study Area

Note: Location of the CSO Decommissioning Project's direct effect study area is shown in yellow.
Source: ASM, *An Archaeological Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Maunakea, TMK: (3) 4-4-015:009 (por.), Ka'ohe Ahupua'a, Hāmākua District, Island of Hawai'i* (2018)

Figure 4-2 Direct Effects Study Area and Visual Effects Study Area with nearby Historic Properties



Note: Direct Effects Study Area outlined in yellow; Visual Effects Study Area shown in shaded green.
Source: ASM, *Cultural Impact Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Mauna Kea, TMK: (3) 4-4-015:009 (por.), Ka'ohe Ahupua'a, Hāmākua District, Island of Hawai'i* (2020)

4.1.2 PRIOR STUDIES

The direct effects study area was examined during three prior archaeological surveys (McCoy 1982a; McCoy and Nees 2010; McCoy et al. 2010) and by ASM Affiliates in 2018. The visual effects study area was surveyed in the same three studies, and also two other archaeological inventory surveys (McCoy and Nees 2009, 2013) and by ASM Affiliates in 2018. Results of these surveys and summaries of prior archaeological studies were presented in four AIS reports (Table 4.1).

Table 4.1 AIS Reports for the Maunakea Summit Region

Year	***Author(s)***	***Scope***	***No. of Historic Properties***
2009	McCoy and Nees	Lake Waiau	41 sites, 1 TCP[1]
2010	McCoy et al.	Astronomy Precinct	6 sites, 1 TCP
2010	McCoy and Nees	Mauna Kea Science Reserve (MKSR)	263 sites, 2 TCP[2]
2013	McCoy and Nees	Mauna Kea Ice Age Natural Area Reserve	109 sites, 1 TCP[3]

Notes:
1. Traditional Cultural Property (TCP)
2. Includes McCoy et al. (2010) findings.
3. Includes McCoy and Nees (2009) findings.

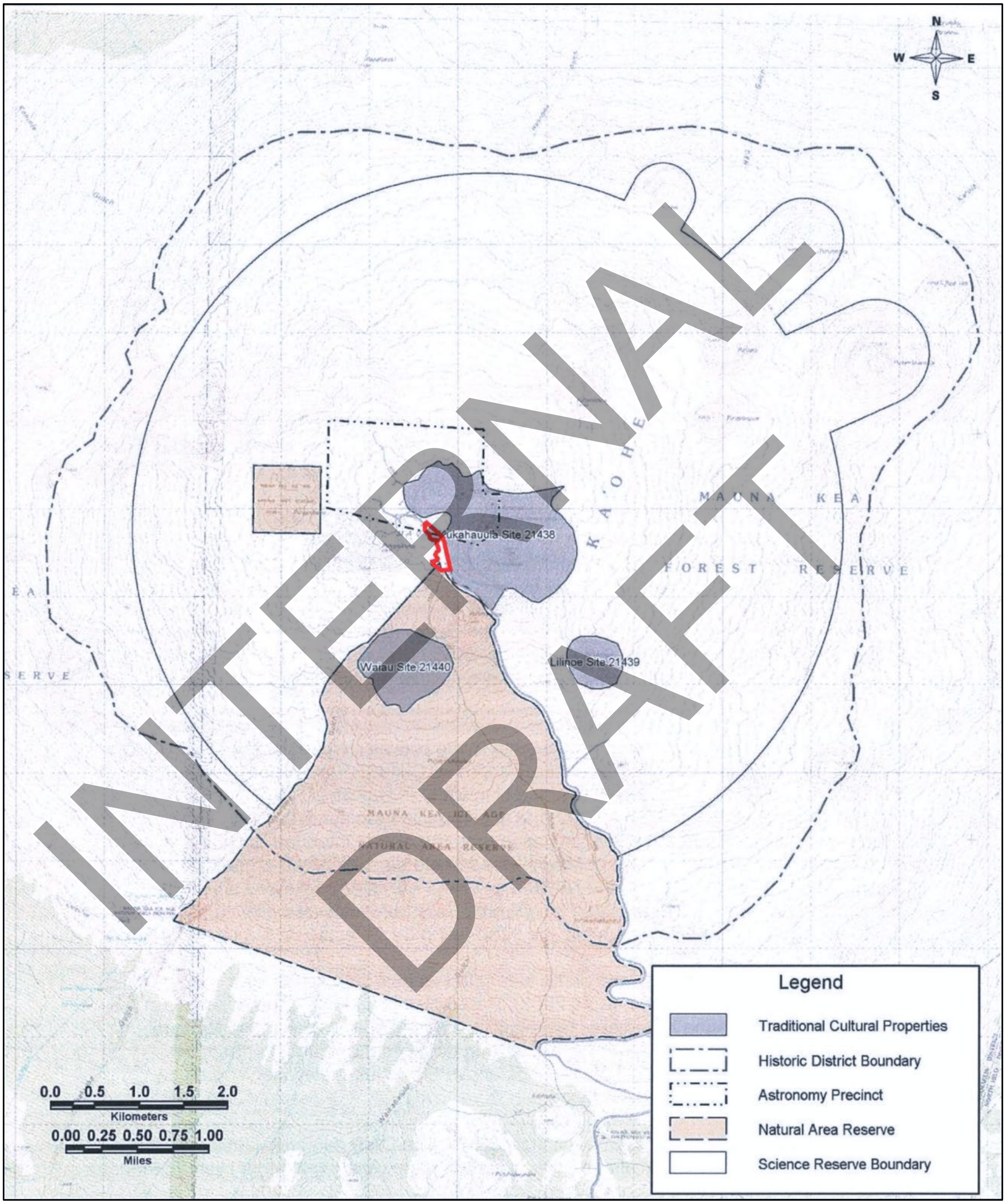
Source: ASM, *Archaeological Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Mauna Kea, TMK: (3) 4-4-015:009 (por.), Ka'ohe Ahupua'a, Hāmākua District, Island of Hawai'i* (2020)

The CSO site was also subject to an archaeological survey by the B. P. Bishop Museum (McCoy 1982a) in support of the observatory's EIS.

4.1.2.1 ***Mauna Kea Summit Region Historic District***

The Mauna Kea Summit Region Historic District (State Inventory of Historic Places (SIHP) Site No. 50-10-23-26869), which encompasses the extent of the glacial moraines and crest of the relatively pronounced change in slope that create the impression of a summit plateau (Figure 4-3), was designated by SHPD during the preparation of a draft Historic Preservation Plan for the MKSR. While the draft plan was never finalized, elements of the plan were incorporated into the *Mauna Kea Science Reserve Master Plan* (Group 70 International 2000). The district was initially proposed in the cultural impact assessment for the *Mauna Kea Science Reserve Master Plan* (PHRI 1999) and was later discussed in a SHPD review of the *Draft Environmental Assessment for the Keck Outrigger Telescope Project* and the *Final Environmental Impact Statement for the Keck Outrigger Telescope Project* (NASA 2005). The archaeological inventory surveys conducted (Table 4.1) indicated that the district is eligible for listing in the National Register of Historic Places (NHRP) under Criteria A, B, C, and D, and was also determined to be historically significant under Criteria a, b, c, d, and e of HAR §13-275-6 as a result of the McCoy et al. (2010) AIS.

Figure 4-3 Direct Effects Study Area Relative to the Mauna Kea Summit Region Historic District Boundary and the Extent of Traditional Cultural Properties



Note: Location of the CSO Decommissioning Project's direct effect study area is shown in red.
Source: ASM, *An Archaeological Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Maunakea, TMK: (3) 4-4-015:009 (por.), Ka'ohe Ahupua'a, Hāmākua District, Island of Hawai'i* (2018)

The archaeological surveys conducted (Table 4.1) recorded 263 historic properties in the MKSR and 109 historic properties in the Mauna Kea Ice Age Natural Area Reserve (Figure 4-4). Most, but not all, of these historic properties are within the historic district's boundaries; all those within the boundary are considered to be contributing elements to the district. Combined, these sites include: (*i*) three SHPD-designated Traditional Cultural Properties (TCPs), (*ii*) 151 shrines, (*iii*) 139 sites comprising the Mauna Kea Adze Quarry Complex, (*iv*) five burial features and 56 possible burial features, (*v*) 23 stone markers or memorials, (*vi*) four Historic campsites, (*vii*) three temporary shelters, (*viii*) three trails, (*ix*) one Historic dump, (*x*) one Historic transportation route, (*xi*) one petroglyph, and (*xii*) three sites of unknown function.

Figure 4-4 Direct Effects Study Area Relative to the Archaeological-Historic Properties and Traditional Cultural Properties in the MKSR and Mauna Kea Ice Age Natural Area Reserve

Note: Location of the CSO Decommissioning Project's direct effect study area is shown in red.

Source: ASM, An Archaeological Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Maunakea, TMK: (3) 4-4-015:009 (por.), Ka‘ohe Ahupua‘a, Hāmākua District, Island of Hawai‘i (2018); from (McCoy and Nees 2013)

The TCPs comprise three puʻu (Figure 4-4): (*i*) Site No. 21438 Kūkahauʻula; (*ii*) Site No. 21440 Puʻu Waiau; and (*iii*) Site No. 21439 Puʻulīlīnoe, that were determined to be eligible for inclusion in the National Register of Historic Places (NRHP) based on consultation begun by Langlas (1999) with knowledgeable kūpuna, or elders. The Kūkahauʻula TCP is adjacent to the direct effects study area and portions of the Kūkahauʻula and Puʻu Waiau TCPs are within the visual effects study area (Figure 4-2).

The Mauna Kea Adze Quarry Complex, located near Pōhakuloa Gulch on the southern slope of Maunakea, is partially in both the MKSR and the Mauna Kea Ice Age Natural Area Reserve; it is not within the direct effects study area or the visual effects study area. This complex contains 141 sites that include the quarry, workshop locations used for manufacturing and/or ritual activities, and one habitation rock-shelter located outside of the quarry proper.

In addition to archaeological sites and other historic properties, archaeological surveys conducted on the summit since 1997 have been recording "find spots" (called "locations" in early reports). During the MKSR AIS (McCoy and Nees 2010), 339 find spots were recorded, and approximately 313 find spots were recorded during the Mauna Kea Ice Age Natural Area Reserve AIS (McCoy and Nees 2013). The placement of objects and features classified as "find spots" by cultural practitioners and other visitors to the summit is understood to be ongoing, and management policies regarding construction of new Hawaiian cultural features and constructions considered to be "find spots" is governed by the CMP (2009).

4.1.2.2 ***<u>Historic Properties in the Study Areas</u>***

The entirety of the studies areas (direct and visual) were surveyed during one or more of the previous archaeological surveys (Table 4.1). The entire direct effect study area is within the Mauna Kea Summit Region Historic District (Figure 4-3); however, no individual historic properties have been previously reported in the direct effects study area. The two closest historic archaeological sites are two shrines (Site Nos. 50-10-23-16164 and -16165) located 188 meters and 250 meters, respectively, to the south-southwest of CSO (Figure 4-2).

The entire visual effects study area (Figure 4-2) is also within the Mauna Kea Summit Region Historic District (Figure 4-3). Eleven previously identified historic properties lie within the visual effects study area (Table 4.2, Figure 4-2).

Table 4.2 Historic Sites within the Visual Effects Study Area

Site No.	*Type(s)*	*No. of Features*	*Type of Features*	*Location Relative to CSO*
16164	Shrine	2	5, possibly 6, uprights	188 meters (m) SSW
16165	Shrine	1	2 uprights	250 m SSW
21438	Kūkahauʻula	1	Maunakea Summit as TCP	149 m E
21440	Puʻu Waiau	1	Puʻu as TCP	1,280 m S
26132	Possible Burial	2	Alignments	1,550 m SSE
26133	Cairn	1	Cairn	1,545 m SSE
26134	Possible Burials, Possible Shrine, Marker/Memorial	17	1 terrace, 1 mound/terrace, 4 pavements, 9 mounds, 2 rock piles	1,530 m S
26142	Workshop	1	Lithic scatter	1,510 m S
27579	USGS Marker	1	1 USGS marker	630 m W
27585	Workshop	1	4 adze manufacturing workshops, flakes, hammerstones, cores	2,530 m SW
28623	Possible Burial	4	4 mounds	930 m SE

Source: ASM, Cultural Impact Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Mauna Kea, TMK: (3) 4-4-015:009 (por.), Kaʻohe Ahupuaʻa, Hāmākua District, Island of Hawaiʻi (2020)

4.1.3 Fieldwork and Findings

The Principal Investigator for the AA (ASM 2018) was Benjamin Barna, Ph.D and the fieldwork was conducted by Theodore Bibby, Ph. D. and Benjamin Barna, Ph.D., on May 10, 2018. During the archaeological field survey, the entire ground surface of the direct effects study area was visually inspected by walking transects oriented parallel to the study area boundaries and spaced no more than 15 meters apart. No subsurface testing was conducted because the entire direct effects study area was previously disturbed by construction activities, covered in some places with recently dumped cinder fill, and known to overlie bedrock. No archaeological resources of any kind were identified within the direct effects study area. No find spots were observed within the current study area.

In addition to the pedestrian survey of the direct effects study area, an assessment of the potential visual impacts of the removal of the CSO dome and facilities was made by photographing the CSO facility site from the nearest historic property within the visual effects study area (Site No. -16164, a shrine located approximately 188 meters south-southwest of the CSO facility). Removal of the CSO facility was simulated by digitally erasing the telescope superstructure from the photographs taken from Site No. -16164 (see Figure 4-5).

Figure 4-5 View from Site No. -16164 and Simulated View Without CSO

View northeast of CSO, at center left, with Site No. 16164 in foreground.

Simulated view northeast from Site No. 16164 after full removal of CSO.

Source: ASM, *Cultural Impact Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Mauna Kea, TMK: (3) 4-4-015:009 (por.), Ka'ohe Ahupua'a, Hāmākua District, Island of Hawai'i* (2020)

4.1.4 Potential Impacts

Given that no archaeological resources were identified within the direct effects study area, ASM and Caltech have concluded that CSO Decommissioning Project action alternatives (ALT-2, ALT-3, and ALT-4) will have no direct effect on any historic properties. With respect to indirect effects, the eleven previously-recorded significant historic properties (Table 4.2; Figure 4-2) within the viewshed of the CSO facility and the Mauna Kea Summit Region Historic District will experience overall beneficial effects from the removal of the CSO facilities. For those sites and the district, the removal of the aboveground facilities will partially restore the appearance of the summit as it was prior to the construction of the CSO. This will result in an enhancement of the integrity of setting, feeling, and association of the 11 sites as well as the historic district; Figure 4-5 provides a comparison of the view toward the CSO from Site No. -16164. Therefore, because this effect is not "harmful," the determination of effect for the proposed project in accordance with HAR §13-284-14(a) and (b) is "no historic properties affected."

The No Action Alternative (ALT-1) does not have the potential to cause any further impact to archaeological or historic properties. However, it would perpetuate the ongoing impact related to the visibility of the CSO within its viewshed as discussed above.

With respect to the historic preservation review process of the Department of Land and Natural Resources–State Historic Preservation Division (DLNR-SHPD), no further historic preservation assessments or surveys need to be conducted within the CSO facility project area prior to project implementation.

4.1.5 Mitigation Measures

The project will comply with all aspects of the CMP as outlined in Section 2.1.2.1 and elsewhere in this document. For example, this will entail:

- All construction personnel being educated regarding the historic resources in the project area as required by CMP management action C-7.
- Archaeological monitoring per CMP management action C-6 and an Archaeological Monitoring Plan (AMP) prepared in accordance with HAR §13-279. A draft AMP is provided in Appendix J and will be approved by DLNR-SHPD prior to project implementation. Among other roles, the AMP will ensure protection of Site No. -21438 (Kūkahau‘ula), which is on the opposite side of the Mauna Kea Access Road from the direct effects study area, and as a contingency for the discovery of unanticipated archaeological resources.

4.2 CULTURAL IMPACT ASSESSMENT

4.2.1 Context

As discussed in Section 1.1, the issuance of a CDUP by the BLNR for the CSO Decommissioning Project subjects this action to the requirements of the Hawai‘i Environmental Policy Act (HEPA), as codified in HRS, Chapter 343. Among those requirements is the preparation of a Cultural Impact Assessment (CIA), intended to inform this EA, and prepared pursuant to Act 50 and in accordance with the Office of Environmental Quality Control's (OEQC) *Guidelines for Assessing*

Cultural Impacts, adopted by the Environmental Council of the State of Hawaiʻi on November 19, 1997 (OEQC, 1997). Act 50, which was signed into law by the Governor on April 26, 2000, specifically acknowledges the State of Hawaiʻi's responsibility to protect native Hawaiian cultural practices. The OEQC guidelines identify several possible types of cultural practices and beliefs that are subject to assessment. These include subsistence, commercial, residential, agricultural, access-related, recreational, and religious and spiritual customs. The guidelines also identify the types of potential cultural resources, associated with cultural practices and beliefs, that are subject to assessment. Essentially, these are natural features of the landscape and historic sites, including traditional cultural properties.

Act 50 further states that, "environmental assessments…should identify and address effects on Hawaiʻi's culture, and traditional and customary rights," and that, "native Hawaiian culture plays a vital role in preserving and advancing the unique quality of life and the 'aloha spirit' in Hawaiʻi." Further, Articles IX and XII of the *Constitution of the State of Hawaiʻi* impose on government agencies a duty to promote and protect the cultural beliefs, practices, and resources of Native Hawaiians and other ethnic groups.

Pursuant to this requirement, Caltech had ASM Affiliates (ASM) prepare a CIA assessing the potential cultural impacts of the proposed action and its alternatives (see Chapter 2 and Section 3.3). The resulting report, a *Cultural Impact Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Mauna Kea, TMK: (3) 4-4-015:009 (por.), Kaʻohe Ahupuaʻa, Hāmākua District, Island of Hawaiʻi* (ASM, 2020), provides the basis for the information and analysis summarized in the following subsections. The complete CIA is included as Appendix C.

4.2.2 Cultural Overview

An extensive body of literature describing the significance of Maunakea and the summit region has been developed over the past three decades (Kanahele and Kanahele 1997; Lang and Byrne 2013; Langlas 1999; Langlas et al. 1999; Maly 1998, 1999; Maly and Maly 2005, 2006; McCoy et al. 2009; McEldowney 1982; PHRI 1999; Simonson and Hammatt 2010). Through archival research and a compilation of native traditions, historical accounts, and oral-historical interviews, a detailed cultural history of Maunakea has been presented that documents a wide range of cultural knowledge and practice associated with the mountain, and more specifically with the summit region and its association with Hawaiian deities. These studies have also recognized Maunakea as a "cultural landscape" that continues to be sacred to contemporary cultural practitioners. The cultural landscape is not merely a sum of specific, identifiable resources; it represents the combined works of nature and cultural practitioners and the values attributed to the landscape by Native Hawaiians.

Linking the traditional with the contemporary are the numerous historically documented excursions to Maunakea undertaken by Hawaiian aliʻi during the nineteenth century. Citing various accounts (Desha 2000; Kamakau 2001; Korn 1958; NASA 2005, de Silva and de Silva 2006) note that several aliʻi ascended Maunakea for ceremonial purposes. Kamehameha I went to Lake Waiau to pray and leave an offering of ʻawa, and Kaʻahumanu made the same journey in 1828 in an unsuccessful attempt to retrieve the iwi of her ancestress Līlīnoe. Waiau was also visited by Kauikeaouli in 1830, Alexander Liholiho in 1849, and Peter Young Kaʻeo in 1854. In October, 1882, Queen Emma Kaleleonālani and her royal party ascended Maunakea, "to demonstrate her lineage and godly connections, and to perform a ceremonial cleansing in the most sacred of the waters of Kane in Lake Waiau," (Maly and Maly 2005). Her journey to the summit was commemorated in several mele, or songs, and in the names of descendants of its participants, and also physically on the mountain in the form of a pillar of stones observed ten years later by members of a scientific expedition led by W.D. Alexander and E.D. Preston (Maly and Maly 2005). Kanahele and Kanahele (1997) also relate that, "Emma went to the top of Mauna Kea to bathe in the waters of Waiau. The ceremony was to cleanse in Lake Waiau at the piko of the island."

The cultural-historical background information that has been generated for Maunakea as a result of the numerous detailed studies clearly demonstrates the sanctity of Maunakea and Maunakea's summit region. The compiled oral-historical information provides further specific details about the cultural importance of the summit's viewplanes, the traditional significance of individual pu'u, and the importance of proper cultural protocol. It is also clear from the oral-historical information that current-day Hawaiian cultural practices on Maunakea are perceived by the practitioners of those activities to be an exercise in, and extension of, traditional and customary practices.

4.2.3 CONSULTATION

In an effort to solicit input from concerned Native Hawaiian practitioners and community members, a public notice was published in the August 2018 edition of Ka Wai Ola o OHA; no responses were received. In addition, consultation invitation letters, dated June 8, 2018, were mailed and emailed to 23 individuals and organization, all of whom filed as intervenors in the recent TMT contested case hearing. The full text of the consultation invitation letter is provided in Appendix C of this report. Table 4.3 identifies the parties to whom a consultation letter was provided. Four responses were received to the letter and only one individual, Harry "Hank" Fergerstrom, gave their consent to participate.

Table 4.3 Individuals and Organizations Sent Consultation Request Letters for CIA

Name	*Responded*	*Consented*
Joseph Kualii Lindsey Camara	No	n/a
B. Pualani Case	No	n/a
Clarence Kukauakahi Ching	No	n/a
Harry Fergerstrom	Yes	Yes
Flores-Case ʻOhana (E. Kalani Flores)	Yes	No
William Freitas	No	n/a
Cindy Freitas	No	n/a
KAHEA (Yuklin Aluli, Esq.)	Yes	No
Tiffnie Kakalia	No	n/a
Kalikolehua Kanaele	No	n/a
C. M. Kahoʻokahi Kanuha	No	n/a
Brannon Kamahana Kealoha	No	n/a
Mehana Kihoi	No	n/a
Glen Kila	No	n/a
Maelani Lee	Yes	No
Paul K. Neves	No	n/a
Kealoha Pisciotta	No	n/a
PUEO (Lincoln Ashida)	No	n/a
J. Leinaʻala Sleightholm	No	n/a
Stephanie-Malia Tabbada	No	n/a
The Temple of Lono (Lanny Alan Sinkin)	No	n/a
Dwight J. Vicente	No	n/a
Crystal F. West	No	n/a
Source: ASM, Cultural Impact Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Mauna Kea, TMK: (3) 4-4-015:009 (por.), Kaʻohe Ahupuaʻa, Hāmākua District, Island of Hawaiʻi (2020)		

Hank Fergerstrom initially responded via email, which motivated a follow-up telephone conversation in which he provided his manaʻo concerning the CSO decommissioning process. First and foremost, Hank was emphatic that every element of the CSO facility, above and below ground level, should be removed for the project to be pono. He expressed concern about too much activity taking place within sacred space and suggested that only one project at a time should occur in the summit region, and that the extent of activity for that project should be kept to a minimum. Hank further recommended that cultural protocols be developed in consultation with practitioners to act as a guide for behavior and activity during the decommissioning process.

On July 5, 2019, Robert B. Rechtman, Ph.D. was contacted by Jimmy Medeiros, Sr., who had responded to an earlier invitation to consult on this project. Mr. Medeiros indicated that he was a recognized descendant for burial sites in Kaʻohe Ahupuaʻa, Hāmākua and that he has long been involved in such issues. When asked about his thoughts on the CSO Decommissioning Project, he was clear that all of the extant elements of the observation facility should be "completely gone." With respect to restoration of the land following removal, he stated that the, "place should be restored as much as can." Mr. Medeiros suggested that the demolition and restoration work should be subject to cultural monitoring, and he requested to be kept informed as he wanted to, "stay involved as the process moves forward." A second, in-person consultation was conducted with Mr. Medeiros on July 17, 2019, in which he reiterated that the entire aboveground expression of the observatory, and as much of the subsurface infrastructure as possible, should be removed. He stated that the ground surface should be restored as much as possible to pre-observatory conditions. He expressed concern that all contaminated ground material that may be identified should be removed from the mountain. He again requested that he be included in the decommissioning process as it moves forward, offering his services as a cultural monitor.

The Office of Hawaiian Affairs (OHA) West Hawaiʻi branch was contacted for consultation and the office coordinator, Shane Palacat-Nelsen, explained that, in his OHA capacity, he had no comment as OHA was engaged in a lawsuit with UH with respect to the management of Maunakea. He also indicated that he was a member of Kahu Kū Mauna Council and his comments on the project were, and continue to be, delivered through that committee. Mr. Palacat-Nelson referred ASM to contact Keola Lindsey at the main OHA office on Oʻahu for official comments. Mr. Lindsey was contacted and related that, if OHA was interested in consulting, they would get back to ASM. As of the time this EA was written, no response from OHA had been received.

On December 11, 2018, Robert B. Rechtman Ph.D. attended a meeting of Kahu Kū Mauna at which proposed decommissioning alternatives were presented. While all members agreed that total removal and restoration would be the best option, they did leave open the possibility for considering retaining the CSO outbuilding, to be repurposed to support OMKM (now CMS) emergency operations; currently there is no such dedicated facility available to the Ranger staff in the summit area, and reusing or repurposing an existing structure would be preferable to new construction.

Peter Young (of Hoʻokuleana, LLC) met with Pua Kanahele and Noe Noe Wong Wilson on February 7, 2020, to discuss the decommissioning of CSO. Pua Kanahele and Noe Noe Wong Wilson have been identified as among the leadership of the Ku Kiaʻi Mauna on Maunakea; however, both noted that they were speaking of their own personal positions and not speaking on behalf of the Ku Kiaʻi Mauna. In the meeting, potential project alternatives were discussed, and without hesitation and with firm conviction, both noted that any alternative that retains the outbuilding was not acceptable and that the only viable alternative from a cultural perspective is for the total removal of all man-made improvements and the full restoration of the site. Alika Desha, a Nā Aliʻi with the Royal Order of Kamehameha I, was present during the meeting, and while mostly silent, he was in agreement with their position.

In a follow-up meeting with Kahu Kū Mauna on February 12, 2020, Kahu Kū Mauna stressed the importance of acknowledging that, "there is a diversity of perspectives regarding the sacredness of Maunakea and some Native Hawaiians do not view Maunakea as sacred." Native Hawaiians are not monolithic in their views and there are a multitude of opinions regarding the sanctity of Maunakea. However, for the purposes of the CIA for the CSO Decommissioning Project, it was the manaʻo from individuals and organizations who are familiar with traditional cultural resources and practices, and regard such as sacred or significant, that informed the identification and assessment process. In the hope of better assessing the diversity of viewpoints in the Hawaiian community, Kahu Kū Mauna requested that a "wider net" be cast to obtain additional consultation.

A second round of consultation letters were sent to the 14 Native Hawaiian organizations listed in Table 4.4 below on July 7, 2020.

Table 4.4 Organizations Sent Second Round Consultation Request Letters for CIA

Name	*Responded*	*Consented*
Kohala Hawaiian Civic Club	Yes	Yes
Waimea Hawaiian Civic Club	No	n/a
Hawaiian Civic Club of Laupāhoehoe	No	n/a
Nā Wahine O Kamehameha	No	n/a
Queen Liliʻuokalani Trust	No	n/a
Kailapa Community Association	No	n/a
Piʻihonua Hawaiian Homestead Community Association	Yes	No
Laʻiʻōpua 2020 Association	Yes	Yes
South Kohala Hawaiian Civic Club	No	n/a
Kona Hawaiian Civic Club	No	n/a
Hawaiian Civic Club of Kaʻū	No	n/a
Royal Order of Kamehameha, Māmalahoa	No	n/a
Waimea Hawaiian Homesteaders' Association	No	n/a
Keaukaha Community Association	No	n/a

Source: ASM, Cultural Impact Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Mauna Kea, TMK: (3) 4-4-015:009 (por.), Kaʻohe Ahupuaʻa, Hāmākua District, Island of Hawaiʻi (2020)

Three responses were received from this second round of attempted consultation. On July 20, 2020, Ronald Kodani of the Piʻihonua Hawaiian Homestead Community Association called the ASM office and related that his organization had no cultural input to offer. Velda "Napua" Akamu, President of the Kohala Hawaiian Civic Club, responded in the affirmative to the request for consultation in an email dated July 13, 2020, and on July 17, 2020, participated in a telephone interview.

Mrs. Akamu was raised on Hawaiʻi Island in the Kohala area, and as a youth in the 1960s would travel to Maunakea as part of school field trips, where they "would walk up the mountain." It was during those visits that she developed her spiritual and cultural attachment to the Mauna that she now shares with her son as they visit Maunakea. She considers the mountain sacred space and it is her tradition to request assistance from kūpuna through chant and prayer when in that space. When presented with the various alternatives to the removal and restoration of the observatory she responded that the only viable option, from a cultural perspective, is complete removal and restoration of the landscape. When asked specifically about the removal activities, Napua indicated that care should be taken to not harm any other cultural assets and recommended that guidance be sought from within the group of "protectors" with respect to cultural protocols to be implemented during the decommissioning activities.

On September 5, 2020, Kawehi Inaba, President of Laʻiʻōpua 2020, responded by email expressing an interest in participating in the consultation process, and a telephone consultation ensued that same day. Similar to others who were consulted, Mrs. Inaba expressed that the only acceptable option from her cultural perspective would be the complete removal of the observatory facility and as much environmental restoration as would be feasible.

Those consulted and CIA research did not identify any specific ongoing traditional, customary, or contemporary cultural practices occurring within or associated with the CSO Site or direct effects study area, nor did it identify any resources used for traditional and customary cultural practices that are present on the CSO Site. No CIA participants or past studies suggest that the CSO Site or direct effect study area is used to access locations where traditional and customary cultural practices are conducted or cultural resources are gathered.

4.2.4 Potential Impacts

It was a conclusion of the companion archaeological study (Section 4.1; Barna 2018; Appendix B) that the CSO Decommissioning Project action alternatives will have no direct effect on any historic property; and, with respect to indirect effects, the 11 historic properties within the viewshed of the CSO facility and the Mauna Kea Summit Region Historic District will experience overall beneficial effects from the removal of the CSO facilities. For these sites, the removal of the aboveground facilities will partially restore the appearance of the summit area as it was prior to the construction of the CSO, resulting in an enhancement of the integrity of setting, feeling, and association of the sites as well as of the historic district.

The CIA begins its analysis of impacts of site decommissioning as follows (Appendix C):

> *"…there is no disputing that the decommissioning of an observatory facility within the Astronomy Precinct on Mauna Kea would have a positive cultural impact. What is up for review and discussion in this analysis is the identification of those aspects of the decommissioning that could diminish or reverse the positive impact, and the measures that can be taken to avoid or mitigate any potential negative effects."*

The CIA analyzes the impact of CSO decommissioning associated with its goals and intents on the cultural landscape as follows:

> *"What has been expressed by several cultural practitioners in prior and current interviews is that the goal of decommissioning from their perspective would be to ultimately clear the summit of Mauna Kea of "Western" intrusions and return the landscape as best as possible to its pre-development condition. While this ideal is not necessarily achievable given the existing roadways and associated infrastructure, it is the assessment of the current study that any decommissioning proposal that leaves behind physical remnants of a facility, whether above or below the current ground surface, would result in a negative cultural impact with respect to the proposed action [with the proposed action being removal and restoration to the fullest extent possible]."*

From this point of view, the presence of the current CSO facilities, including any invisible underground infrastructure, has a negative impact on the cultural landscape, and the greater the degree of removal and restoration, the proportionately greater the potential positive impact on that resource would be. However, while the above discussion suggests simply that greater levels of removal and restoration have greater benefit, the CIA (ASM Affiliates, 2020) follows immediately with a statement regarding targets and desires created by the DP (2010) and how the restoration outcome may or may not align with them:

> *"As stated in the Decommissioning Sub-Plan, "Ideally, the target for all sites is restoration to the site's historical condition prior to construction of the facility." (Sustainable Resources Group Int'l, Inc. 2010:23). If this is DLNR and the University's position, adopted through approval of the CMP (and its sub-plans),*

> *then as stated in the CMP, the "[d]esired outcome to the extent possible, [is to] reduce the area disturbed by physical structures … by upgrading and reusing buildings and equipment at existing locations, removing obsolete facilities, and restoring impacted sites to pre-disturbed condition" (Ho'akea 2009:7-53; emphasis [added]). Both the CMP and the Decommissioning Sub-Plan indicate that the decommissioning starting point is for the observatories to do their utmost to completely remove all structures and fully restore the site, and based on what was said during consultation, doing less than that could be perceived as improper and culturally offensive."*

Thus, a negative impact to the cultural landscape may arise if the removal option and restoration level employed at the CSO Site is less extensive than the DP's "starting point" (e.g., complete removal and full restoration) when the greater extent was technically feasible. The CIA provides the following statements and recommendations related to decommissioning:

> *With the understanding that some negative impacts may result from decommissioning, these impacts would not completely erase the overall positive impact. However, a perception exists that anything short of an attempt at complete facility removal and full environmental restoration would result in a disingenuous decommissioning effort, as well as be an affront to cultural sensibilities. Therefore, it is recommended that the complete facility (above and below ground) be removed and the affected environment be restored to the fullest extent possible. Following this, and the other above-offered recommendations, will help to ensure that the proposed decommissioning will not result in impacts to any traditionally valued cultural or historical resources nor any traditional cultural practices or beliefs.*

These two passages indicate, in the view of the authors of the CIA and based upon the sentiments expressed during the consultation process, that removal and restoration of the CSO Site to the greatest extent possible would result in a qualitatively better outcome for the cultural landscape than other options. By extension, these two quotes also suggest that anything less than an attempt at total removal and full site restoration could have a negative impact, compounding the ongoing adverse impact caused by the presence of the CSO.

Consequently, remaining committed to Caltech's intent to completely remove the CSO infrastructure and fully restore the site (e.g., the preferred alternative and proposed action, Chapter 2) will maximize the beneficial effects, and prevent negative impacts, of decommissioning on the cultural landscape. This benefit is based on repeated statements, both in the DP (2010) and by Caltech, regarding total removal and full restoration being the starting point and the desired goal of the decommissioning process. ALT-2, ALT-3, and ALT-4 all reflect Caltech's intent, but under ALT-3 and ALT-4 that intent would not be fully realized, despite being attempted, due to unanticipated factors beyond Caltech's control. Thus, ALT-2 would provide the largest beneficial effect and ALT-3 and ALT-4 would provide a quantitatively lesser, but qualitatively comparable, benefit if complete removal and full restoration could not be achieved.

Based on the studies conducted, Caltech has concluded that there will be no direct effect on any cultural resources or practices as a result of the CSO Decommissioning Project and, provided its intent remains intact, that any resulting indirect effects will be entirely positive. Nevertheless, Caltech will implement the mitigation measure suggested by those that participated in the CIA and discussed in Section 4.2.5.

Finally, to the extent that the No Action Alternative (ALT-1) would retain all the structures present on the CSO Site, it would at minimum perpetuate—and potentially exacerbate—the negative impact on the cultural landscape its presence causes.

4.2.5 Mitigation Measures

The project will comply with all aspects of the CMP as outlined in Section 2.1.2.1 and elsewhere in this document. For example, this will entail:

- All construction personnel being educated regarding the historic resources in the project area as required by CMP management action C-7.
- Archaeological monitoring per CMP management action C-6 and an Archaeological Monitoring Plan (AMP) prepared in accordance with HAR §13-279. A draft AMP is provided in Appendix J and will be approval by DLNR-SHPD prior to project implementation.
- A Cultural Monitoring Plan will be developed and reviewed by the Kahu Kū Mauna Council and approved by the CMS Director prior to project implementation. Caltech will ensure that both an archaeological monitor and a cultural monitor are present during ground-altering activity.

4.3 BIOLOGY

4.3.1 Context

In order to characterize the existing biological resources, assess potential impacts of implementing the CSO Decommissioning Project, and identify any needed mitigation measures, Caltech retained the services of Sustainable Resources Group International, Inc. (SRGII) to prepare a Biological Setting Analysis (BSA). The report: (*i*) describes the existing environment with regard to biological resources, (*ii*) outlines the restoration scenarios that may occur as part of the decommissioning process, (*iii*) describes the potential effects on biological resources for the deconstruction and restoration scenarios, and (*iv*) recommends protocols and mitigation measures for the protection of biological resources. The *Biological Setting Analysis: Caltech Submillimeter Observatory Decommissioning* (SRGII 2019) is provided in Appendix D and provides the basis for the information and analysis provided in the following subsections.

4.3.2 Existing Conditions

The CSO Site was disturbed by grading and construction of the CSO in the mid-1980s. Other construction in the area during the same period included erection of the James Clerk Maxwell Telescope (JCMT) and a branch of the Mauna Kea Summit Access Road. These activities resulted in fill being deposited on the natural lava flow ground surface and the sites being leveled.

The CSO Site is located in the alpine stone desert ecosystem, which occurs above roughly the 11,150-foot elevation on Maunakea. The alpine stone desert is characterized by low precipitation, high rates of evaporation, high wind speeds, high solar radiation, regular freezing and thawing cycles, and a porous substrate. These characteristics limit the development of the plant and animal communities in this zone (Aldrich 2005). The CSO site is located on a lava flow composed mainly of basalt and covered with fill native to the summit of Maunakea.

4.3.2.1 ***Flora***

The plant community in the alpine stone desert consists of species of lichens and mosses with sparsely distributed vascular plants.[7] Lichens are the dominant species present. About half of the lichens recorded on Maunakea have not been identified to the species level and thus are of unknown origin. Twenty-three species of lichen and approximately twelve species of moss known to occur within the Maunakea alpine stone desert have been identified to the species level (Berryman and Smith 2011, Smith et al. 1982). All lichen and moss species identified on Maunakea to date are native to the Hawaiian Islands.

Vascular plants grow mainly at the base of larger rocks where soil and water accumulate and are protected from the wind (Char 1999). The most abundant vascular species in Maunakea's alpine stone desert are two grass species, Hawaiian bentgrass (*Agrostis sandwicensis*) and pili uka (*Trisetum glomeratum*), and two fern species, ʻiwaʻiwa (*Asplenium adiantum-nigrum*) and Douglas' bladderfern (*Cystopteris douglasii*). Of these four species, Hawaiian bentgrass is the most common in the alpine stone desert.

To determine the presence, abundance and composition of lichens, mosses, and vascular plants the survey involved walking transects and recording species presence within and just outside of the site (Appendix A, Medeiros 2019). The survey report details the sparse nature of lichens and vegetation and their locations. Eleven clumps of lichens were observed. Species observed included: (*i*) the lichen *Lecanora polytropa*; (*ii*) ʻiwaʻiwa; and (*iii*) pili uka. The most abundant vascular plant in and near the survey site was the endemic grass pili uka. Most pili uka clumps were growing on topographically disturbed areas and one individual was found growing in a pavement driveway crack (Figure 4-6). Several individual ʻiwaʻiwa ferns were found in the CSO site between the east-to-south boundary of the subleased area and the dirt road, and none were found within the subleased area (Figure 4-6). No other plant species were recorded.

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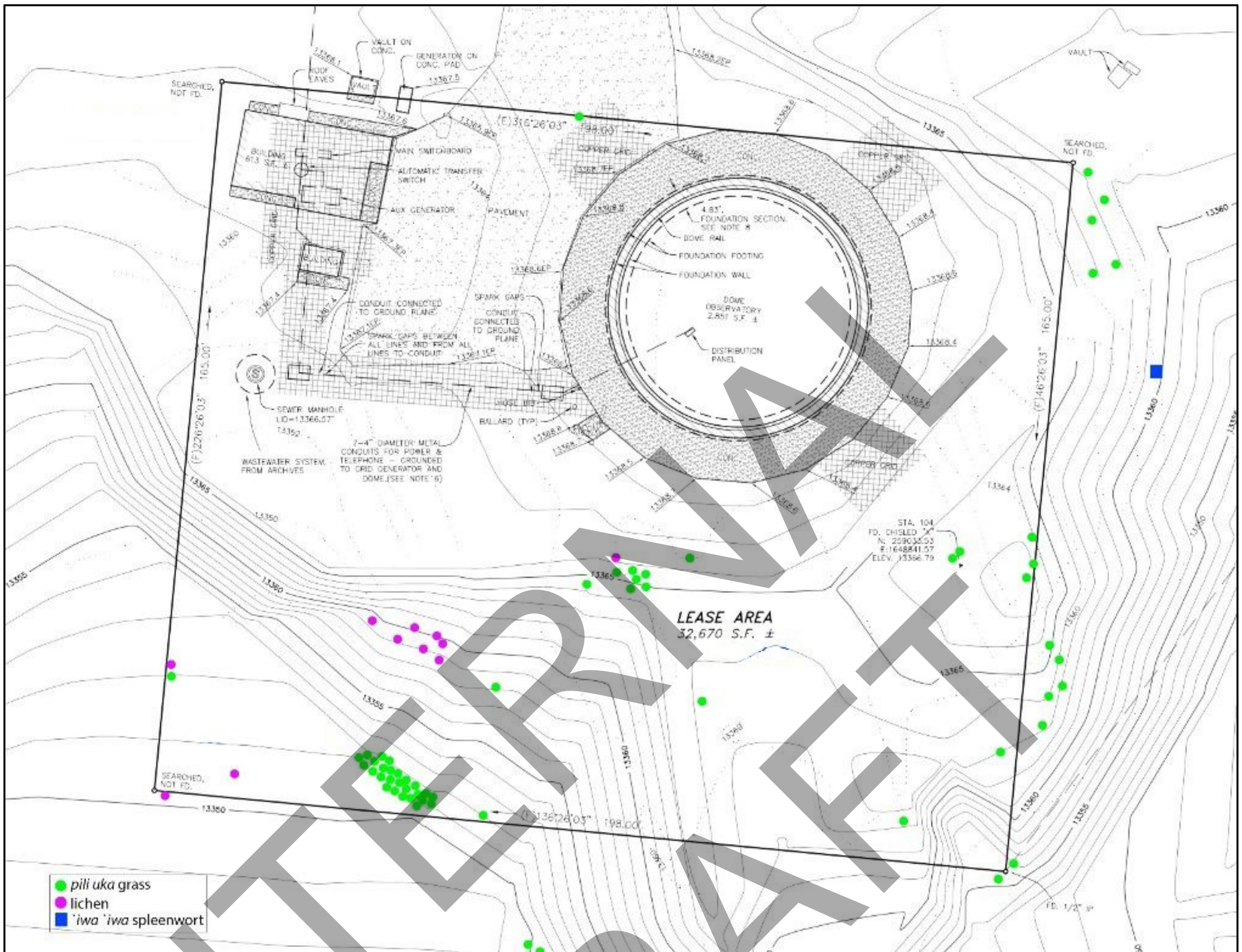
[7] All discussion on the plant community in general includes lichens. Although lichens are not plants they are often grouped into the vegetative community by land managers for consideration of species presence and effects of management activities.

Figure 4-6 Flora Locations



Source: BSA (SRGII 2019).

4.3.2.2 ***Fauna***

4.3.2.2.1 Arthropods

Arthropods are the most common fauna present in the alpine stone desert ecosystem. Both native and non-native arthropods are known to inhabit the region. Surveys typically distinguish between resident arthropod species, which are cold-adapted species that occur and survive on the mountain at higher elevations, and non-resident arthropod species, which are those that are brought to the summit by the aeolian drift process (i.e. blown up by the wind) or are inadvertently transported through human activity. Non-resident species die in the cold weather and provide an important food source for resident species.

While the diversity of resident native arthropod species present in the summit region is low, arthropod surveys and invasive species monitoring has indicated that the abundance of resident native arthropods is much higher than resident non-natives (SRGII 2009, Kirkpatrick and Klasner 2015, and OMKM unpublished data). Native resident species include the wēkiu bug (*Nysius wekiuicola*), a noctuid moth (*Agrotis kuamauna*), a hide beetle (*Dermestes maculatus*), the Hawaiian wolf spider (*Lycosa hawaiiensis*), a bark louse (*Palistreptus inconstans*), and a centipede

(*Lithobius* sp.) (Medieiros et al. 2019, Howarth and Stone 1982). Some taxa recorded in the summit region have not been identified to species level, and because both native and non-native species from these families are known to occur in Hawaiʻi, the origin is unknown. These include two sheet-web spiders (*Erigone* spp.), an unidentified linyphiid sheet-web spider (Family *Linyphiidae*), two slender springtails (Family *Entomobryidae*), and two species of mites (Families *Anystidae* and *Eupodidae*) (Howarth and Stone 1982).

Invasive species monitoring is conducted by CMS (formerly OMKM) annually at various locations at the summit and quarterly at all observatories (facility monitoring) with the goal of detecting new invasive species threats. Invasive arthropod monitoring at observatories involves placing traps within and around the facilities and retrieving them approximately seven days later. Hand searches around the perimeter of each observatory are also conducted. Specimens are identified to the lowest taxa necessary to determine if the arthropod represents a potential threat as an invasive not currently present in the summit region. CMS staff are responsible for identification. Identification may entail sending specimens to the Bishop Museum staff, Hawaiʻi Ant Lab staff, or Department of Land and Natural Resources Division of Forestry and Wildlife (DLNR-DOFAW) entomologist for consultation. Most invasive species found in perimeter searches or traps outside of observatories are already dead and believed to be products of aeolian drift. If live specimens of invasive species are detected outside of the observatories, further monitoring is done to determine the extent of the population and the potential for eradication. Rapid response protocols and plausible control methods by taxa are detailed in the Maunakea Invasive Species Management Plan (ISMP) (Vanderwoude et al. 2015). Table 4.5 lists arthropods found in and around the CSO during a five year period (2013-2017) of invasive species monitoring. None of the species found warranted response actions.

Table 4.5 Arthropods Found near CSO during OMKM Invasive Species Facility Monitoring (2013-2017)

Order	***Family***	***Scientific Name***	***Common Name***	***Origin***
Acari	Unknown	Unknown	mites	Native & Non-native
Araneae	Unknown	Unknown	spiders	Native & Non-native
Coleoptera	Coccinellidae	*Harmonia conformis*	ladybird beetle	Non-native
Coleoptera	Coccinellidae	*Hippodamia convergens*	ladybird beetle	Non-native
Coleoptera	Scarabaeidae	*Onthophagus nigriventris*	dung beetle	Non-native
Diptera	Various	Various	Flies	The majority of fly species are either non-native or of unknown origin.
Diptera	Calliphoridae	Unknown	blow flies	Non-native
Diptera	Sphaeroceridae	Unknown	dung flies	Native & Non-native
Diptera	Syrphidae	Unknown	hover flies	Non-native
Hemiptera	Aphididae	*Aphis* sp.	Aphids	Non-native
Hemiptera	Lygaeidae	*Nysius palor*	seed bug	Non-native
Hemiptera	Pentatomidae	*Bagrada hilaris*	shield bug	Non-native
Hemiptera	Psyllidae	Unknown	jumping plant louse	Native & Non-native
Hymenoptera	Braconidae	Unknown	braconid wasp	Native & Non-native
Lepidoptera	Pieridae	*Pieris rapae*	cabbage butterfly	Non-native
Psocoptera	Psocidae	Unknown	bark lice	Native & Non-native
Source: BSA (SRGII 2019)				

An assessment of the arthropod fauna present at the CSO Site was conducted prior to construction of the observatory as part of its EIS (Group 70 1982). Two species of springtails and four species of mites were found in the soil, and Hawaiian wolf spiders (*Lycosa hawaiiensis*) and an anystid mite were found under rocks at the CSO Site.

An arthropod survey conducted as part of the proposed decommissioning project involved sampling by trapping, hand searches, and specimen collection from ice on the north side of the CSO Observatory (see Table 4.6, Appendix D). The majority of species recorded, with the exception of three, were not native to the alpine stone desert on Maunakea. One native spider species (*Lycosa hawaiiensis*) and one native moth species (*Agrotis kuamauna*) were recorded, along with one fly species from an unknown origin (*Bradysia* sp.). Arthropods from the Aphis genera were found in the traps but could not be identified to the species level. All Aphis species in Hawaiʻi are non-native. Aphis species have been previously recorded in the alpine stone desert on Maunakea. One member of the survey team who samples arthropods regularly in the UH Management Areas reported previously noting native spiders and caterpillars at or near the CSO Site, although they were not common in this survey (Jesse Eiben, pers. comm. 2018).

Table 4.6 Arthropods Recorded Within the CSO Site, November/December 2018

Order	*Family*	*Scientific Name*	*Common Name*	*Origin*
Araneae	Lycosidae	*Lycosa hawaiiensis*	Hawaiian lycosid wolf spider	Endemic
Araneae	Trachelidae	*Meriola arcifera*	spider	Non-native
Coleoptera	Coccinellidae	*Hippodamia convergens*	convergens ladybird beetle	Non-native
Coleoptera	Dytiscidae	*Rhantus gutticollis*	diving beetle	Non-native
Dermaptera	Forficulidae	*Forficula auricularia*	European earwig	Non-native
Diptera	Agromyzidae	*Phytomyza plantaginis*	leaf miner fly	Non-native
Diptera	Calliphoridae	*Eucalliphora latifrons*	blue bottle fly	Non-native
Diptera	Ephydridae	*Hydrellia* sp.	ephydrid fly	Non-native
Diptera	Phoridae	*Diplonevra peregrina*	humpbacked fly	Non-native
Diptera	Sciaridae	*Bradysia* sp.	darkwinged fungus gnat	Unknown
Diptera	Syrphidae	*Allograpta exotica*	hover fly	Non-native
Hemiptera	Aphididae	*Aphis* sp.	Aphids	Non-native
Hemiptera	Psyllidae	*Acizzia uncatoides*	jumping plant louse	Non-native
Heteroptera	Lygaeidae	*Neacoryphus bicrucis*	whitecrossed seed bug	Non-native
Heteroptera	Lygaeidae	*Nysius palor*	seed bug	Non-native
Heteroptera	Miridae	*Coridromius variegatus*	plant bug	Non-native
Heteroptera	Nabidae	*Nabis capsiformis*	pale damsel bug	Non-native
Hymenoptera	Braconidae	*Apanteles* sp.	braconid wasp	Non-native
Hymenoptera	Braconidae	*Biosteres* sp.(?)	braconid wasp	Non-native
Hymenoptera	Ichneumonidae	*Diadegma insulare*	Ichneumon wasp	Non-native
Hymenoptera	Ichneumonidae	*Pristomerus spinator*	Ichneumon wasp	Non-native
Lepidoptera	Noctuidae	*Agrotis kuamauna*	noctuid moth	Endemic
Orthoptera	Gryllidae	*Metioche vittaticollis*	cricket	Non-native
Thysanoptera	Thripidae	*Frankliniella* sp.	Thrip	Non-native
Source: BSA (SRGII 2019)				

Wēkiu bugs are normally not found on lava flows, such as the CSO Site, or in areas dominated by compacted ash/silt as the habitat is considered unsuitable (Stephenson et al. 2017, UH Hilo 2010, Englund et al. 2007, Porter and Englund 2006). While wēkiu bugs have not been found in the lava flow habitat around the CSO, they are found in the area called the Poi Bowl, which is to the east of the CSO on the other side of the Mauna Kea Access Road. The Poi Bowl is considered prime habitat for the wēkiu bug and will not be subject to disturbance during CSO deconstruction and restoration activities.

None of the arthropods identified during this study or known to occur in the alpine stone desert are listed as threatened or endangered species.

4.3.2.2.2 Birds and Mammals

Two endangered birds, ʻuaʻu (*Pterodrama sandwichensis* or Hawaiian petrel) and ʻakēʻakē (*Oceanodroma castro* or band-rumped storm petrel), may utilize the alpine shrubland ecosystem on Maunakea, which is well below the CSO Site in the elevation range from roughly 9,800 to 11,150 feet. There have been no recorded detections of birds or burrows in the vicinity of the CSO Site. Although there are records of pigs and sheep occurring in the alpine stone desert, feral ungulates are not common as there are very few plants to browse. CMS personnel report that mice are regularly encountered and are believed to actively reproduce in the summit region. The endangered ʻōpeʻapeʻa (*Lasiurus cinereus semotus* or Hawaiian hoary bat) has not been detected in the vicinity of the CSO Site or summit region, but may occur at high elevations.

4.3.3 Potential Impacts

Under the No Action Alternative (ALT-1), there would be no negative or positive biological impact relative to status quo, and negative biological impacts relative to the pre-construction conditions (e.g., the presence of structures and hardscape displacing habitat) would endure. Resources would remain unimpacted by any decommissioning activities, and both native and non-native species would continue to occupy the project footprint. While Caltech retained its lease, they would maintain the facility, but thereafter the facility would begin to deteriorate. As the facility deteriorated over the years, the site would gradually re-naturalize and biological resources would continue to expand into the developed portions of the CSO Site as the pili uka grass in the pavement crack demonstrate. However, the no action alternative could never achieve the level of restoration and biological benefit that the action alternatives can.

Potential effects on biological resources would be similar for all the Action Alternatives and are described in the sections below.

4.3.3.1 ***ALT-2 Effects***

Vegetation. Lichens, mosses, and vascular plants present within the CSO Site would be subject to disturbance and possible mortality during deconstruction. Adverse impacts include being crushed, buried, or covered in dust. Due to the sparse nature of lichens, mosses, and plants within the affected area and the presence of the same species on adjacent lands, the loss of some individuals during deconstruction does not represent a threat to the continued presence of these species on Maunakea. It is expected that lichens, mosses, and vascular plants would recolonize the site after it is restored, as has been the case in other disturbed areas in the summit area. Due to extreme environmental conditions, recolonization of the restored site will likely take longer than it would at a lower elevation. Overall, the reduction in hardscape, increase in natural habitat, and recolonization of that habitat by species already established in the area represents an environmental benefit.

Arthropods. As with vegetation, there would be some temporary impacts to native and endemic arthropods during deconstruction. Some mortality to arthropods would occur due to use of heavy equipment and moving of materials around the CSO Site and the Batch Plant. However, the level of arthropod mortality associated with deconstruction activity on 1.3 acres of the roughly 23,000-acre alpine stone desert ecosystem is unlikely to significantly affect the metapopulation of any single native arthropod species within the ecosystem. Arthropod surveys in areas around the summit have recorded the presence of native arthropods in many previously disturbed areas, including around observatory structures, indicating a high likelihood of arthropods recolonizing the site after restoration. Removal of the CSO would have no effect on the process of aeolian drift, which operates on a scale of thousands of feet of elevation, and thus would not diminish the food supply for resident arthropods. No adverse effects on wēkiu bugs would be anticipated as a result of the deconstruction and restoration activities as lava flows are not wēkiu bug habitat, and restoration activities would not require fill material to be taken from current wēkiu bug habitat. Overall, the reduction in hardscape via deconstruction, increase in natural habitat via restoration, and recolonization of that habitat by species already established in the area represents an environmental benefit.

Invasive Species. The threat of importing new species of invasive plant, arthropods, or other types of species must be considered. There are several factors that minimize the likelihood of invasive species becoming established in connection with the proposed action. Although the proposed project involves bringing heavy machinery and other equipment up to the summit that could harbor invasive species if not properly cleaned, there would be no building materials or aggregate transported from lower elevations on which invasive species could "hitchhike" to the site. As discussed in Section 4.3.4, the project will comply with the CMP and implement invasive species prevention protocols (e.g., inspection and cleaning) that will reduce the likelihood of invasive species being introduced and control them if they are found. Significant adverse effects related to the establishment of invasive species are not anticipated due to mitigation measures and extreme environmental conditions. Finally, the extreme environmental conditions at the summit are not conducive for the establishment of most species not already present and, should a new species become established, the conditions would limit its movement and potentially its reproduction, providing opportunity for eradication.

Organic Compounds & Inorganic Chemicals. There is the potential for biological organisms to be exposed to organic compounds (i.e. solids from cesspool) and inorganic chemicals (i.e. metals from cutting the observatory structure during deconstruction). Project protocols will detail how to avoid these impacts including implementing BMPs to, for example, (*i*) contain any spills; (*ii*) properly store, maintain, and use materials and equipment; and (*iii*) properly store, recycle, and dispose of wastes. In the event that residue is inadvertently left on-site, it would be subject to decomposition, albeit very slowly due to the characteristics of the alpine ecosystem. Due to project protocols that will be followed, no significant adverse impacts to biological organisms due to exposure to organic and inorganic chemicals is anticipated

Native Birds & Mammals. Adverse effects on native birds or mammals are highly unlikely, as none are known to frequent the CSO Site or summit region.

4.3.3.2 ***ALT-3 Effects***

Under ALT-3, full restoration would occur over as much of the CSO Site as possible, but some portion would undergo only moderate restoration due to currently unforeseen circumstances (Section 3.3.3). In this scenario, that portion of the site would be graded and left in a safe condition, but without matching the pre-construction topography. The only difference between ALT-2 effects (Section 4.3.3.1) and ALT-3 effects would be associated with the portion of the CSO Site not fully restored. Flora and fauna would recolonize both the fully and moderately restored areas, but the diversity and density of recolonization may differ between the two areas. Assuming the fully restored areas are more advantageous to the native species, ALT-3 would result in a slightly less beneficial outcome than ALT-2, but it would remain a beneficial effect relative to no action.

4.3.3.3 ***ALT-4 Effects***

Under ALT-4, where unforeseen circumstances encountered during deconstruction require it, some infrastructure capping would occur (Section 3.3.4). Leaving quantities of inert infrastructure in place would not have an impact on biological resources. In the event that it is unfeasible to remove some portion of cesspool solids or hydraulic fluid impacted soil, any residue present, and/or a portion of the cesspool structure, would be buried underneath native material used to restore the site. The only biological organisms likely to come in contact with the cesspool structure or residue are invertebrates. Given that every effort will be made to remove as much material as possible and that any remaining material would occupy a very small amount of invertebrate habitat, if any (depending on depth), they would not represent a significant adverse impact.

The overall ALT-4 project impacts would be similar to those outlined for ALT-3 in Section 4.3.3.2 because ALT-4 would also result in a portion of the CSO Site not being fully restored. In addition, the benefit may be slightly diminished relative to ALT-3 due to the residual subsurface materials that could not be removed.

4.3.4 Mitigation Measures

The project will comply with all aspects of the CMP as outlined in Section 2.1.2.1 and elsewhere in this document. For example, this will include:

- All construction personnel being educated regarding the environment, ecology, and natural resources in the project area as required by CMP management action C-8.
- Consistent with CMP management actions C-5 and C-9 and as recommended in the Biological Setting Analysis (SRGII, 2019), a biologist/entomologist will implement an Invasive Species Monitoring Plan (ISMP) approved by the CMS Director and DLNR. A draft of the ISMP is included in Appendix I. The plan includes an invasive species prevention and control program and is consistent with and incorporates Standard Operating Procedures (SOPs) from OMKM's Invasive Species Management Plan (ISMP) (Vanderwoude et al. 2015).
- Implement a BMP Plan that complies with other CMP requirements and will avoid or minimize impacts to biological resources through protocols such as minimizing habitat disturbance, avoiding dust generation, and managing construction waste effectively. A draft BMP Plan is included in Appendix I.

4.4 VISUAL AND AESTHETIC RESOURCES

This section: (*i*) describes the existing visual conditions on the Island of Hawai‘i and Maunakea summit region, (*ii*) discusses the visual impacts the CSO Decommissioning Project may have, and (*iii*) identifies how the deconstruction and removal of the CSO Observatory mitigates its potential visual impacts.

4.4.1 Existing Conditions

The Island of Hawai‘i's landscape and visual resources are varied. On the northern tip, the coast is rugged, covered in dense vegetation and dotted with waterfalls and rivers. Inland, around the town of Waimea, at an elevation of 4,000 feet, the landscape is comprised of rolling pastures used for cattle ranching. The western side of the island consists of popular resorts and beaches, but lacks dense vegetation along the coast. The southern and southeastern portions of the island experience high rainfall and are covered with lush vegetation; Volcanoes National Park is located in this area. The eastern portion of the island consists of steep terrain with dramatic views of the rainforest and cliffs along the coast.

The *Hawai'i County General Plan* (GP; County of Hawai'i, 2005) includes a chapter on natural beauty that recognizes the importance of preserving the island's natural and scenic beauty. The chapter includes goals, policies and standards to identify and protect scenic vistas and viewplanes. One goal is to, "Protect scenic vistas and viewplanes from becoming obstructed." The GP also provides guidelines for designating sites and vistas of extraordinary natural beauty to be protected, and includes the standard, "Distinctive and identifiable landforms distinguished as landmarks, e.g. Mauna Kea, Waipi'o Valley." Around the Island of Hawai'i, the following views of Maunakea have been identified as sites of profound natural beauty:

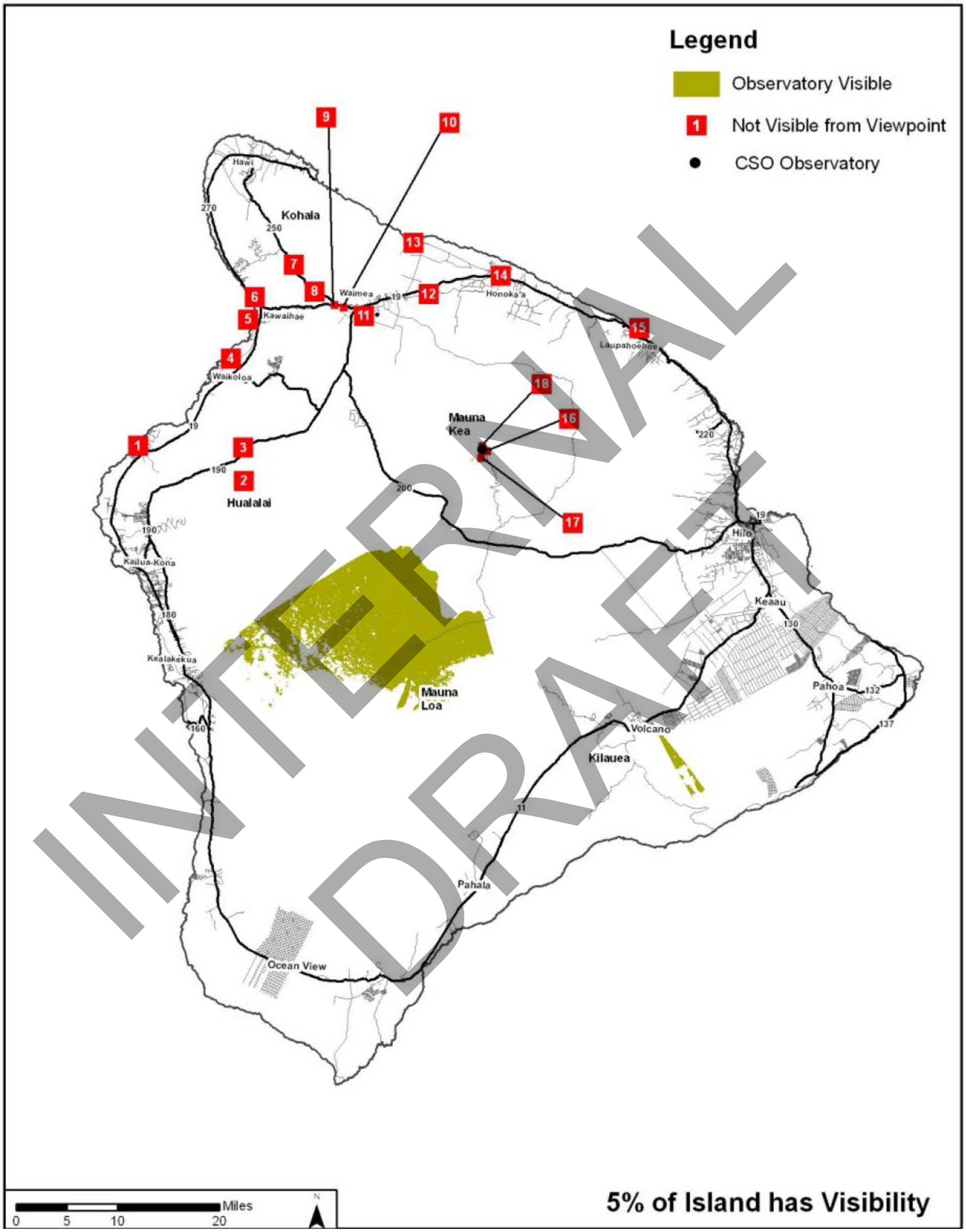
- Views of Maunakea and Maunaloa from Pahoa-Kea'au, Volcano-Kea'au Roads, and various Puna subdivisions;
- Views of Hilo Bay with Maunakea in the background; and
- Mauna Kea State Recreation Area.

In addition, the *South Kohala Development Plan* (County of Hawai'i, 2008) includes a policy to preserve Waimea's sense of place. It includes a recommended strategy to, "protect the pu'u of Waimea that have cultural, historical and visual importance," and which have, "grand views of Mauna Kea."

In contrast to the lush coastal areas of the Hāmākua District, the summit of Maunakea is an alpine desert ecosystem. The lands of Maunakea's summit region are characterized by their isolation, high elevation, cool temperatures, and the relative lack of moisture. Above the tree line, at approximately 9,500 feet above sea level, vegetation is comprised of low shrubs, and above 11,150 feet in elevation the vegetation is generally limited to lichens, moss, low ferns, and small clumps of native grass (see Section 4.3.2). A small alpine lake, Lake Waiau, is situated on the upper southern flank of the mountain. Views of the summit of Maunakea from lower elevations (e.g., Honoka'a, Hilo, and Waimea) are often obscured by clouds and/or vog, a volcanic smog formed when sulfur dioxide and other volcanic gasses emitted by Kīlauea mix with oxygen, moisture, and sunlight. The levels of vog can fluctuate over time. There was a particularly thick period from 2008 through 2018, when vog dramatically increased, in the decade prior to Kīlauea's March 2018 eruption.

Currently, there are 13 astronomy facilities, with one additional astronomy facility permitted but not yet built; some of these facilities are visible from locations around the island including Honoka'a, Hilo, and Waimea. During planning for the TMT Project, UH Hilo worked with their planning consultant, Parsons Brinckerhoff, Inc. to prepare a viewshed analysis of existing observatories, accounting for their visual attributes including their elevation, dome height, and dome color (UH Hilo, 2010) and identifying the viewshed, expressed as a percentage of the Island's total area, from which each observatory is visible. The conclusion of that study was that the CSO facility is 13,362 feet above sea level, the dome is 63 feet high, metallic silver in color, and visible from just five percent of the island. The five percent is primarily in uninhabited areas on the upper slopes of Mauna Loa (Figure 4-7). This indicates that the CSO facility is not visible from any of the scenic vistas and viewplanes identified in the GP (County of Hawai'i, 2005).

Figure 4-7 CSO Facility Viewshed



Source: TMT EIS (2010)

More recently, as part of their analysis of potential impacts to historic properties as a result of the CSO Decommissioning Project, ASM conducted a visual effects review, based on the relationship of the observatory site to nearby archaeological features (see Section 4.1.2). As part of that study, they used Google Earth™ visual analysis software to identify areas within the MKSR from which the CSO is visible; the result of that analysis is shown in Figure 4-2. Per the findings of that analysis, ASM concluded that the CSO facility could be seen from 11 contributing elements (see Table 4.2) of the Mauna Kea Summit Region Historic District (Figure 4.4).

4.4.2 Potential Impacts

Pursuant to the significance criteria contained in HRS, Chapter 343, the CSO Decommissioning Project would result in significant impact(s) to visual and aesthetic resources if it substantially affects scenic vistas and viewplanes identified in the GP, Hawaiʻi State Plan, or other related studies. A substantial effect could occur if any aspect of the proposed action or its alternatives were to obstruct views of an identified scenic resource or create a new visual presence which is incongruous with an existing scenic vista or viewplane. However, because all of the action alternatives (ALT-2, ALT-3, and ALT-4) consist of varying levels of CSO deconstruction, removal, and site restoration, no such impact will occur. Thus, no significant impact to visual resources will occur.

With respect to the visual effects within the CSO viewshed, including the 11 historic properties and the Mauna Kea Summit Region Historic District, these areas and resources will experience overall beneficial effects from the removal of the CSO facilities. For those areas, the removal of all aboveground facilities, as called for under all of the action alternatives evaluated in this EA, will partially restore the appearance of the summit as it was prior to the construction of the CSO. This will result in enhancement of the integrity of the setting, feeling, and associate of the historic sites and district.

The No Action Alternative would not produce any beneficial effects to visual and aesthetic resources as the CSO facilities would remain. Once Caltech's sublease lapsed, and they were no longer able to maintain the facility, it would fall into disrepair and its adverse visual impact within its viewshed would gradually increase.

4.4.3 Mitigation Measures

The project will comply with all aspects of the CMP as outlined in Section 2.1.2.1and elsewhere in this document. However, no specific mitigation efforts are proposed as all of the action alternatives evaluated in this EA will result in a reduction in visually intrusive structures and equipment and have beneficial effect.

4.5 GEOLOGY AND TOPOGRAPHY

4.5.1 Context

In order to assess the potential impacts of implementation of the action alternatives assessed in this EA, Caltech has assembled information regarding the pre-construction topography of the CSO Site based on documents and other evidence that were accumulated at the time the observatory was constructed. It also conducted later analysis of post-construction conditions, including an analysis by Intera, Inc. of the fill material placed on the site at the time of construction. The resulting report, *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (Intera, Inc. 2019) forms the basis for some of the information and analysis in the following subsections and is included as Appendix E. The following subsections present these findings, followed by discussion of potential impacts and mitigation measures.

4.5.1.1 ***Pre-Construction Geological Analysis (1982)***

Prior to construction of the CSO in 1982, Dames & Moore was retained to conduct a biological study of the proposed telescope site and its environs; their report was appended to the Final EIS for the CSO (Dames & Moore 1983) as Appendix B. While the focus of their report was biology, their analysis and findings noted in part that:

> *"The rocks of Mauna Kea have evolved through the typical phases of Hawaiian volcanism to a relatively mature stage. The most recently erupted rocks possess higher alkali and silica contents than the basalts which comprise the main mass of the volcano. This so-called alkalic cap phase of volcanism typically marks the waning of eruptive activity.*
>
> *Mauna Kea has been dormant for at least 3,600 years although occasional weak seismicity and the general evolutionary characteristics do not preclude future eruptions. The subaerial portion of Mauna Kea has been dated at least 315,000 + 50,000 years (Porter et al, 1977). Buried parts of the mountain are no doubt older. At least four periods of glaciation have accompanied eruptive activity at Mauna Kea, the last occurring about 20,000 years ago. Eight periods of eruptive activity have been identified. Post glacial eruptive activity has apparently been confined to the south rift of the mountain below elevation 10,000 feet.*
>
> *Thus, the deposits in the site area (Elevation 13,300 ft) erupted prior to, or during the last glacial episode. Some lavas have erupted through or adjacent to the glaciers and display features characteristic of subglacial eruptions.*
>
> *The principal rock type of the summit area of Mauna Kea is hawaiite which commonly forms clinkery aa lava flows or cinder cones up to 600 feet high with ejecta fragments up to 10 feet in size. These hawaiites range from non-vesicular and dense to extremely vesicular and less dense.*
>
> *The surfaces of lava flows are frequently striated (which signify overriding glacier movement) and inter stratified with glacial debris (characterized by loose rock fragments), which in turn are interlayered with cinder, ash and other volcanic pyroclastic materials.*
>
> *Based on available photographs and interviews with University of Hawaii researchers, the proposed site is interpreted to be an aa lava flow which vented in the vicinity of the site (probably from one of the summit cones) and flowed primarily northwest with one lobe extending to the south. From the existing topography, the southern lobe of this flow appears to have moved about 2,000 feet downhill from the site --approximately 80% of the distance to Lake Waiau.*

> *However, the flow surface has been subject to subsequent glaciation and the original flow paths of the lava are obscured. This aa flow overlies a slightly older flow (possibly part of the same eruption period) which also moved to the south and southwest -- surrounding Lake Waiau and filling the area between Puu Waiau, Puu Poliahu and Puu Hau Kea and partially covered the north and west rim of Puu Waiau."*

With respect to the then-anticipated site work required to build the CSO, Dames & Moore noted the following in their report:

> *"The proposed earthwork for the site is minimal — limited to minor levelling, removal of lava fragments, and footing excavations up to 4 feet deep at the telescope site. Estimated total excavation is only about 100 cubic yards. The excavated lava rock will be utilized mostly for footing backfills."*

In addition to this information, several pre-construction surveys have helped Caltech identify the original topography of the site prior to CSO-related earthwork. Figure 2-11 presents a detailed site survey prepared by Austin Tsutsumi & Associates, Inc. dated January 21, 1983.

4.5.1.2 ***Fill Material Methodology, Analysis, and Results***

The origin of the fill material used on the CSO Site was not documented at the time of construction. In order to better understand the source of the fill material present on the CSO Site, Caltech retained a geotechnical engineering firm, Intera, Inc. to obtain and analyze fill samples and assess whether the fill was native to Maunakea or from some other source. Intera, Inc. obtained four samples for geochemical analysis; three samples were from the CSO Site itself and the fourth sample was from a lava flow immediately adjacent to the CSO Site, intended to provide additional compositional data on the Laupāhoehoe Volcanics. The locations where the four samples were taken is shown in Figure 4-8.

The general lithology of the fill material was determined with observations from six randomly located holes dug to various depths, ranging from 0.8 to 1.5 feet below the top of the fill surface. Fill-clast lithology was described using terminology consistent with Compton (1985) and Wentworth and MacDonald (1953). The location of the lithological test holes is shown in Figure 4-9.

The four samples were shipped to the Washington State University (WSU) GeoAnalytical Lab in Pullman, Washington. XRF analysis was conducted to get percent composition (by weight) for 29 elements.[8] The results of Intera, Inc.'s investigation, which compared the elemental compositions of the three fill samples to that of the lava flow adjacent to the CSO Site, found that the fill samples were consistent with the Laupāhoehoe Volcanics. As shown in Figure 4-8, the "F" samples are from the CSO Site fill and the "N" sample is from the adjacent lava flow. The results show that N1, F1, and F2 are very similar and are probably from the same flow. F3 was also drawn from Laupāhoehoe Volcanics but is likely from a cinder cone. To illustrate the samples' relationship to

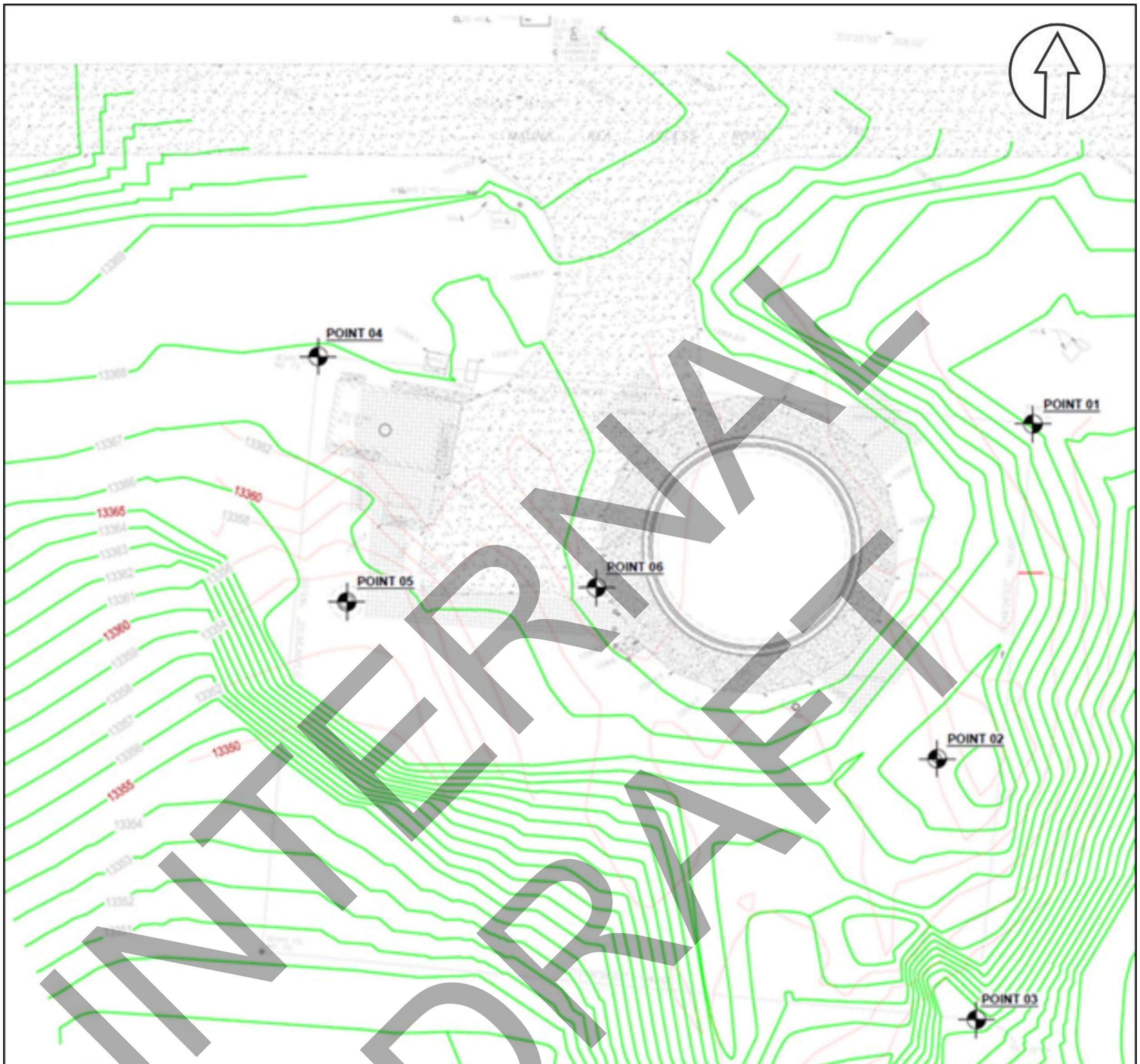
[8] The elements were: silicon, aluminum, titanium, iron, manganese, calcium, magnesium, potassium, sodium, phosphorus scandium, vanadium, nickel, chromium, barium, strontium, zirconium, yttrium, rubidium, niobium, gallium, copper, zinc, lead, lanthanum, cesium, thorium, neodymium and uranium.

the area's geology, Figure 4-10 superimposes the sample locations on a diagram from Wolfe et al. (1997) that compositionally classifies the lavas of Maunakea.

Figure 4-8 Fill Material Analysis Sample Locations

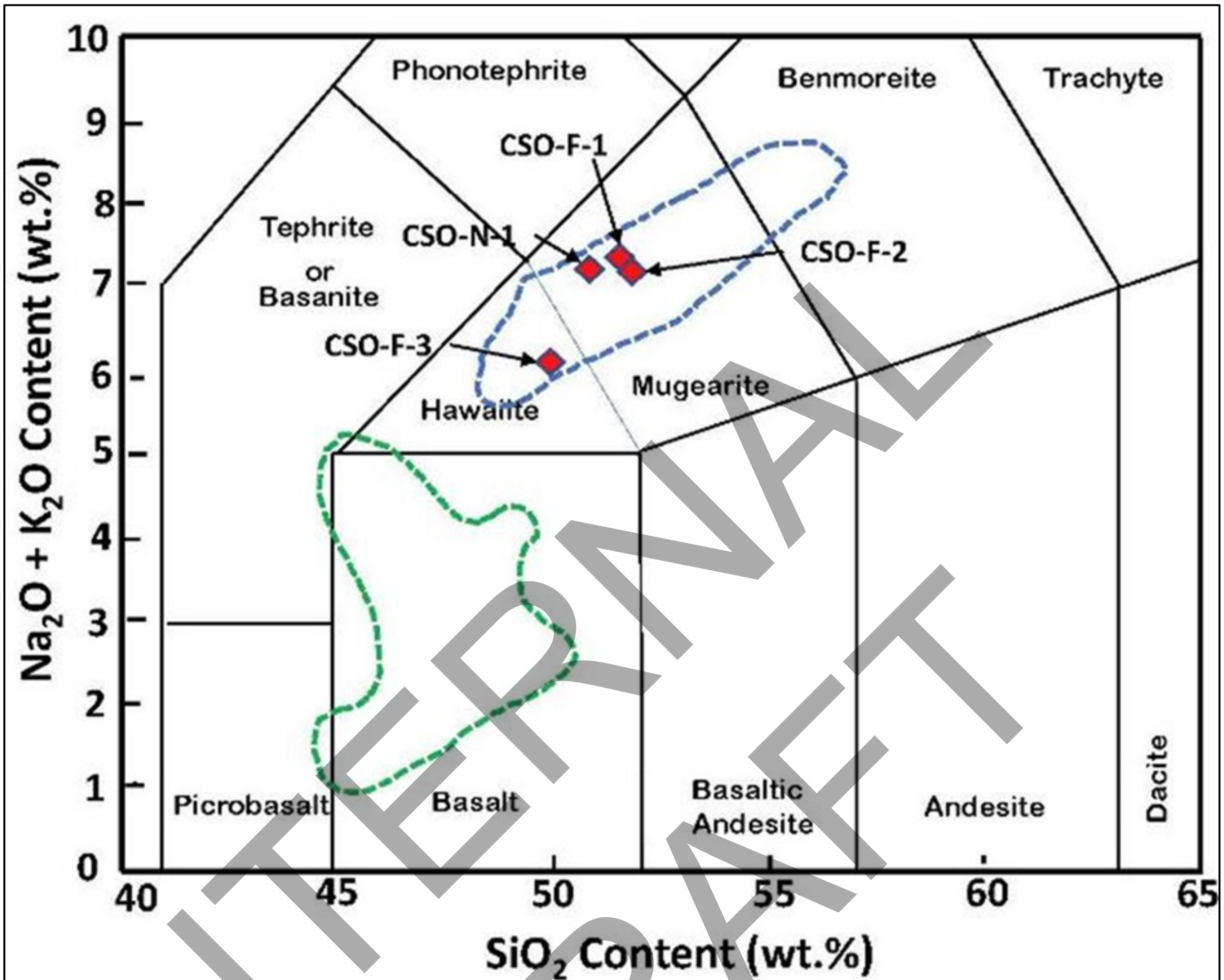
Source: Intera, Inc. (2019)

Figure 4-9 Lithological Test Hole Locations



Source: Intera, Inc. (2019)

Figure 4-10 Sample Locations and Classified Lavas on Maunakea per Wolfe et al. 1997



Note: The green dashed line denotes the approximate extent and range of geochemically analyzed older Hāmākua Volcanics and the blue dashed line denotes the approximate extent and range of geochemically analyzed younger Laupāhoehoe Volcanics
Source: Intera, Inc. (2019)

4.5.2 Existing Conditions

As noted in Section 2.1.3, Austin Tsutsumi & Associates, Inc. prepared a pre-construction site topographical survey (1982); that survey is shown in Figure 2-11. During preparation of the SDP and this EA, M3 Engineering and Technology, Caltech's decommissioning engineering and design contractor, digitized this prior survey and overlaid it with an updated site survey performed by dlb & Associates in 2016 (see Figure 2-12), with corrections for relative calibrations, to determine topographical discrepancies between the two and to calculate cut and fill requirements.

A comparison of the two surveys indicates that approximately 495 cubic yards of material were cut and approximately 2,830 cubic yards of fill were emplaced on the CSO Site during construction of the CSO facility in the 1980s. The maximum depth of the fill currently on the site is approximately 10 feet deep on the downslope, southeast side of the CSO Site. As previously discussed in Section 4.5.1.2, the origin of the fill currently on the CSO Site was not documented, but has been determined to be consistent with the Laupāhoehoe Volcanics found in the vicinity of the CSO Site and likely to be native to Maunakea's summit area. Much or all of the CSO Site fill is believed to have been sourced from an excavation in a Laupāhoehoe lava flow during widening of the Mauna Kea Summit Access Road and possibly tephra from one of the nearby Laupāhoehoe cinder cones.

4.5.3 Potential Impacts

The No Action Alternative (ALT-1) would not involve any earthwork and will have no impact on the geology, topography, or soils of the CSO Site or elsewhere.

For all action alternatives (ALT-2, ALT-3, and ALT-4), restoration of the CSO Site will entail changing the topography from its developed condition to as close to its natural, pre-construction condition as feasible. Those topographic modifications are considered beneficial effects in this case even though, during deconstruction, stormwater runoff may be affected and the site will be made less easy to walk on. The impacts would remain beneficial under ALT-3 and ALT-4 because, even though a portion of the site's topography would not be fully restored to the pre-construction topography, it would be left in a safe condition.

For all action alternatives, only modest quantities of backfilling will be required for site restoration, primarily related to backfill after the cesspool vault is removed, and all wastes and non-native materials will be removed. All of the fill material used will be native to the Maunakea summit region and is already present on the CSO Site. The use of this native fill for backfill during decommissioning does not represent a hazard or an adverse impact to geologic resources. The removal of all wastes and non-native materials ensures that the geologic resources of the region will not be adversely affected by the proposed project.

4.5.4 Mitigation Measures

The project will comply with all aspects of the CMP as outlined in Section 2.1.2.1 and elsewhere in this document. For example, this will entail:

- All construction personnel being educated regarding the environment, ecology, and natural resources in the project area as required by CMP management action C-8.
- A Rock Movement Plan (Appendix J) will be observed as required by CMP management action C-3.
- Implement a BMP Plan that covers a range of topics, including stormwater management, and incorporates sustainable practices as required by CMP management actions C-2 and C-9 (Appendix I).

4.6 HYDROLOGY

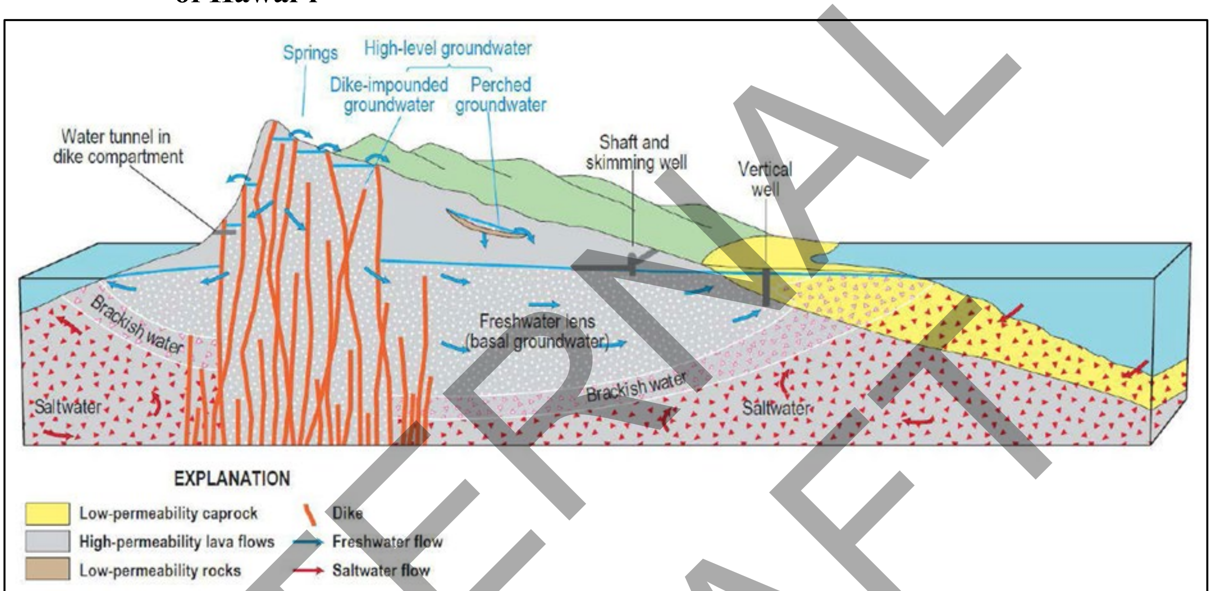
Caltech retained the services of geosciences and engineering consulting firm, Intera, Inc., to assess the hydrological conditions near the CSO Site and the potential water resource impacts of the action alternatives. The resulting report, *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (Intera, Inc. 2019) forms the basis for the information and analysis in the following subsections and is included as Appendix E.

4.6.1 EXISTING CONDITIONS

4.6.1.1 ***Islandwide Context***

Historically, groundwater in the State of Hawai‘i has been conceptualized in four categories: (*i*) basal groundwater, (*ii*) high-level or impounded groundwater, (*iii*) perched groundwater; and (*iv*) sedimentary or caprock groundwater. Figure 4-11 illustrates this concept.

Figure 4-11 Historic Conceptual Model of Groundwater Occurrence and Flow in the State of Hawai‘i



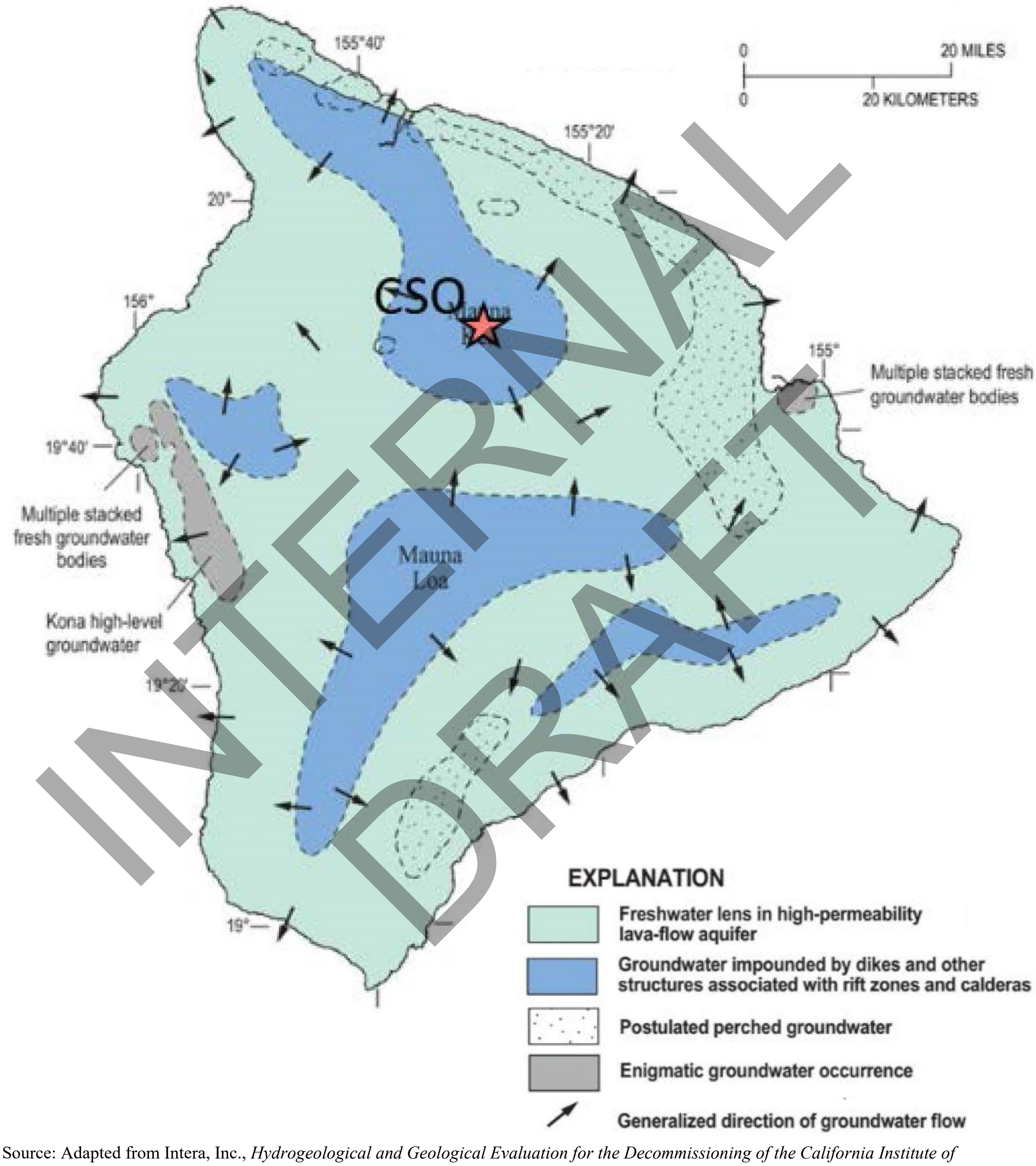
Source: Intera, Inc., Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory (2019); from Izuka et al., 2018.

The hydrology of the Island of Hawai‘i is unusual relative to the older Hawaiian Islands due to the presence of active volcanoes, little weathering, and the absence of sedimentary caprock deposits that provide for the fourth type of groundwater listed above (shown in yellow in Figure 4-11). Research and core samples conducted over the past 25 years have shown that the historic model may not be fully applicable to Hawai‘i Island, and possibly other islands as well (Thomas et al., 1996; Stolper et al., 2009; Thomas, 2016). Researchers have discovered deep freshwater aquifers in Hilo and Kona that do not fall into the four general categories noted above. Hawai‘i Island's hydrogeology as categorized by Izuka et al. (2018) based on these new discoveries departed from the historic model somewhat and identified four principal groundwater settings (Figure 4-12):

- Freshwater lens in highly permeable lava flows, which is largely analogous to basal groundwater;
- Groundwater impounded by dikes and other structures associated with rift zones and calderas, which is analogous to high-level or impounded groundwater;
- Perched groundwater associated with sediment or tephra deposited in between lava flows ("postulated perched groundwater" on Figure 4-12), which is similar to perched groundwater in the historic model; and

- Stacked freshwater bodies located below sea level ("enigmatic groundwater occurrence" on Figure 4-12) (detailed in Figure 4-14), which is an entirely new classification.

Figure 4-12 Conceptual Model of Groundwater Systems for Hawai'i Island



Source: Adapted from Intera, Inc., *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (2019), from Izuka et al., 2018.

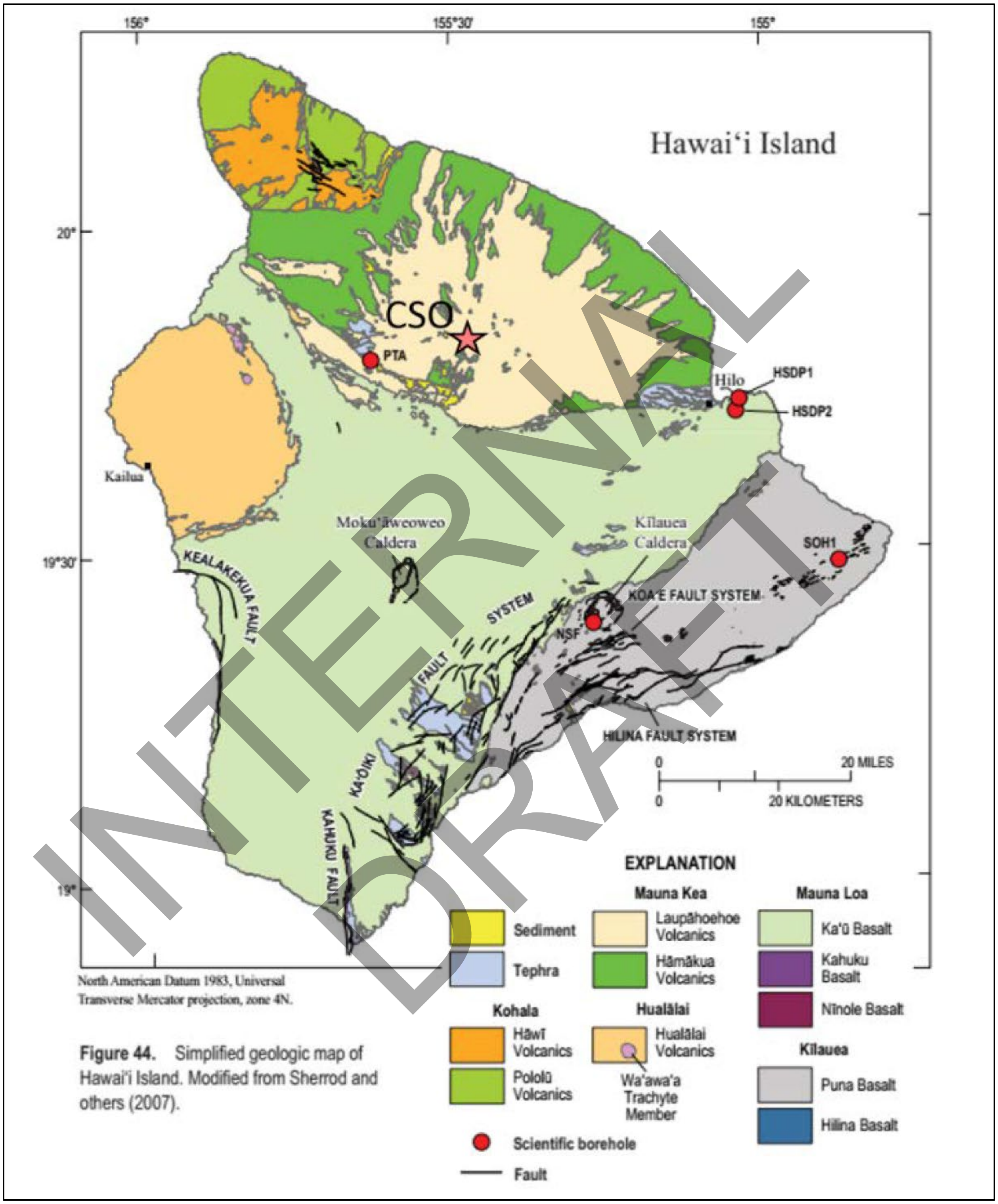
Groundwater basal aquifers, also called freshwater lens systems, are an important source of drinking water in Hawai'i. Hawai'i basal aquifers can occur in basalt and other igneous rocks as well as in sedimentary formations, locally known as caprock, if present. In a basal aquifer, lower density (lighter) fresh water can be thought of as floating on higher density (heavier) salt water. The fresh water and salt water are separated by a mixing or transition zone where salinity gradually increases from near-fresh to seawater concentrations (i.e., brackish, see Figure 4-11). The behavior of basal groundwater is a function of the geologic properties of the rock, groundwater recharge, the dynamics of the transition zone and groundwater pumping. The water level in feet above sea level of basal aquifers is generally less than 50 feet. Basal groundwater that is not pumped out of the ground ultimately discharges into the ocean as seeps and/or springs.

Some groundwater is retained behind dikes on the upper slopes of the volcanoes or along rift zones. Dike-impounded water is also called high-level water because groundwater can be impounded several thousand feet above sea level. There are no mapped dikes in the study area, but this is not surprising because dikes are subsurface features that are exposed by mass wastage or fluvial erosion and Maunakea is only slightly eroded. It is probable that dikes occur in Maunakea's subsurface (blue areas in Figure 4-12). There is no direct information on the regional groundwater table below the summit of Maunakea; based on evidence from Pōhakuloa Training Area (PTA) and extrapolation from other Hawaiʻi summit areas, Intera Inc. assumed the average depth to groundwater below the summit area is 3,000 feet below ground surface (bgs) (e.g., groundwater elevation is roughly 10,000 feet above mean sea level [msl]). The dike-impounded groundwater discharges or "leaks" into deeper or neighboring dike groundwater bodies, the basal groundwater, or, in cases where erosion has occurred to expose the dikes, into streams. Researchers believe that the dike-impounded aquifers below the CSO Site discharge into the stacked freshwater aquifers discussed below.

Perched water in Hawaiʻi generally refers to relatively small aquifers situated on restrictive layers of weathered ash or soil above the basal or high-level aquifers. Perched groundwater can occur thousands of feet above sea level. Perched aquifer systems either leak downward, slowly, through the restrictive layers or discharge laterally to underlying basal or dike-impounded aquifers, or discharge to streams and springs. An example of perched groundwater, with a surface expression, is Lake Waiau, which is discussed in Section 4.6.1.3).

The hydrogeologic framework of Hawai'i is not understood as well as the other islands due to the relatively large size of the island and the uneven distribution of lithological and hydrological data from wells that are generally clustered near the coastline (Mink and Lau, 1993; Whittier et al., 2004). Because of these data gaps, island-wide groundwater elevation contours cannot be made. A few scientific exploratory wells (i.e., Pōhakuloa Training Area, and the deep Hawaiian Scientific Drilling Project (HSDP) drill holes near Hilo, HSDP1 and HSDP2; see Figure 4-13) and geophysical studies (Zohdy and Jackson, 1969; Pierce and Thomas, 2009; Thomas, 2016) provide some subsurface information, but little or no subsurface hydrogeological data exists at the high-altitude interior, including beneath Maunakea.

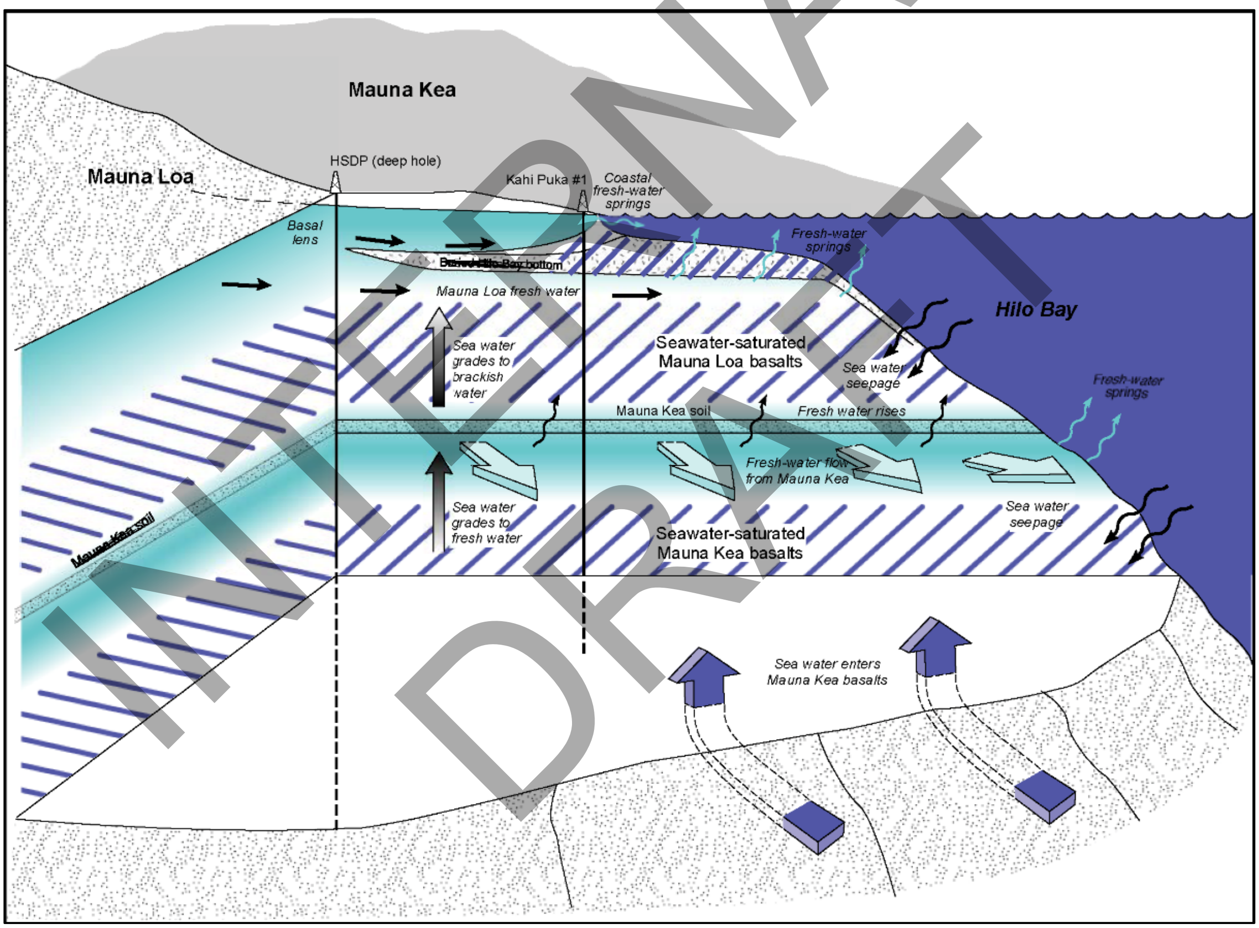
Figure 4-13 Geology of Hawai‘i Island with Locations of Scientific Borings



Source: Intera, Inc., *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (2019)

This recent research on the Island of Hawai’i indicates that, contrary to the historic model that assumed a monolithic basal lens (Figure 4-11), there are multiple stacked bodies of freshwater thousands of feet below sea level separated by seawater-saturated basalts (Thomas et al., 1996; Stolper et al., 2009) (Figure 4-14). The deep HSDP drill holes near Hilo, HSDP1, and HSDP2 (Figure 4-13), revealed upper and lower freshwater-saturated aquifers (enigmatic groundwater on Figure 4-12, Thomas et al., 1996). They found a freshwater body about 400 feet thick, confined below a soil layer at 900 feet bgs that marked the transition from Maunakea lavas below and younger overlying Mauna Loa lavas above in the HSDP1 borehole. The second, deeper HSDP2 borehole encountered this same deep freshwater aquifer at about 1,000 feet bgs, as well as several, much deeper, freshwater-saturated aquifers extending from a depth of about 6,500 feet bgs to more than 9,900 feet bgs (Stolper et al., 2009). This clearly diverges from the monolithic basal lens concept and indicated stacked freshwater bodies, as illustrated in Figure 4-14. Similar stacked freshwater bodies have been observed on the west side of the island in Kona (see enigmatic groundwater on Figure 4-12).

Figure 4-14 Conceptual Model of Stacked Freshwater Bodies



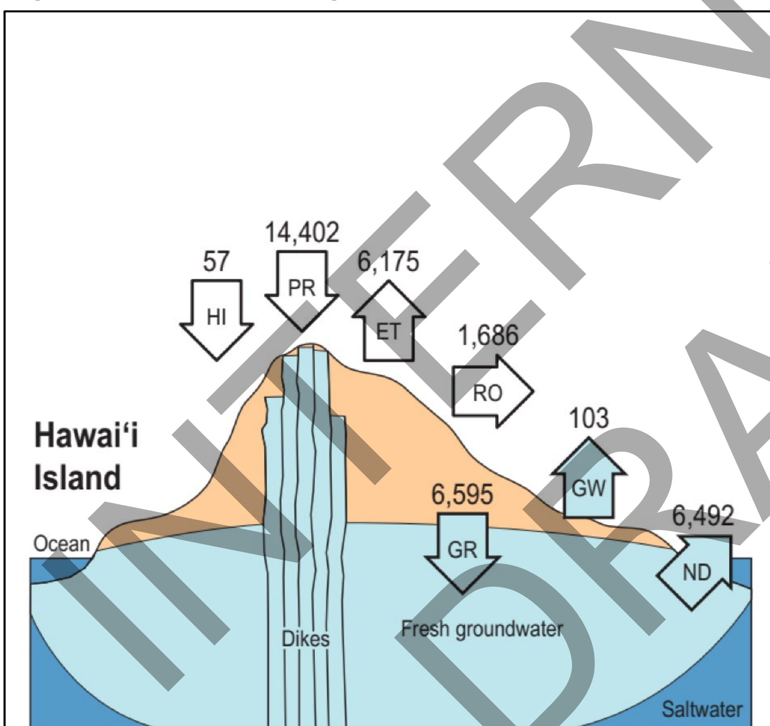
Source: Intera, Inc., *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (2019)

Thomas et al. (1996) considered these stacked freshwater bodies as part of a deep groundwater system that receives water from approximately 7,000 feet elevation on the slopes of Maunakea, based on stable isotope ratios and carbon-14 age dating. Stolper et al. (2009) estimated these fresh groundwater bodies account for as much as one third of the rainfall recharge from the windward, mid-altitude slopes of Maunakea. Based on the distance between the 7,000 foot elevation and the HSDP drill holes (18 miles), it was estimated that groundwater in the lower portion of the stacked freshwater aquifer was flowing roughly 44 feet/year because the water is roughly 2,200 years old. Scientists continue to investigate these systems.

4.6.1.2 ***Maunakea Groundwater***

The regional groundwater body below the summit of Maunakea is probably a dike-impounded high-level aquifer (Figure 4-15; Izuka et al., 2018). It is "probable" because there is no direct confirmation of high-level water from drilling. Groundwater hydrologic units have been established by the Commission on Water Resource Management (CWRM) to provide a consistent basis for managing groundwater resources (CWRM, 2008). The five aquifer systems that connect to the peak of Maunakea are: (*i*) Honokaʻa, (*ii*) Paʻauilo, (*iii*) Hakalau, (*iv*) Onomea, and (*v*) Waimea. There are also an unknown number of relatively small perched water bodies associated with buried glacial deposits and deposits of weathered ash or sediment. Lake Waiau is the surface expression of a shallow perched aquifer (Leopold et al., 2016).

Figure 4-15 Water Budget Schematic for Hawaii Island



Note: PR = precipitation, HI = human inputs, ET = evapotranspiration, RO = runoff, GR = groundwater recharge, GW = groundwater use, ND = discharge.
Source: Intera, Inc., *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (2019)

There are several factors affecting the vulnerability of an aquifer. They include potential flow pathways of groundwater recharge, the occurrence of potential contaminating activities, and physical and geochemical conditions in the vadose zone[9] that may affect contaminant transport (Whittier et al., 2010; Eberts et al., 2013). Contaminant transport is affected by attenuation factors, including adsorption, biological action, chemical action (cation and anion exchange or

[9] The vadose zone is the unsaturated sediment and rock between the ground surface and the top of the underlying aquifer's phreatic (saturated) zone.

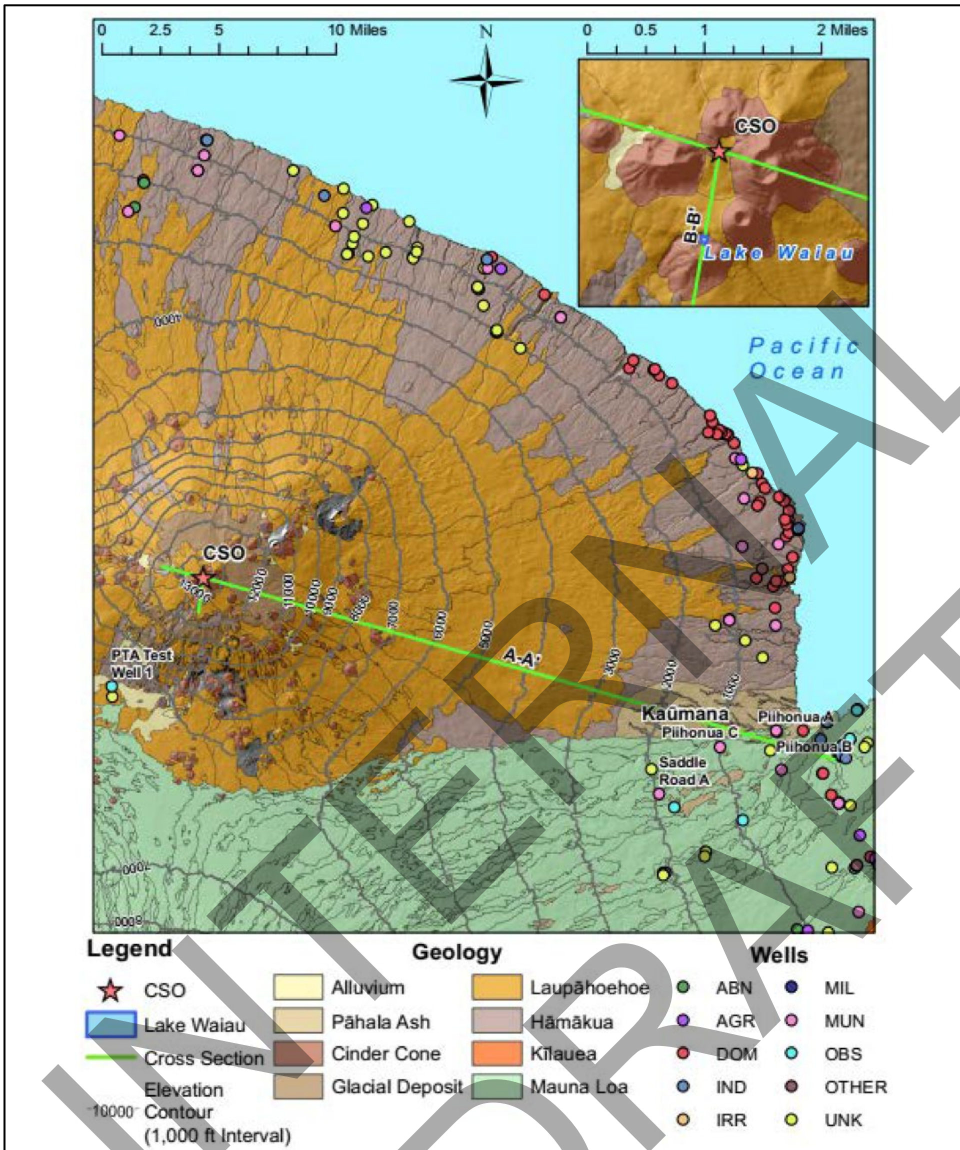
precipitation), filtration, and dilution. These natural geochemical and physical conditions also influence the viability and transport of bacteria. For example, slightly elevated temperatures may increase biological activity and accelerate alteration of organic contaminants and nutrients. Other important factors in the phreatic zone (the saturated zone below the vadose zone) include travel time and dilution. Dilution of contaminants will be greater in areas with high groundwater recharge. Travel time is a function of groundwater velocity and distance between recharge areas and discharge areas. There is more potential for attenuation during longer travel times.

The primary purpose of Intera, Inc.'s report (2019) was to assess the potential for groundwater pollution from the on-site cesspool to occur (see Section 2.1.2.12). Intera prepared a conceptual groundwater model of Maunakea's summit region; this conceptual model is a simplified graphic representation of the relevant geology and hydrology of the CSO Site and its environs.

The depth to groundwater is important in determining possible recharge flow pathways. There is no direct information on the regional groundwater table below the summit of Maunakea, but data exist at the PTA in the saddle between Maunakea and Mauna Loa from the scientific boring at PTA Test Well 1 (Figure 4-16) (Thomas and Haskins, 2013). Perched groundwater was encountered at two depth intervals in the PTA Test Well 1: 500-540 and 700-1,181 feet bgs. The regional water table was encountered at 1,806 feet bgs, or at about 4,500 feet above msl. Geophysical surveys have also indicated elevated groundwater levels at the lower slopes of the eastern flank of Maunakea (Pierce and Thomas, 2009; Thomas, 2016). Zones of low resistivity observed in magneto-telluric surveys collected about the eastern flank of Maunakea suggest the frequency and extent of perched or high-level groundwater bodies is higher than previously anticipated (Thomas, 2016).

This information indicates that the regional groundwater level below Maunakea is at the deepest 9,000 feet bgs (4,500 feet-msl). If known water levels in other Hawai'i summit areas are extrapolated, the regional water level below the summit is probably significantly higher. Intera have assumed an average depth to groundwater below the summit area of 3,000 feet bgs (10,000 feet-msl). The regional groundwater below the summit is probably dike-impounded, so water levels will vary, perhaps significantly, in different dike compartments.

Figure 4-16 Geologic Map with Cross-Section A-A' and Locations



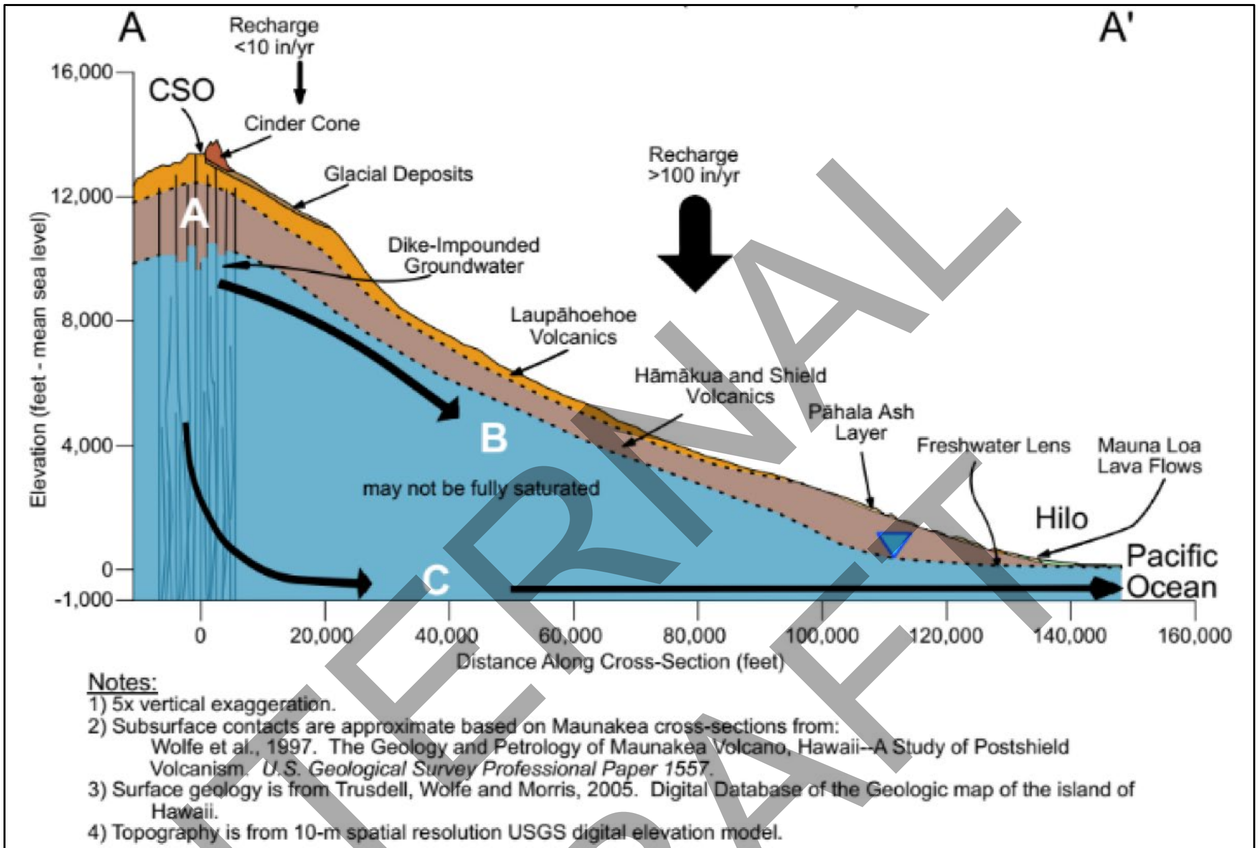
Source: Intera, Inc., *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (2019)

Groundwater travel time is also a factor in assessing aquifer vulnerability. As discussed in Section 4.6.1.1, it is estimated that water in the lower portion of the stacked freshwater aquifer flows roughly 44 ft/year. It is likely that groundwater originating near the peak of Maunakea enters that lower flow system. These findings suggest it would take at least 3,000 years for groundwater to travel from the summit area of Maunakea to the shoreline of Hilo (Thomas 2018a).

Based on these and other data, the Maunakea groundwater system is represented by Cross Section A-A' on Figure 4-17. Cross Section A-A' depicts the groundwater system for approximately 24 miles between the CSO near Maunakea's summit and Hilo. The Laupāhoehoe Volcanics are assumed to extend approximately 1,000 feet bgs in the summit area and become a thinner veneer downslope. The Hāmākua Volcanics are lumped with the shield volcanics because they have similar hydrogeological properties (i.e., relatively high hydraulic conductivity), while the

Laupāhoehoe Volcanics have distinctly lower hydraulic conductivity. Groundwater levels in the dike-impounded zone beneath the CSO are thought to vary around an average of 10,000 ft-msl in the 3-mile wide rift zone.

Figure 4-17 Cross-Section from CSO to Hilo (and other locations)



Source: Intera, Inc., *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (2019)

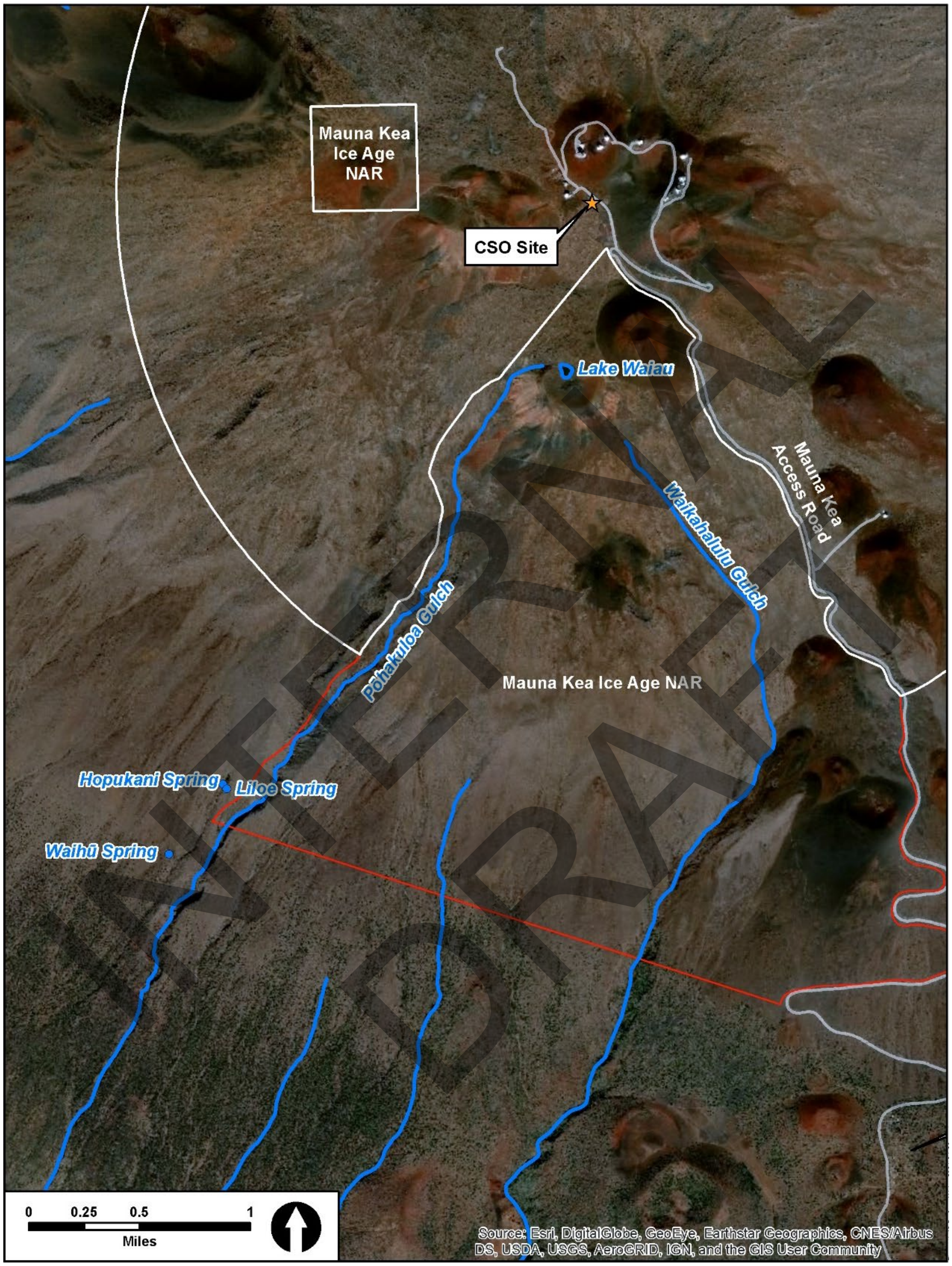
Intera, Inc. depicted two major flow paths for regional groundwater flow originating in the summit area. The upper arrow depicts overflow or spill from the dike compartments. This water would flow through other high-level aquifers in areas that are potentially not fully saturated. The lower arrow shows a flow path for water discharging at or below sea level from the dike compartments and flowing as basal or lower portion of the stacked freshwater aquifer towards the ocean. Recharge at higher elevations will be pushed to deeper levels in the saturated zone by recharge occurring at lower elevations. This will result in deeper groundwater flow paths for higher elevation recharge. Contaminants transported in groundwater from higher elevations will also tend to be pushed deeper in the aquifer.

The dike-impounded groundwater beneath the summit of Maunakea is a leaky system that flows radially in all directions away from the summit and CSO. This distribution of flow directions means a contaminant that is introduced to the dike-impounded groundwater system could be transported radially, in several directions from the Maunakea summit area. The "may not be fully saturated" labeled zone between 20,000 and 100,000 ft (horizontal) on Figure 4-17 is in a zone where extensive perching likely exists with alternating saturated and unsaturated zones (Thomas, 2018). If high level water discharges into this zone, the flow would be both saturated and unsaturated.

4.6.1.3 ***Surface Water***

A map showing the surface water in the summit region of Maunakea is shown in Figure 4-18. The only continuous surface water in the summit area is Lake Waiau, which is roughly 4,000 feet to the south of the CSO Site. The Pōhakuloa and Waikahalulu Gulches are the most highly developed gulches on the upper mountain slopes (Figure 4-18), but only have surface flow during and for a brief period after storm events. Over three miles south of the CSO Site there are three known springs near Pōhakuloa gulch: the Hopukani, Waihū, and Liloe Springs (collectively "Pōhakuloa Springs"). The highest of these three springs is at an elevation of roughly 10,440 feet and thus not in the summit area.

Figure 4-18 Surface Water



Source: PSI (2021)

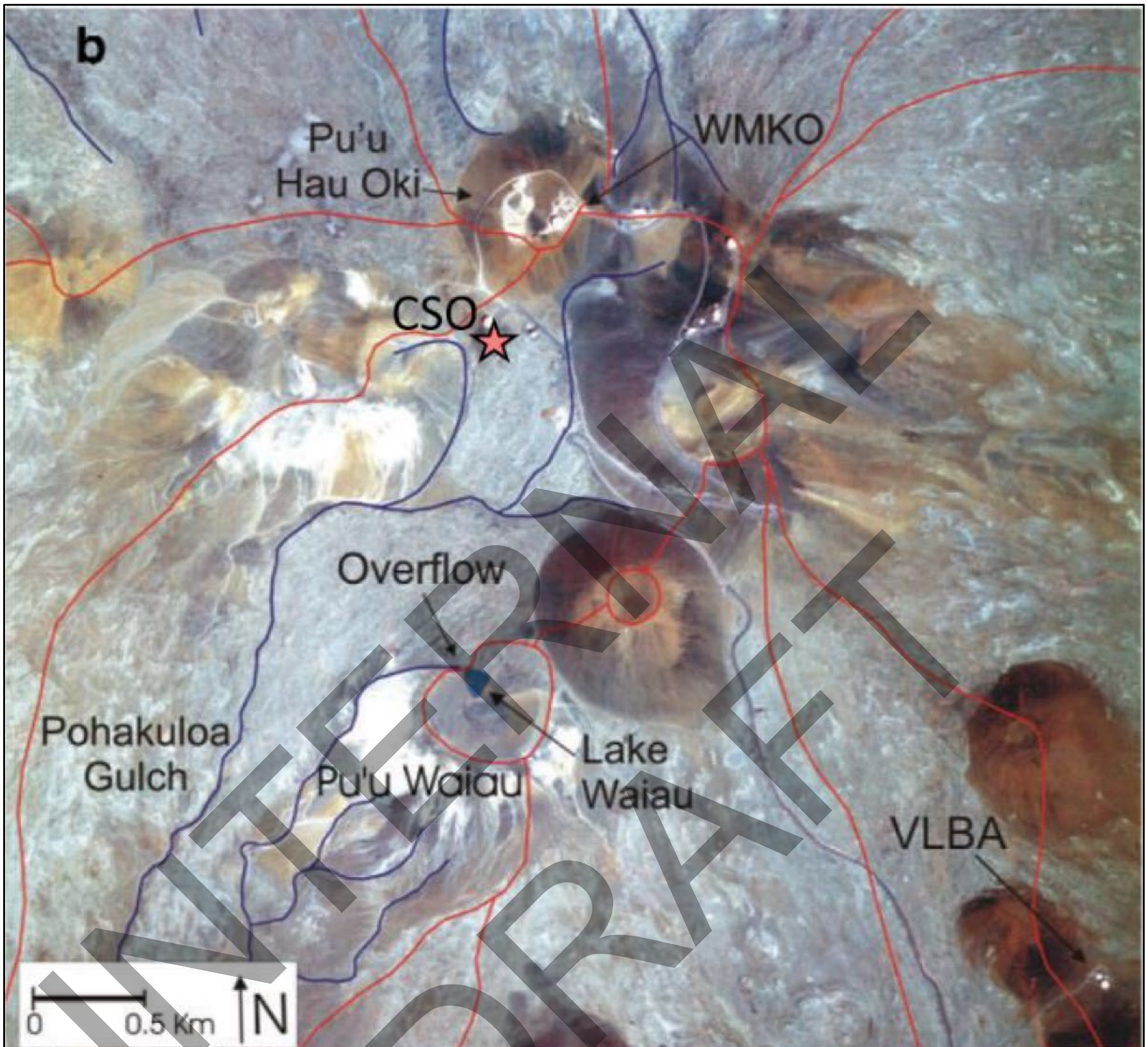
Pōhakuloa Gulch originates on the southwest side of Maunakea. The watershed includes the CSO Site and Lake Waiau. The gulch likely formed due to scouring from melting glaciers (Macdonald et al., 1983; Lockwood, 2000; Porter, 2005). These melt waters are thought to have contributed to the initial filling of Lake Waiau (Sherrod et al., 2007).

During fieldwork, Intera, Inc. personnel visited Lake Waiau and walked the upper portion of the Pōhakuloa Gulch watershed on November 9, 2018. As illustrated in Figure 4-19, the lake was filled and overflowing into the gulch. The watershed around the lake is mostly rock rubble, red weathered lava rock, and slightly weathered lava flows; the CSO Site is not within the lake's watershed (Figure 4-20). Occasional tufts of grass grew in the weathered material. The lake was pigmented green from algae, and the perimeter of the lake was surrounded by grass. Although the lake was overflowing, the soil was dry and there was no indication of recent precipitation or surface water inflows, indicating that the lake is an expression of perched groundwater.

Figure 4-19 Photo of Lake Waiau Taken dated November 9, 2018

Source: Intera, Inc., *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (2019)

Figure 4-20 Watersheds and Surface Water Flowpaths in Summit Area



Note: Flow lines are shown in blue, watershed boundaries are shown in red.
Source: Intera, Inc., *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (2019)

Intera, Inc. personnel noted that there are green algae in the lake; this implies the presence of nutrients. Nutrients and algae have been documented in Lake Waiau in 1977 to 1978 before the CSO was constructed (Laws and Woodcock, 1982). Laws and Woodcock noted that there were hypereutrophic conditions in the lake and found elevated levels of chlorophyll a in the lake during a drought. Patrick and Kauahikaua (2015) also noted that the lake was green during a period of low water levels in September 2013.

Lake Waiau (Figure 4-19) fluctuates in size with precipitation; it has been observed to shrink (Patrick and Delparte, 2014) and then regain its full volume. It is a perennial body of water in the crater of a cinder cone that was occupied by ice during past glaciations. Water remains in the lake despite being situated atop porous volcanics due to a fine-grained ash or glacial till layer that perches groundwater (Leopold et al., 2016). A study by Woodcock (1980) indicated that Lake Waiau water is similar to the water discharging at the Pōhakuloa Springs.

Ehlmann et al. (2005) concluded that Lake Waiau is fed by a small 135,000 square meter circular basin and is isolated from the surface drainage of the telescopes. They concluded that precipitation within that basin is sufficient to fill and sustain the lake. There is no indication that the small aquifer and watershed that feeds Lake Waiau are hydraulically connected to the CSO Site via surface water or groundwater.

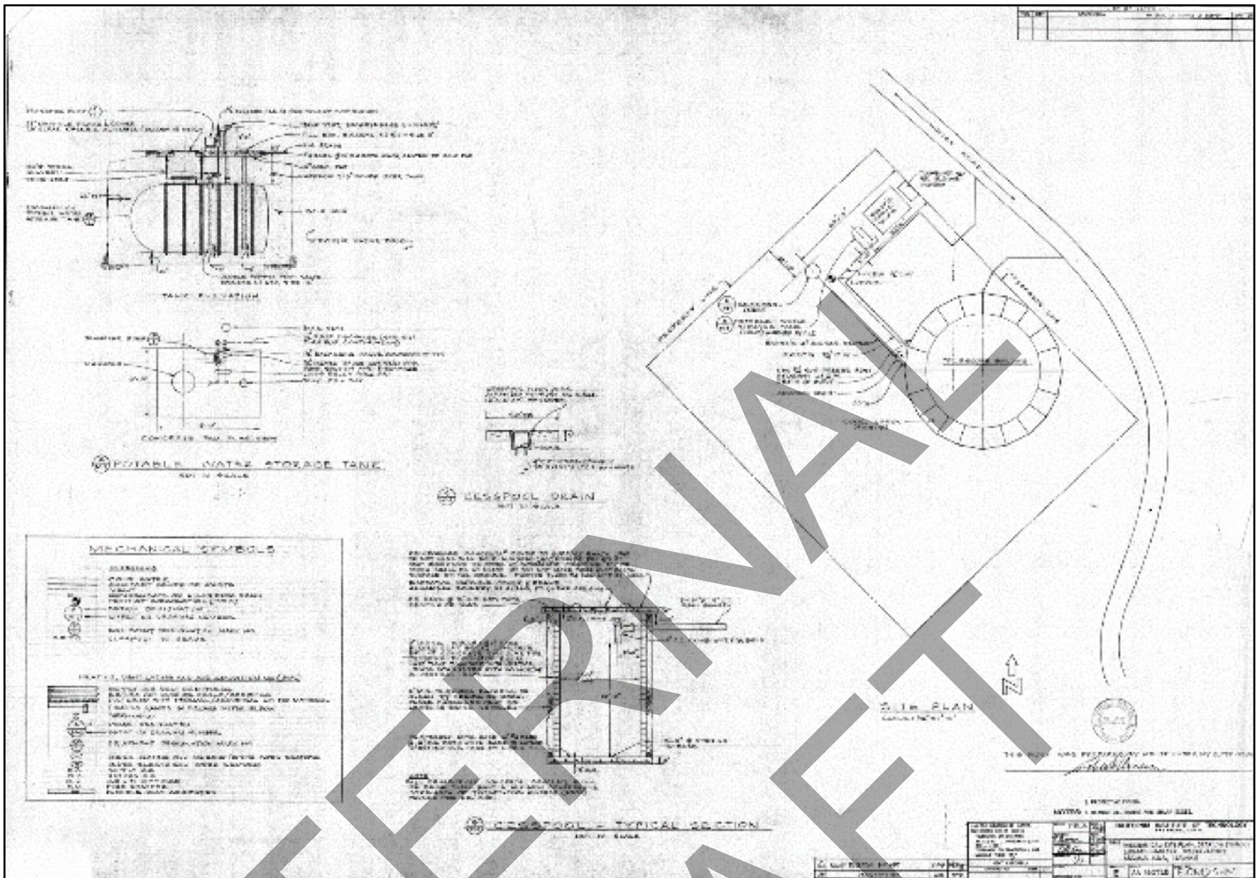
4.6.1.4 ***Wastewater***

The CSO facility includes a small wastewater system that, when the facility was in use, disposed of waste from two toilets and a few sinks. The initial Conservation District Use Application (CDUA) for the CSO submitted June 10, 1982, notes:

> *"It is estimated that when the telescope becomes operational an average of five to seven persons will be present on the mountain at one time, operating in two shifts per day at the telescope site. The additional personnel are expected to generate an additional 1,100 to 1,500 gallons per month (gal/mo) of liquid sewage."*

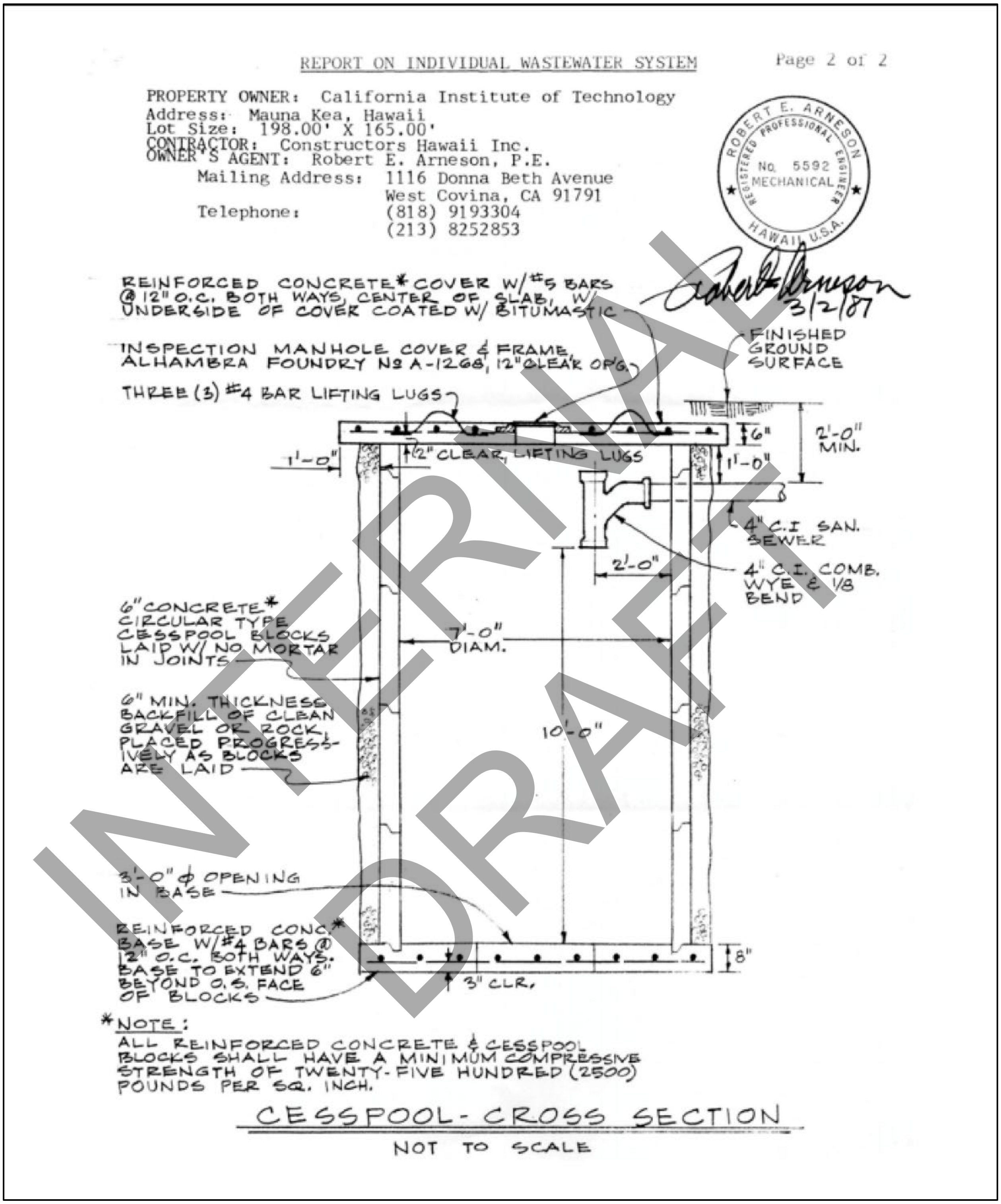
Consistent with these prior estimates and review of a sampling of water delivery to the CSO over the years, it appears that the average monthly water delivery to CSO was 1,250 gal/mo. An as-built figures of the CSO cesspool are shown on Figure 4-21 and Figure 4-22 (Stolper, 2015). The cesspool is 7 feet in diameter, 10 feet tall and the discharge occurs through the bottom perforations.

Figure 4-21 As-Built Plan View of Cesspool on CSO Site



Source: Intera, Inc., *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (2019)

Figure 4-22 As-Built Section View of Cesspool on CSO Site



Source: Intera, Inc., *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (2019)

The EIS (Caltech, 1982), prepared prior to the construction of CSO, notes that:

> *"Disposal of 1,100-1,500 gal/mo of liquid sewage into an 850-gallon septic tank is not expected to impact the hydrology of the area or pollute Lake Waiau."*

The EIS (1982) further noted:

> *"The combined factors of relatively low effluent flow, evaporation losses from the cesspool tank, storage within the underlying lava rock or permafrost, probable downward dispersion (in event of a deep permafrost layer) and estimated negligible flow rate combined with significant purification within a few hundred feet of the source−lead to the conclusion of no impact on Lake Waiau."*

Intera estimated that during operation, the CSO effluent had an average nitrogen concentration of 87 mg/L and, based on that and the flow rate of 1,250 gal/mo, calculated an average nitrogen loading rate of 0.41 kg/month for the CSO cesspool. This is much lower than the average effluent and nitrate loading rate for a single cesspool in the Kaūmana area above Hilo, which is 20,100 gallon/month and 4.5 kg/month, respectively. The nitrogen loading rate at the CSO is significantly lower than a typical cesspool because of the low total effluent discharge.

4.6.2 Potential Impacts

4.6.2.1 ***Potential Impacts to Groundwater***

No long-term impacts to groundwater are anticipated due to the proposed action because the proposed action would result in the removal of facilities, including the cesspool, and the restoration of the CSO Site so that no residual potential contaminants remained.

During scoping effort, the public voiced concern regarding the roughly 30 year operation of the cesspool at the CSO Site. Although the cesspool structure would be removed as part of the proposed action, the 30 years of wastewater leachate cannot be removed. Community members are concerned that the leachate will contaminate aquifers in the future. This concern is addressed in the follow subsections, the first of which address groundwater flow toward Hilo and the second address groundwater flow toward Waimea.

4.6.2.1.1 Modelled Travel Time from CSO to Drinking Water Wells

Figure 4-17 shows a diagram of the conceptual flow system from the CSO to Hilo or other locations, including Pa'auilo, Waimea, and Waikoloa. Intera, Inc. used the graphical software package VS2DI to model the vertical flow of leachate through the unsaturated zone, estimated to be roughly 3,000 feet thick and indicated by "A" on Figure 4-17. VS2DI simulates fluid flow and solute or energy transport through variably saturated porous media (USGS, 2000). Intera, Inc. constructed a conservative model that:

- Did not account for low permeability zones that would slow flow. This is a conservative approach because if the flow slowed, travel time would increase, providing additional time for contaminants to attenuate.
- Did not simulate any saturated zones, although they may be present. This is also a conservative approach because saturated zones would also slow the flow.

- Did not simulate dispersion or attenuation factors that in reality are certainly reducing the concentrations of pathogens and nutrients.
- Simulated 35 years of CSO operation with the cesspool discharge leachate at a rate of 1,250 gal/mo throughout. This is conservative because it is longer than the actual operation period.
- Assumed groundwater recharge of <8 inches/year at the summit of Maunakea.
- Incorporated several conservative assumptions regarding porosity, hydraulic conductivity, residual moisture, and other parameters.

The results indicate the leachate plume would travel downward through the vadose zone to the dike-impounded groundwater level 3,000 feet below ground surface in 34 years (see "A" on Figure 4-17). This equates to a vertical velocity of about 88 feet/year. Leachate that percolates to the dike-impounded groundwater table(s) would become part of the dike-impounded aquifer system below Maunakea (Figure 4-12 and Figure 4-17).

Estimation of the travel time through the unsaturated zone is the first step. Next, the travel time though the saturated or phreatic zone was evaluated. Figure 4-17 illustrates two flow paths (B and C) through the saturated zone. The estimated travel time for leachate from the CSO cesspool to the basal aquifer beneath the Hilo-Kaūmana area via the less likely shallow pathway ("B" on Figure 4-17) is estimated to range between 72 years to 412 years, based on the sum of travel times through Components A and B (Table 4.7). Regarding the more likely deep aquifer flow path (Component C from Figure 4-17 and Table 4.7), the groundwater travel time is estimated to be roughly 3,000 years from the peak of Maunakea to Hilo based on the age dating of groundwater from Thomas et al. (1996).

Table 4.7 Groundwater Velocity and Travel Time Estimates for Components of Regional Groundwater System Between CSO and Hilo

	Groundwater Velocity			***Travel Distance (feet)***	***Travel Time (years)***		
Component	***Mean***	***Min.***	***Max.***		***Mean***	***Min.***	***Max.***
A – Vadose Zone	88	--	--	3,000	34	--	--
B – Basal Aquifer	1,747	318	3,176	120,000	208	38	378
C– Deep Aquifer	50	--	--	120,000	3,000	--	--
Notes: Source for basal aquifer is Lau and Mink (2006); Liu (2007); Whittier (2018b). Source for deep aquifer is Thomas et al. (2016).							
Source: Intera, Inc., *Hydrogeological and Geological Evaluation for the Decommissioning of the California Institute of Technology Submillimeter Observatory* (2019)							

Thus, the earliest estimated arrival time for effluent from CSO to Hilo is 72 years. In other words, the Intera model estimates that no effluent from the cesspool, even in miniscule amounts, has reached Hilo; in fact, only a small portion of it has reach the dike-impounded aquifer beneath the summit region.

Intera, Inc. also considered the travel time to other drinking water sources in the area around Maunakea. Groundwater flow emanates radially from Maunakea and is as likely to flow toward Waiki‘i, Waikoloa, and Waimea as Hilo. The cross section and flow paths would be analogous (Figure 4-17). Based on the basal groundwater velocities presented in Table 4.7, Intera, Inc. estimated the minimum groundwater travel times from the CSO Site to the public water supply wells serving Waikoloa and Waimea to be in the range of 70 to 400 years (similar to the Hilo travel times).

Waikiʻi Ranch is located about 12 miles from the CSO Site. Based on the basal groundwater velocities presented in Table 4.7, Intera, Inc. estimated the minimum groundwater travel times from the CSO to drinking water wells serving that community to be in the range of 55 to 240 years.

4.6.2.1.2 Contaminant Fate

Contaminants from cesspools are typically assessed by nitrate (as nitrogen). Nitrate (as nitrogen) in samples from public drinking water wells serving Waikiʻi, Waikoloa, Waimea, Paʻauilo, and Hilo has consistently between 1 and 2 mg/L, well below the Maximum Contaminant Level (MCL) of 10 mg/L. These nitrate levels are also lower than the Hawai'i natural background level of 3 mg/L. Based on this information, there is no indication of impacts from the CSO cesspool or other cesspools and other wastewater disposal systems on the drinking water wells.

It is extremely unlikely that any pathogens from the CSO cesspool will reach the regional aquifer system. Pathogens from wastewater have been known to degrade by 10^{-5} (five orders of magnitude) within 92 days of travel time (Crockett, 2007). This means that the unit concentration of pathogens would be 0.00001 after 92 days due to attenuation factors including adsorption, biological action, dispersion, chemical action (cation and anion exchange or precipitation), filtration, and dilution. Thus, the 87 mg/L concentration of nitrate in the CSO discharge would be reduced to 0.00087 mg/L, which is three orders of magnitude below the MCL. Leachate transport through the 3,000 feet of unsaturated volcanics separating the CSO cesspool from the dike-impounded groundwater is modelled to take a minimum of 34 years. This travel time is 134 times longer than the 92 days during which wastewater pathogens have been shown to degrade by five order of magnitude.

If contaminants remain in the leachate when it enters the dike-impounded groundwater, they would have to travel 12 to 24 miles, estimated to take another 21 to 3,000 years, before entering a drinking water well. During that travel time, they would continue to be subject to the attenuation factors mentioned above.

To put the potential for the CSO cesspool operation to impact drinking water resources into context, Intera compares the CSO to the cesspools at residential properties in the Kaūmana area above Hilo that are upgradient of drinking water wells (Piʻihonua #1 A & B). Based on HDOH records and estimates, there are about 1,000 cesspools with 680,000 gallons/day of effluent for a nitrate loading rate of 155 kg/day of nitrogen (a loading rate more than 10,000 times the CSO cesspool's). Most of the cesspools in the Kaūmana area upgradient of the wells are on residential properties that have an elevation of 400 to 1,000 feet MSL. Therefore, their effluent percolates through a thinner vadose zone than the CSO effluent did (less than 1,000 feet vs. roughly 3,000 feet). As the Kaūmana effluent nitrates move through the subsurface they are subject to attenuation processes discussed above. Despite this much greater nitrate load, sourced much closer to the drinking water wells than the CSO cesspool, the nitrate level in groundwater extracted from those wells have consistently been under 0.5 mg/L.

4.6.2.1.3 Conclusion

As discussed in Section 2.1.2.12, based on its consultation with HDOH-WB and HDOH-ES, for all action alternatives Caltech now plans to: (*i*) pump out all sludge remnants in the cesspool, (*ii*) test the sludge for potential contaminants and dispose of it properly, (*iii*) trench around the outer perimeter of the concrete cesspool cylinder to its depth; (*iv*) remove the concrete cesspool structure and dispose of it properly; and then (*v*) use structural fill from the CSO Site to fill the void to a depth even with the surrounding native lava flow surface and compact the fill during the backfilling process to minimize settling in the future. CSO will continue to coordinate with the HDOH and comply with the instructions provided by it, including *General Backfilling Scenarios for an Injection-Well Cesspool* (2004), during closure of the cesspool.

By relying on these procedures, and based on the analysis and evidence outlined in the sections above, Intera concludes (Appendix E) that there is virtually no potential for CSO cesspool leachate to impact the drinking water supplies of Hilo or other communities around Maunakea. This confirms that the CSO cesspool effluent will have no to a negligible impact on groundwater quality and drinking water quality.

Similarly, all workers will use portable toilets brought to and from the project site; thus, activities associated with the proposed project are not expected to have an impact on groundwater quality.

4.6.2.2 ***Potential Impacts to Surface Water***

There is virtually no potential for cesspool leachate to impact Lake Waiau or the Pōhakuloa Springs based on the lack of hydraulic connection between these water bodies and the CSO Site.

Prior to implementation of the proposed project, Caltech will obtain a National Pollutant Discharge Elimination System (NPDES) permit and will implement the BMPs outlined in the Site-Specific Stormwater Pollution Prevention Plan (SWPPP), which will be prepared when the NPDES permit application is prepared. These protections will prevent the project from having a significant effect on stormwater runoff and surface water quality.

4.6.3 MITIGATION MEASURES

The project will comply with all aspects of the CMP as outlined in Section 2.1.2.1 and elsewhere in this document. For example, this will include:

- All construction personnel being educated regarding the environment, ecology, and natural resources in the project area as required by CMP management action C-8.
- Implement a Best Management Practices Plan that covers a range of topics, including stormwater management, and incorporates sustainable practices as required by CMP management actions C-2 and C-9 (Appendix I).

In addition, regarding the closure of the cesspool, Caltech will comply with applicable provisions of the *General Backfilling Scenarios for an Injection-Well Cesspools* and other directives from HDOH-WB.

4.7 SOLID AND HAZARDOUS WASTE

This section addresses the solid and hazardous waste and materials management practices associated with the action alternatives considered in this EA. During consultation and scoping conducted during the preliminary planning for the CSO Decommissioning Project, many individuals repeatedly stated that Caltech should make every effort to reuse and/or recycle as much of the deconstruction material as possible rather than discard it as waste, including the CSO telescope itself (see Section 2.1.2.5). These suggestions align with Caltech's intent. Caltech's goal is to reuse and/or recycle as much of the telescope and facility as reasonably practicable during implementation of the CSO Decommissioning Project.

4.7.1 EXISTING CONDITIONS

4.7.1.1 ***Deconstruction Waste***

The estimated amount of solid waste which will result from the CSO deconstruction are provided in Table 4.8.

Table 4.8 Solid Waste Associated with CSO Decommissioning

Type of Solid Waste	***Quantity***
Aluminum	5 tons
Concrete	350 tons
Copper Grounding Mesh	0.26 tons
Miscellaneous[1]	350 tons
Steel	150 tons
TOTAL	**855.26 tons**
Note 1: Includes wood, drywall, ceilings, piping, etc.	
Source: M3 Engineering and Technology (2020)	

There is no reason to expect that any of these wastes are hazardous wastes. Minor amounts of these wastes were found to have lead-containing paint (LCP) or lead-based paint (LBP) on them. As discussed in Section 2.1.2.4, loose and flaking LCP and LBP that may be disturbed during deconstruction will be removed and disposed of in accordance with applicable regulations prior to these materials become wastes themselves. Wastes with residual (not loose or flaking) LCP and LBP will be managed so that lead-containing dust is not generated during deconstruction and will be disposed of with the unpainted wastes.

On February 2, 2018, representatives of Caltech met with the Hawai‘i County Department of Environmental Management (DEM) as part of the scoping and pre-assessment consultation that has taken place during the preliminary planning for the CSO Decommissioning Project. A second, follow-up discussion was held on January 23, 2020, with the Division Chief of the DEM's Solid Waste Division (SWD), which is tasked with: (*i*) municipal wastewater management; (*ii*) maintenance of the Island's five municipal wastewater system; (*iii*) solid waste disposal; (*iv*) landfill operation and management; (*v*) vehicle disposal; and (*vi*) all other environmental management and recycling programs conducted by the County.

While the SWD indicated their preference that Caltech reuse or recycle as much material as possible, the Chief indicated that all deconstruction material, including aluminum, steel, concrete foundation rubble, etc. are eligible to be deposited at the West Hawai‘i Pu‘u Anahulu Landfill. No permit is required to do so. In addition, SWD noted that Caltech should coordinate large deliveries of solid waste with the West Hawaiʻi Puʻu Anahulu Landfill so that personnel could be scheduled to open earlier or close later, as needed.

On February 22, 2018, representatives of Caltech met with the DEM's Recycling Coordinator who indicated that Caltech could, with minimal additional effort, separate and recycle metals (e.g., steel frames, aluminum paneling, copper grounding mesh, etc.). In addition, recycling vendors on the Island may be able to accept and recycle that material, although some may have preconditions associated with accepting them. DEM also suggested that there may be options to recycle and/or reuse concrete rubble resulting from the CSO Decommissioning Project. Based on this feedback, Caltech is currently exploring opportunities to recycle some or all of the material which will accumulate from the deconstruction and removal process.

4.7.1.2 ***<u>Other Waste</u>***

Other wastes consist of (*i*) small quantities of glycol, hydraulic oil, any other remaining liquid, and any other packaged materials (i.e., cleaning products) that remain in the facility, (*ii*) LCP and LBP removed prior to deconstruction, (*iii*) petroleum-impacted soil, if any, associated with historic hydraulic fluid leaks, and (*iv*) residual material within and around the cesspool.

The small quantities of glycol, hydraulic oil, any other liquid materials, and other packaged materials will be removed prior to the start of deconstruction activities by a trained professional (Section 2.1.2.4). These materials and wastes are not hazardous wastes. These materials will be recycled or disposed of in accordance with applicable local, state, and federal regulations prior to deconstruction activities that may disturb them.

LCP and LBP will be removed from painted surfaces prior to deconstruction by trained professionals (Section 2.1.2.4). They will collect all the removed LCP and LBP, conduct a hazardous waste determination according to HAR Chapter 11-261, and dispose of the waste in accordance with applicable local, state, and federal regulations.

Per the Phase II SAP, soil beneath the CSO's concrete slab and material within and around the cesspool will be segregated from other deconstruction waste and assessed (Section 2.1.2.13 and Appendix A). These wastes will be sampled and assessed prior to disposal, but there is no reason to believe that they will be hazardous wastes. Once characterized, these wastes will be disposed of in accordance with applicable local, state, and federal regulations.

4.7.2 POTENTIAL IMPACTS

The No Action Alternative (ALT-1) will produce no solid waste of any kind that would be recycled or disposed in the near term. Once Caltech's sublease had terminated and it was no longer able to access the site, it would result in the CSO materials gradually degrading and eventually becoming waste that others (e.g., Rangers and UH) would have to pick up and dispose of as it blew away or became a hazard. It would likely result in the LCP and LBP continuing to degrade and gradually becoming dust that impacts the area downwind. It would also result in the residual hydraulic oil impacted soil, if any, and the cesspool residue remaining in the subsurface, where it would gradually degrade.

The action alternatives would all result in the removal of all wastes, including the small quantity of wastes that could potentially be hazardous wastes. They will also remove the residual petroleum-impacted soil and other organic wastes (e.g., cesspool residue) to the maximum extent practicable.

While the total quantities of solid waste will vary marginally between alternatives, all of the action alternatives discussed in this EA (ALT-2, ALT-3, and ALT-4) will produce substantial amounts of waste (see Table 4.8). Caltech will work with Hawaiʻi Island-based vendors to see that as much material as possible is reused or recycled. Much of the solid waste will be deposited in the West Hawaiʻi Puʻu Anahulu Landfill, per coordination with the County of Hawaiʻi DEM. However, all of the material is appropriate for disposal at that location and will not substantially affect the public health, involve a substantial degradation of environmental quality, and/or detrimentally affect air or water quality in the Maunakea summit area or the broader region.

Mandatory compliance with existing regulations and requirements and the implementation of the mitigation measures proposed in this section will ensure that the deconstruction and removal of the CSO Observatory will not result in a significant impact due to its solid and hazardous waste management.

4.7.3 Mitigation Measures

The project will comply with all aspects of the CMP as outlined in Section 2.1.2.1 and elsewhere in this document. For example, this will include:

- All construction personnel being educated regarding the environment, ecology, and natural resources in the project area as required by CMP management action C-8.
- Caltech will have experts in the appropriate fields implement LCP/LBP operations and perform the tasks outlined in the HDOH-approved Phase II SAP (attached to the SDP in Appendix A).
    - As outlined in Section 2.1.2.4, items 5 and 6, monitoring will be conducted to assess employee safety and capture methods during the removal of LCP and LBP.
    - The sampling and assessment of the soil and residual material below the cesspool per the Phase II SAP is not required by applicable regulations. It is a mitigation measure that Caltech has incorporated into the proposed project to address community concerns.
- Implement a Best Management Practices Plan that covers a range of topics, including waste management, and incorporates sustainable practices as required by CMP management actions C-2 and C-9 (Appendix I).

4.8 TRAFFIC

During the preliminary planning for the CSO Decommissioning Project, Caltech requested the assistance of Austin, Tsutsumi & Associates, Inc. to better understand, and possibly reduce, potential impacts to area transportation corridors as a result of deconstruction and site restoration operations. The resulting report, *Transportation Management Plan for California Institute of*

Technology Submillimeter Observatory Decommissioning, Mauna Kea, Hawai'i (TMP) (Austin, Tsutsumi & Associates, Inc.; 2019) provides the basis for the information and analysis contained in the following subsections. The complete report is included as Appendix F of this report.

4.8.1 Existing Conditions

Daniel K. Inouye Highway (DKI, Route 200, aka Saddle Road) connects Hilo with central and western portions of the island via the saddle between Maunakea and Mauna Loa. Primary access to the summit region of Maunakea is via Mauna Kea Access Road from its intersection at mile 19.9 of DKI. DKI also provides access to: (*i*) Hilo Solid Waste Recycling and Transfer Station, located approximately 45 miles east of CSO; (*ii*) West Hawai'i Pu'u Anahulu Landfill, located approximately 56 miles west of CSO; (*iii*) Kawaihae Harbor, located approximately 62 miles west of CSO; and (*iv*) Hilo Harbor, located approximately 45 miles east of CSO. Mauna Kea Access Road also provides access to Halepōhaku, where the Visitor Information Station (VIS) and and other facilities are located.

4.8.1.1 ***Roadway Characteristics***

This section provides descriptions of the existing roads that may be impacted by the CSO Decommissioning Project alternatives. The roadway conditions reflect the existing conditions at the time the TMP was prepared (2019).

- Mauna Kea Access Road is generally a north-south, two-way, two-lane undivided road with a posted speed limit of 25 to 40 miles per hour (mph) with steep slopes. This roadway provides access to the summit region of Maunakea and is mostly paved except for a roughly four mile segment above Halepōhaku.
- Daniel K. Inouye Highway (DKI) (aka "Saddle Road") is generally an east-west, two-way, two to four lane undivided, minor arterial with a posted speed limit of 60 mph in the vicinity of its intersection with Mauna Kea Access Road. DKI is a state roadway (Route 200) that begins at the outskirts of Hilo and travels west before terminating at its intersection with Māmalahoa Highway near Waimea.

The following roadways provide access from CSO to the West Hawai'i Pu'u Anahulu Landfill and Kawaihae Harbor:

- Mauna Kea Access Road and DKI (Route 200 – Saddle Road), described above.
- Māmalahoa Highway (Highway 190 – the upper road) is generally a north-south, two-way, two-lane, undivided State roadway between Waimea and Kailua-Kona. Māmalahoa Highway is a minor arterial with a posted speed limit of 55 mph, near the intersection with DKI.
- Waikoloa Road is generally an east-west, two-way, two-lane, undivided roadway that connects Māmalahoa Highway and Queen Kaahumanu Highway. The roadway has a posted speed limit of 35 mph near Waikoloa Village, but the posted limit increases to 45 mph near Queen Kaahumanu Highway and 55 mph near Māmalahoa Highway.
- Queen Ka'ahumanu Highway (Route 19) is generally a north-south, two-way, two-lane, undivided roadway with a posted speed limit of 45 mph, near the intersection with Waikoloa Road. This roadway travels between Kawaihae and Kailua-Kona. West

Hawai‘i Pu‘u Anahulu Landfill is off this highway, just south of the Waikoloa Road intersection.

- ‘Akoni Pule Highway (Route 270) is generally a north-south, two-way, two-lane, undivided roadway with a posted speed limit of 35 mph near Kawaihae Harbor. The roadway travels between Kawaihae and Pololū Valley. Kawaihae Harbor is off this highway, just north of the Queen Ka‘ahumanu Highway intersection.

The following roadways provide access from CSO to Hilo Solid Waste Recycling & Transfer Station and Hilo Harbor:

- Mauna Kea Access Road and DKI (Route 200 – Saddle Road), described above.
- Puainako Street (Route 2000) is generally an east-west, two-way, two-lane, undivided major collector that connects DKI and Māmalahoa Highway (Highway 11) in Hilo. Puainako Street is a state roadway with a posted speed limit of 35 mph and 55 mph east and west of Komohana Street, respectively.
- Māmalahoa Highway (Route 11) is generally a north-south, two-way, two to three-lane, divided principal arterial with a posted speed limit of 35 mph near Leilani Street. This roadway travels between Hilo and Kailua-Kona.
- Leilani Street is generally an east-west, two-way, two-lane, undivided roadway with a posted speed limit of 30 mph. Leilani Street provides access to the Hilo Solid Waste Recycling & Transfer Station.
- Kalaniana‘ole Avenue (Route 19) is generally an east-west, two-way, two-lane, undivided roadway with a posted speed limit of 35 mph, near Hilo Harbor.
- Kūhiō Street (Route 19) is generally a north-south, two-way, two-lane, undivided roadway with a posted speed limit of 25 mph. This roadway provides access to the Port of Hilo.

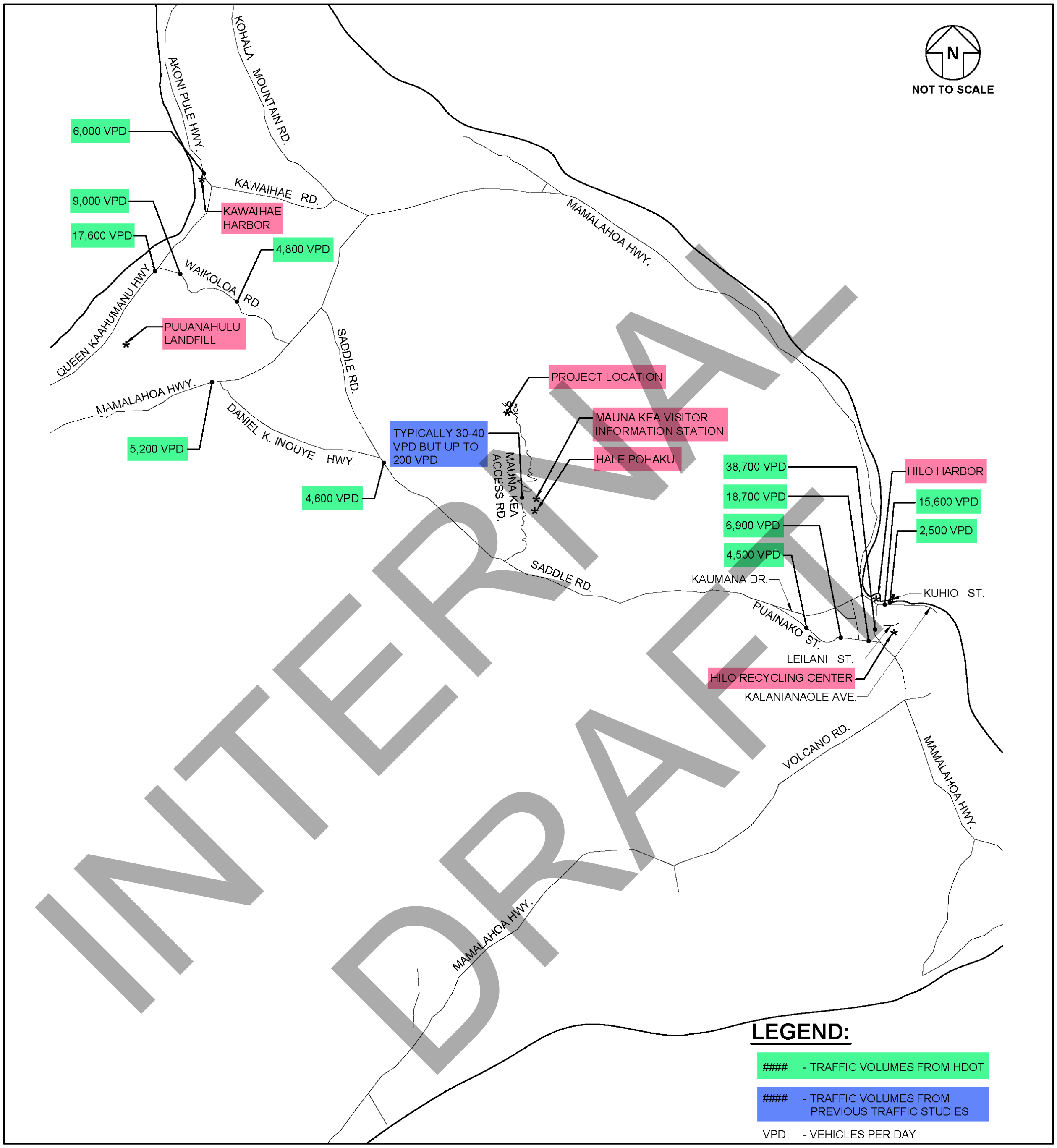
4.8.1.2 ***Existing Traffic***

During preparation of their TMP, Austin, Tsutsumi & Associates, Inc. obtained the latest available data on traffic volumes from the State of Hawai‘i, Department of Transportation (HDOT) and prior traffic studies conducted in the region. Based on their review of available data, there are approximately 30 to 40 vehicles per day (VPD) traveling along Mauna Kea Access Road, but there can be up to 200 VPD on particularly busy days, such as when there is a snowfall on the summit. Table 4.9 summarizes available traffic volume data for affected roadways. Figure 4-23 depicts the locations and volumes identified in Table 4.9.

Table 4.9 Avg. 24-Hour Traffic Volumes for Affected Roadways

Roadway	***Reference Location***	***Avg. 24-Hour Traffic Volume (VPD)***
Mauna Kea Access Road	Above Halepōhaku	30 to 40
Daniel K. Inoue Hwy.	East of Ua Nahele St.	4,500
Daniel K. Inoue Hwy.	East of Māmalahoa Hwy.	4,600
Māmalahoa Hwy.	South of Daniel K. Inoue Hwy.	5,200
Waikoloa Rd.	East of Paniolo Ave.	4,800
Waikoloa Rd.	East of Queen Ka‘ahumanu Hwy.	9,000
Queen Ka‘ahumanu Hwy.	South of Waikoloa Rd.	17,600
‘Akoni Pule Hwy.	North of Kawaihae Rd.	6,000
Puainako St.	West of Komohana St.	6,900
Puainako St.	West of Māmalahoa Hwy.	18,700
Kalaniana‘ole Ave.	East of Māmalahoa Hwy.	15,600
Kūhiō St.	North of Kalaniana‘ole Hwy.	2,500
Source: Austin, Tsutsumi & Associates, Inc., *Transportation Management Plan for California Institute of Technology Submillimeter Observatory Decommissioning, Mauna Kea, Hawai‘i* (2019)		

Figure 4-23 Existing Traffic Volumes



Source: Austin, Tsutsumi & Associates, Inc., *Transportation Management Plan for California Institute of Technology Submillimeter Observatory Decommissioning, Mauna Kea, Hawai'i* (2019)

4.8.2 Potential Impacts

The standard threshold for determining whether an action has a significant impact is 1,000 passenger cars per lane, per hour (PC/PL/PH). The three action alternatives are sufficiently similar in scope and schedule that their traffic impacts would be imperceptibly different. Per the TMP all of the action alternatives are expected to produce 36 construction-related VPD on roads beyond the CSO Site and staging areas. Applying the 1,000 PC/PL/PH standard, there would be no significant impacts to traffic as a result of implementing any of the action alternatives considered in this EA (ALT-2, ALT-3, and ALT-4).

The construction personnel trips will likely occur during the AM and PM peak hours of traffic, while the construction vehicle trips may occur at any time during construction work hours. A work schedule is still in development for the CSO Decommissioning Project, but typical construction work hours are between 7:00 AM and 4:00 PM. Depending on construction crew size, they will either: (*i*) drive individually each day to Halepōhaku and then vanpool to the CSO Site; (*ii*) drive individually each day and park in the Batch Plant staging area; or (*iii*) drive individually each day to a designated site in Hilo or elsewhere, then vanpool to the CSO Site. For the first and second options, Mauna Kea Access Road would experience a higher increase in traffic volume, as all construction-related traffic would travel along this roadway, when compared with the third option. However, regardless of the commute option selected for construction crews, the impact to existing traffic is expected to be minimal.

Peak periods of traffic throughout the day along Mauna Kea Access Road generally align with various activities on the summit, including commercial tours for sunrise viewing, observatory workers commuting to/from in the mornings and afternoons, and both independent and commercial tours for sunset viewing. Assuming all construction-related traffic will travel along Mauna Kea Access Road, traffic would double with the additional construction-related trips, but the total volume would be less than 100 VPD. If all 36 construction-related trips occurred on the busiest days, there would be roughly 230-240 VPD, or 23 to 24 vehicles during the PM peak hour (i.e., 10 percent), which is still considerably less than the 1,000 PC/PL/PH threshold described above. Since the existing volumes on Mauna Kea Access Road are low, the potential increase in construction traffic on that corridor is not anticipated to have more than a minimal impact.

Temporary road closures will be limited to Mauna Kea Access Road during the mobilization and demobilization of the crane and office trailer (see Section 2.1.2). However, the duration of the temporary closures will be very brief and scheduled during off-peak hours; thus, the impact of these short closures is not expected to be more than a minor inconvenience for the few on the road during that brief off-peak period.

Since construction personnel will travel from various origins and construction trips will be split between West Hawai‘i Pu‘u Anahulu Landfill, Hilo Solid Waste Recycling and Transfer Station, Hilo Harbor, and Kawaihae Harbor, the remaining roadways will only serve a portion of the additional construction-related vehicle trips. As a conservative evaluation, if all 36 daily vehicle trips are added to the remaining roadways identified in Table 4.9, the additional construction traffic would account for less than one percent of the average daily volume for each roadway. Thus, the increase in construction traffic would not have a significant impact on traffic.

The No Action Alternative (ALT-1) would produce no additional traffic of any kind.

4.8.3 Mitigation Measures

The project will comply with all aspects of the CMP as outlined in Section 2.1.2.1 and elsewhere in this document. For example, the BMP Plan (Appendix I) will include:

- A number of work area strategies to mitigate potential impacts to area traffic flow in the summit region as a result of the CSO Decommissioning Project. They include employing as appropriate: (*i*) temporary signage; (*ii*) changeable message boards; (*iii*) channelizing devices; (*iv*) flaggers and uniformed traffic control officers; (*v*) barricades; (*vi*) portable barriers; and (*vii*) escort vehicles.
- The construction manager or designee responsible for discharging the terms of the TMP will monitor all phases of construction work and shall document any problems, issues, or recommendations for remediation and for use by future decommissioning projects.
- Ride-sharing and/or vanpooling by workers, when appropriate, to and from the summit region.

In addition, should MKSS find that additional road maintenance is necessary due to CSO decommissioning activities, Caltech would reimburse CMS for additional road maintenance costs incurred.

4.9 NOISE

4.9.1 CONTEXT

Hawaiʻi Administrative Rules, Title 11, Chapter 46, Section 4 (HAR §11-46-4) defines the maximum permissible community sound levels in dBA. These differ according to the kind of land uses that are involved, as defined by zoning district, and time of day (i.e., daytime or nighttime). These limits are shown in Table 4.10. Definitions of two technical terms used in this discussion are as follows:

- *A-Weighted Sound Level (dBA)*. The sound level, in decibels, read from a standard sound-level meter using the "A-weighted network." The human ear is not equally sensitive in all octave bands. The A-weighted network discriminates against the lower frequencies according to a relationship approximating the auditory sensitivity of the human ear.
- *Decibel (dB)*. This is the unit that is used to measure the volume of a sound. The decibel scale is logarithmic, which means that the combined sound level of ten sources, each producing 70 dB will be 80 dB, not 700 dB. It also means that reducing the sound level from 100 dB to 97 dB requires a 50 percent reduction in the sound energy, not a 3 percent reduction. Perceptually, a source that is 10 dB louder than another source sounds about twice as loud. Most people find it difficult to perceive a change of less than 3 dB.

The maximum permissible sound levels specified in HAR §11-36-4(b) apply to any excessive noise source emanating from within the specified zoning district. They are measured at or beyond the property line of the premises from which the noise emanates. Mobile noise sources, such as construction equipment or motor vehicles are not required to meet the 70 dBA noise limit. Instead, construction noise levels above these limits are regulated using a curfew system whereby noisy construction activities are not permitted during nighttime periods, on Sundays, and on holidays, unless the project obtained a "noise variance."

Table 4.10 Hawai‘i Administrative Rules §11-46 Noise Limits

Zoning District	***Noise Limit (in dBA)***	
	Daytime (7:00 a.m. to 10:00 p.m.)	***Nighttime (10:00 p.m. to 7:00 a.m.)***
Class A: Areas equivalent to lands zoned residential, conservation, preservation, public space, open space, or similar type.	55	45
Class B: All areas equivalent to lands zoned for multi-family dwellings, apartment, business, commercial, hotel, resort, or similar type.	60	50
Class C: All areas equivalent to lands zoned agriculture, country, industrial, or similar type.	70	70

Source: Hawai‘i Administrative Rules §11-46 *Community Noise Control*

Pursuant to HAR 11-46-3, areas such as the CSO Site that is within the State Conservation District is in Class A, the most restrictive for the purposes of noise limits. A maximum L_{10} noise level of 55 dBA during daytime hours (7:00 a.m. to 10:00 p.m.) and 45 dBA during nighttime hours (10:00 p.m. to 7:00 a.m.) is allowed, as measured from the property lines of a parcel in a Class A District (i.e., the MKSR parcel boundary).[10] Noise levels from stationary sources are not to exceed the maximum permissible L_{10} levels within any twenty-minute period, except by permit or variance.

4.9.2 Existing Conditions

Noise sensitive sites near the CSO Site are limited to areas where outdoor use is common in the MKSR. The summit region of Maunakea is removed from urban areas and generally experiences low ambient noise levels. No one resides in the summit region and the scientists and staff that visit the summit region will retire to the Halepōhaku dormitories or other lower elevation locations, while other visitors leave the summit after sunset and prior to nightfall. The primary activities on the summit of Maunakea which produce noise above the natural background level include:

- *Vehicular Travel*. Traffic is discussed in Section 4.8. The existing astronomy facilities generate, on average, approximately 36 vehicle trips a day, and there are approximately additional 52 vehicle trips a day related to visitors, rangers, etc.
- *Observatory Operations*. Observatories are generally quiet facilities with all operations occurring indoors during the day. Most of the existing observatories utilize heating, ventilation, and cooling (HVAC) systems to keep the interior of the observatory domes in equilibrium with the outside temperature when they open in the evening. The HVAC systems and/or their exhaust vents are the primary sources of noise at the observatories.
- *Construction Operations*. Periodically, construction operations occur in the summit region. Most are related with observatory upgrades and improvements. Roadway work is another source of construction noise.

Other potential contributors to noise levels on the summit of Maunakea are: (*i*) the Army’s Pōhakuloa Training Area; (*ii*) Bradshaw Army Airfield; and (*iii*) local and regional air traffic. However, nothing has been documented in literature indicating that military-related noise is an

[10] L_{10} is the noise level exceeded for 10 percent of the time of the measurement duration. This is often used to give an indication of the upper limit of fluctuating noise, such as that from road traffic and takes account of any peaks in noise.

issue within the MKSR. While no noise study was conducted during the planning of this project, based on measurements made for nearby projects, ambient noise levels during regular trade wind weather is probably near 55 dBA. Noise levels during periods of calm winds and no traffic are probably less than 45 dBA.

4.9.3 Potential Impacts

Audible construction noise, while intermittent and temporary, will be an unavoidable result of deconstruction, removal, and site restoration activities under all of the action alternatives considered in this report (ALT-2, ALT-3, and ALT-4). Deconstruction, excavation, transport and other activities will also entail the use of heavy equipment including a crane, lift, heavy trucks with backup alarms, and excavators (e.g., backhoes which generate up to 84 dBA at a distance of 50 feet) to dig and fill the trenches necessary during removal operations. As depicted in Table 4.11, some of this equipment is inherently noisy. Because the nearest places where non-construction personnel work or congregate are hundreds of feet away, the most noticeable sources of construction noise to them are likely to be related to transport of equipment, material, and personnel along Mauna Kea Access Road.

Due to the location of the CSO Site, well removed from the MKSR boundaries, construction noise will not exceed 55 dBA at the property line. Caltech does not anticipate the need for a Construction Noise Permit. Caltech does not anticipate the need for a Noise Variance because decommissioning work will take place during normal work hours.

The No Action Alternative (ALT-1) will produce no additional noise of any kind.

Table 4.11 Construction Equipment Noise Emissions Levels

Equipment	*Typical Noise Levels (dBA) 50 ft., U.S. Dept. of Trans. Study (1979)*	*Average Noise Level (dBA) 50 ft., CA/T Project Study (1994)*	*Typical Noise Level (dBA) 50 ft., U.S. Dept. of Trans. Study (1995)*	*Lmax Noise (dBA) 50 ft., CA/T Project Spec. 721.560*
Air Compressor	--	85	81	80
Backhoe	84	83	80	80
Chain Saw	--	--	--	85
Compactor	82	--	82	80
Compressor	82	--	82	80
Concrete Truck	--	81	--	85
Concrete Mixer	--	--	85	85
Concrete Pump	--	--	85	85
Concrete Vibrator	--	--	76	80
Crane, Derrick	86	87	88	85
Crane, Mobile	--	87	83	85
Dozer	88	84	85	85
Drill Rig	--	88	--	85
Dump Truck	--	84	--	84
Excavator	--	--	--	85
Generator	84	78	81	82
Gradall	--	86	--	85
Hoe Ram	--	85	--	90
Impact Wrench	--	--	85	85
Jackhammer1	--	89	88	85
Loader	87	86	85	80
Paver	80	--	89	85
Pile Driver, Impact	--	101	101	95
Pile Driver, Sonic	--	--	96	95
Pump	80	--	85	77
Rock Drill	--	--	98	85
Roller	--	--	74	80
Scraper	89	--	89	85
Slurry Machine	--	91	--	82
Slurry Plant	--	--	--	78
Truck	89	85	88	84
Vacuum Excavator	--	--	--	85

Note 1: There are 82 dBA at 7-meter rated jackhammers (90 lbs. class) available. This would be equivalent to 74 dBA at 50 ft. These are silenced with molded intricate muffler tools.

Source: http://ops.fhwa.dot.gov/wz/workshops/accessible/Schexnayder_paper.htm

4.9.4 MITIGATION MEASURES

The project will comply with all aspects of the CMP as outlined in Section 2.1.2.1 and elsewhere in this document. For example, this will include:

- All construction personnel being educated regarding the environment, ecology, and natural resources in the project area as required by CMP management action C-8.

- Implement a Best Management Practices Plan that covers a range of topics and incorporates sustainable practices as required by CMP management actions C-2 and C-9, including practices associated with noise directly or indirectly:
  - The total number of vehicle trips for workers, and thus the noise related to vehicular travel, will be minimized via ride-sharing and/or vanpooling, when appropriate.
  - Exterior gas- or diesel-powered generators will be properly maintained and only be used when needed.

4.10 AIR QUALITY

4.10.1 Existing Conditions

Pursuant to the Clean Air Act (CAA), which is the primary federal law governing air quality, the EPA has established National Ambient Air Quality Standards (NAAQS) for six designated criteria air pollutants: (*i*) ozone (O_3), (*ii*) particulate matter (PM_{10} and $PM_{2.5}$), (*iii*) carbon monoxide (CO), (*iv*) nitrogen dioxide (NO_2), (*v*) sulfur dioxide (SO_2), and (*vi*) lead (Pb). These standards establish the maximum safe concentrations of pollution considered to be acceptable, with an adequate margin of safety, to protect the public health and welfare. In accordance with the CAA, Section 176(c)(1), federal agencies are required to ensure that their undertakings conform to applicable implementation standards for achieving and maintaining NAAQS.

As required by the CAA, each state is required to provide a framework for regulating air quality and to develop plans to maintain and attain the NAAQS. The HDOH Clean Air Branch (CAB) has adopted State Ambient Air Quality Standards (SAAQS) that apply within the State of Hawai‘i, which in some cases are more stringent than national standards. The proposed CSO Decommissioning Project is in the County of Hawai‘i and is under the jurisdiction of the CAB. Under the provisions of the CAA, the County of Hawai‘i is classified as being in attainment with regard to all NAAQS.

Air quality is an important factor for astronomy facilities, as unique visibility conditions are required for astronomical observations. Although many studies have been performed to evaluate astronomical observing conditions, traditional air quality monitoring of the six criteria pollutants noted above has not been actively undertaken in the summit region of Maunakea. However, air quality monitoring has been performed at the Mauna Loa Observatory at an elevation of approximately 11,140 feet MSL since its construction in 1956. This monitoring station provides data most representative of conditions on Maunakea. The data gathered at this station indicate that the air quality at the Mauna Loa Observatory is excellent and well within attainment for both NAAQS and SAAQS. Given the similarities between the two locations (Maunakea and Maunaloa), it may be inferred that overall air quality at the CSO Site is excellent as well.

Maunakea rises well above the atmospheric temperature inversions that occur at approximately 7,000 feet MSL. Particulates and aerosols like vog (volcanic gas), smog, dust, smoke, salt, and water vapor generated below the inversion level are “capped” by the temperature inversion, so they do not rise above the inversion layer and do not cause any interference with observatories on the summit. Periodically, anabatic winds can come up the slopes of Maunakea, penetrating the inversion layer, and bringing with them insects and relatively small volumes of air from lower elevations.[11] Locally generated contributors to air pollution above the inversion level include vehicle exhaust, chemical fumes from construction and maintenance activities, and fugitive dust from various sources, including vehicles traveling on unpaved surfaces, road grading, and construction or other activities conducted in unpaved areas. Rapid dispersion of pollutants is aided by strong winds in the summit region.

4.10.2 Potential Impacts

Under all of the action alternatives (ALT-2, ALT-3, and ALT-4) considered in this report, potential air quality effects will be short-term, construction related, and less than significant. During the deconstruction, removal, and site restoration process (see Section 2.1.2), the heavy construction equipment that will be used for implementation of the CSO Decommissioning Project (e.g., bulldozers, tractor trailers, excavators, etc.) will be powered by internal combustion engines that emit a variety of air pollutants. Construction equipment emissions result from the following sources and activities: (*i*) construction equipment engine exhaust; (*ii*) motor vehicle exhaust, brake, and tire wear; (*iii*) entrained dust from material delivery trucks; (*iv*) entrained dust from roadways; (*v*) entrained dust from construction worker vehicles; (*vi*) fugitive dust from bulldozing, grading, and scraping, and from the handling of excavated material, such as depositing excavated fill into haul trucks; and (*vii*) fugitive dust from wind erosion of disturbed areas.

This equipment, powered by internal combustion engines, will emit a variety of air pollutants, all in small quantities and over a relatively limited period of time (i.e., several months). None of these equipment emissions will add substantively to the existing area sources of these pollutants, which consists principally of vehicles traveling along Mauna Kea Access Road. As a result, combustion emissions such as NO_X and diesel particulate matter from this equipment are not expected to have a significant effect on local or regional air quality.

Soil disturbance during deconstruction, removal, and site restoration activities will also have temporary effect on air quality, which may be more noticeable than emissions from engines. Activities such as the removal of the cesspool and copper grounding mesh will require disturbance of soil and generate fugitive dust, as will hauling excess fill from the CSO Site to the Batch Plant stockpiling area. Caltech will implement BMPs that reduce dust generation so that impacts to air quality, habitat, and astronomical facilities is negligible and less than significant. The potential for fugitive dust will continue until ground-disturbing activities are complete; once site restoration is complete no further potential for air quality impacts, however modest, exists.

The No Action Alternative does not have the potential to cause any impacts to local or regional air quality.

4.10.3 Mitigation Measures

The project will comply with all aspects of the CMP as outlined in Section 2.1.2.1 and elsewhere in this document. For example, this will include:

- All construction personnel being educated regarding the environment, ecology, and natural resources in the project area as required by CMP management action C-8.

[11] Anabatic winds are winds that blow up a steep slope or mountainside, driven by heating of the slope, typically during the daytime in calm, sunny weather.

- Implement a Best Management Practices Plan that covers a range of topics and incorporates sustainable practices as required by CMP management actions C-2 and C-9, including practices associated with air quality directly or indirectly, including, but not limited to:
  - Require all vehicles and motorized equipment to be maintained in good working condition.
  - The total number of vehicle trips for workers, and thus the emissions related to vehicular travel, will be minimized via ride-sharing and/or vanpooling, when appropriate.
  - Exterior gas- or diesel-powered generators will only be used when needed.

4.11 NATURAL HAZARDS

4.11.1 EXISTING CONDITIONS

4.11.1.1 ***Fire***

The Hawai‘i County Fire Department is the primary agency responsible for the delivery of a variety of emergency services for the County of Hawai‘i. Services include fire suppression, emergency medical services (EMS), land and sea rescues, vehicular and other extractions and hazardous materials mitigation. The county is divided into two battalion areas, East and West, with one Assistant Fire Chief for each battalion area.

There are 20 County fire stations and two Federal fire stations (Hawai‘i Volcanoes National Park and PTA). PTA has a Mutual and Automatic Aid Agreement with the County of Hawai‘i and provides first response to 911 calls for all fires, traffic accidents and other emergencies in its vicinity, including at a minimum, the area from Saddle Road Mile Post 17 to 46 and the summits of Maunakea and Mauna Loa.

4.11.1.2 ***Earthquakes and Geological Hazards***

The potential for renewed volcanic activity in the Maunakea summit region is extremely remote. Maunakea last erupted approximately 4,600 years ago, and the volcano is classified as dormant, but not extinct. In 1997, Wolfe and others mapped a dozen separate post-glacial (i.e., less than 10,000 years ago) eruptive vents on Maunakea’s middle flanks, but none younger than 40,000 years old were found in the summit area. These findings support the theory that future eruptions will likely occur well below the summit and will not pose any threat to the CSO Site.

The most significant geologic hazard is seismic activity. Hawai‘i Island is one of the most seismically active areas on Earth, and about two dozen earthquakes with a magnitude 6 or greater have been documented on Hawai‘i since the devastating earthquakes of 1868; those that caused damage are listed in Table 4.12. The approximate epicenter of those earthquakes and the predicted Modified Mercalli Intensity Scale (MMIS) seismic intensities are shown as well. In 2006, a VII intensity earthquake on the MMIS caused minor damage to the Keck, Subaru, UH 2.2m, and the Canada-France-Hawai‘i Telescope (CFHT) astronomical facilities. Some auxiliary equipment was damaged, but the telescopes’ mirrors and overall facility structural integrity were not affected.

The summit of Maunakea will remain susceptible to seismic disturbance with intensities up to VII on the MMIS.

Table 4.12 Summary of Damaging Earthquakes on Hawai‘i Island

Date	*Epicenter Location*	*Max. MMIS*	*Mag.*	*Deaths*	*Damage*	*Repair Cost*
3/28/1868	South Hawai‘i	IX	7.0	0	Extensive throughout South Hawai‘i	Unknown
4/2/1868	South Hawai‘i	XII	7.9	81	>Homes destroyed by tsunami	Unknown
10/05/1929	Hualālai	VIII	6.5	0	Extensive in Kona	Unknown
8/21/1951	Kona	VIII	6.9	0	Extensive in Kona	Unknown
4/26/1973	North of Hilo	VIII	6.2	0	Extensive in Hilo	$5.6M
11/29/1975	Kalapana	VIII	7.2	2	Extensive in Hilo	$4.1M
11/16/1983	Ka‘oiki	IX	6.7	0	Extensive throughout South Hawai‘i	>$6M
6/25/1989	Kalapana	VII	6.2	0	Southeast Hawai‘i	$1M
10/15/2006	Kīholo Bay	VIII	6.0-6.7	0	Northwest Hawai‘i	>$100M
5/4/2018	East Rift Zone	VIII	6.9	0	Moderate damage	Unknown

Source: USGS (2019)

More recently, on Friday, May 4, 2018, a magnitude 6.9 earthquake occurred with an epicenter near Fern Acres in Pāhoa on the east side of the island. This quake, associated with the eruption of Kīlauea Volcano, caused moderate damage. Hawai‘i Electric Light Co., Inc. estimated that this quake temporarily knocked out electrical service to approximately 14,000 customers.

4.11.1.3 ***Flood Hazards and Tsunami Inundation***

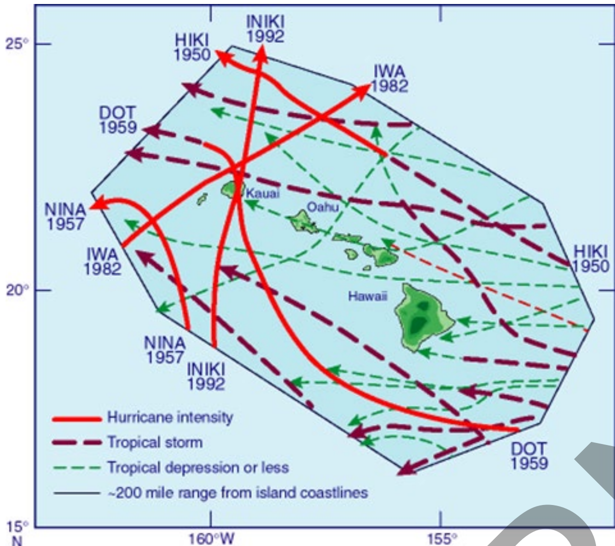
The Federal Emergency Management Area has designated the entire Maunakea summit region as being in Flood Zone X. This designation corresponds to areas that are subject to flooding from a potential 500-year flood or from a 100-year flood with flood levels of less than one foot. Areas designated as Zone X are outside of the 0.2 percent annual chance floodplain; because these areas are considered to have very low potential for flooding, no base flood elevations have been determined. There is no record of any flood occurring at or near the CSO Site.

The CSO Site is not located within a designated Flood Hazard Safety Area nor is it within a Tsunami Evacuation area (Pacific Disaster Center, 2018).

4.11.1.4 ***Hurricanes and Tropical Storms***

While many hurricanes have passed near Hawai‘i Island during the last 50 years, none have directly affected the Island of Hawai‘i (Figure 4-24). However, on Friday, August 8, 2014, Tropical Storm Iselle landed on the eastern side of Hawai‘i Island. It was the strongest tropical system to make landfall on the island since reliable records began in 1950. The storm made landfall just prior to 3:00 AM HST with sustained winds near 60 mph and higher gusts. A gust of 66 mph was observed at Volcano National Park, and a gust to 72 mph occurred as far away as O‘ahu Forest National Wildlife Reserve (AccuWeather, 2014). Another tropical storm in 1958 reached sustained speeds of 35 mph with gusts of 52 mph near Hilo. In other areas of the island, as judged by damage, winds reached sustained speeds of at least 58 mph with gusts of 86 mph or more (CPHC, 2013).

Figure 4-24 Hurricane Tracks, 1950 to 2012



Source: UH School of Ocean and Earth Science and Technology (2014)

4.11.1.5 ***Climate Change and Sea Level Rise***

The global community of climate scientists has concluded that sea levels are currently rising and that this trend is expected to continue for the foreseeable future. The Intergovernmental Panel on Climate Change (IPCC) has predicted (Church et al., 2013; IPCC, 2013) that the average temperature in the Hawaiian Islands is likely to increase by 0.5 to 1.5 C (0.9-1.7 F) by 2100, rainfall is likely to decrease by, at most 10 percent, and sea level could rise between 0.26 and 0.98 m (0.85 to 3.2 feet).

4.11.2 POTENTIAL IMPACTS

4.11.2.1 ***Potential Impacts from Fire***

As discussed in Section 2.1.2.3, fire and fire prevention has been a focus of Caltech from the project's inception. As part of the early planning and scoping for the proposed CSO Decommissioning Project, a meeting was held between Caltech representatives and Chief Darren Rosario, Deputy Chief Lance Uchida, Battalion Chief Robert Perreira of the HCFD to discuss fire and fire-response related issues associated with the project. The HCFD has indicated that during construction Caltech and its contractors may stage trailers to sort and deposit aluminum, steel, and deconstruction waste on-site. Caltech anticipates using roll-off trailers or similar containers, brought to the site, and stationed there during deconstruction. The contractor will be responsible for sorting and depositing construction waste in the appropriate on-site container. HCFD has also stated that:

- Up to four locations may be designated on-site for deconstruction material sorting and collection, and that up to three roll-off trailers may be used, as appropriate, at any time during deconstruction.

- A truck may deliver an empty roll-off container up to a designated open location and haul away the full container while still complying with the total limit of three roll-off containers noted above.
- Recyclable material and deconstruction waste will be properly separated at all times during the deconstruction process.

Caltech and its contractors will also comply with these stipulations along with all applicable standards and procedures of the NFPA's Uniform Fire Code (2006) and, specifically, *Code 241 Standards for Safeguarding Construction, Alteration, and Demolition Operations*. Per that guidance, Caltech or its contractors will develop, maintain, and keep on-site a written fire prevention, fire suppression, and emergency evacuation plan. In addition, Caltech and its contractors will continue to coordinate, as necessary, with HCFD throughout implementation of the CSO Decommissioning Project. With these measures in place, no significant impacts related to fire are anticipated as a result of any of the action alternatives evaluated in this report.

The No Action Alternative does not have the potential to cause impacts related to fire.

4.11.2.2 ***<u>Potential Impacts from Earthquakes and Geological Hazards</u>***

Because CSO Decommissioning Project will not create any new structures or infrastructure, it is not susceptible to damage by seismic activity and will not increase the seismic vulnerability of the CSO Site or adjacent areas.

The No Action Alternative does not have the potential to have any effect on the seismic vulnerability of the CSO Site or adjacent areas.

4.11.2.3 ***<u>Potential Impacts from Flood Hazards and Tsunami Inundation</u>***

The CSO Site is not located in an area with any history of flooding or tsunami inundation and the action alternatives under consideration for the CSO Decommissioning Project will not increase vulnerability of the area to these hazards in any way.

The No Action Alternative does not have the potential to cause or increase the vulnerability of the CSO Site or adjacent areas to flooding or tsunami inundation.

4.11.2.4 ***<u>Potential Impacts from Hurricanes and Tropical Storms</u>***

The CSO Decommissioning Project will not create any buildings or aboveground structures which could be vulnerable to hurricane-force winds. Thus, the likelihood of impacts to the CSO Decommissioning Project from such storms is very low. In the event that a hurricane or tropical storm does occur during the roughly six month deconstruction and restoration effort, all work will cease and workers will vacate the summit region, secure equipment and materials left on site, and remove any vulnerable equipment and/or material prior to the storm.

The No Action Alternative does not have the potential to cause or increase the vulnerability of the CSO Site or adjacent areas due to hurricanes or tropical storms.

4.11.2.5 ***<u>Potential Impacts from Climate Change and Sea Level Rise</u>***

The small predicted temperature change and modest decrease in rainfall would not significantly affect the CSO Decommissioning Project. Because the CSO site is located on the summit of Maunakea, well above sea level, a rise in average sea level of even 3.2 feet (1 m) would not affect any of the action alternatives.

The No Action Alternative does not have the potential to affect the climate, regional microclimate, or to contribute to climate change or sea level rise.

4.11.3 Mitigation Measures

The project will comply with all aspects of the CMP as outlined in Section 2.1.2.1 and elsewhere in this document. For example, this will include:

- All construction personnel being educated regarding the environment, ecology, and natural resources in the project area as required by CMP management action C-8.
- Require all vehicles and motorized equipment to be maintained in good working condition.
- Caltech will prepare and abide by the terms of a fire prevention, suppression, and emergency evacuation plan in coordination with HCFD.
- Implement a Best Management Practices Plan that covers a range of topics and incorporates sustainable practices as required by CMP management actions C-2 and C-9.

4.12 PUBLIC SERVICES

4.12.1 Existing Conditions

4.12.1.1 ***<u>Hawai‘i County Police Department</u>***

The Hawai‘i County Police Department (HCPD) is the designated law enforcement agency for the Island of Hawai‘i. Its operations are separated into two areas of the island. Area I covers the eastern side of the island and includes the districts of: (*i*) Hāmākua, (*ii*) North Hilo, (*iii*) South Hilo, and (*iv*) Puna. It is home to the HCPD headquarters and four stations. Area II covers West Hawai‘i, and includes the districts of: (*i*) North Kohala, (*ii*) South Kohala, (*iii*) Kona, and (*iv*) Ka‘ū, with five stations across these districts. Each of the two areas is run by a Commander, and each district in the County is headed by a police captain. The most recent data presented *County of Hawai‘i Data Book*, is for the year 2015, and lists the per capita ratio of resident population to police officers at 328 to 1; there is no further breakdown by district.[12]

[12] This ratio is extrapolated from information contained in the *2015 County of Hawai‘i Data Book*, which identified the population of the County at 196,428 and the number of HCPD officers as 599.

4.12.1.2 ***Hawaiʻi County Fire Department***

As noted in Section 4.11.1.1, HCFD is the primary agency responsible for the delivery of a variety of emergency services, including responding to fires, EMS, land and sea rescues, vehicular extractions, and hazardous materials mitigation for the County of Hawaiʻi. The County is divided into two battalion areas, East and West, with one Assistant Fire Chief in charge of each battalion area. There are twenty fulltime fire and medical stations and twenty volunteer fire stations, with over sixty pieces of heavy equipment available for a variety of emergencies that may occur on the island.

4.12.1.3 ***Schools***

There are approximately 42 public, 12 charter, and 19 private schools located around the island; some serve grades kindergarten through 12^{th} (K-12) grade, while others serve only certain grade levels. For the 2014-2015 academic year, total combined public and private enrollment for all grades K-12 was 30,046 students.

4.12.1.4 ***Recreational Facilities***

There are various recreational facilities sponsored by the County of Hawaiʻi on the island, including parks, pools, community- and senior-centers. Public school facilities are also available to the community as recreational facilities when school is not in session.

4.12.1.5 ***Medical Services***

There are five major medical facilities on the Island of Hawaiʻi: (*i*) Kohala Hospital, (*ii*) Hale Hoʻola Hāmākua, (*iii*) Kona Community Hospital, (*iv*) Kaʻū Hospital, and (*v*) Hilo Medical Center. These facilities offer varying services and levels of care, but all offer 24-hour EMS.

4.12.2 POTENTIAL IMPACTS

None of the action alternatives in this EA will create conditions which would impose additional pressure on HCFD, HCPD, area schools, recreational facilities, or medical services.

The No Action Alternative does not have the potential to affect any public services in any way.

4.12.3 MITIGATION MEASURES

The project will comply with all aspects of the CMP as outlined in Section 2.1.2.1 and elsewhere in this document. For example, this will include:

- All construction personnel being educated regarding the environment, ecology, and natural resources in the project area as required by CMP management action C-8.
- Caltech will prepare and abide by the terms of a fire prevention, suppression, and emergency evacuation plan in coordination with HCFD (see Section 4.11.2.1).
- Comply with NFPA's *Code 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations*.

- Implement a Best Management Practices Plan that covers a range of topics and incorporates sustainable practices as required by CMP management actions C-2 and C-9.

4.13 CUMULATIVE IMPACTS

During the preliminary planning process, Caltech has evaluated whether the CSO Decommissioning Project, while individually limited in scope, might contribute to significant impacts on the natural or human environment when considered cumulatively along with other projects in the Maunakea summit region. A cumulative impact is an impact on the environment which results from the incremental impact of a proposed action when added to other past, present and reasonably foreseeable future actions, regardless of what agency or person undertakes such other actions. A cumulative impact occurs when the incremental environmental effects of the Project added to other past, present, and reasonably foreseeable future actions result in substantial significant impacts.

Cumulative impacts in the Maunakea summit region have been summarized in numerous environmental disclosure documents in the past, most recently the EIS for the TMT project in 2010. This EA accepts the findings of the analysis documented in that EIS and assesses the effects of the CSO Decommissioning Project and the effects of other foreseeable action in the summit region. The other foreseeable actions in the summit region are:

- The decommissioning of the Hōkū Keʻa astronomy facility, which is foreseeable because UH Hilo submitted a NOI to OMKM on September 16, 2015. The NOI states that "UH Hilo intends to deconstruct and remove the telescope and observatory structure and restore the site. The deconstruction, removal, and restoration activities will be conducted pursuant to the Site Deconstruction and Removal Plan and a Site Restoration Plan, both of which will be developed and implemented in accordance with the Decommissioning Plan. Use of the site for astronomy purposes will be permanently ended; no astronomy re-use is contemplated." Caltech has no further information regarding this foreseeable action. The decommissioning process and effort is likely to be very similar to that employed to decommission CSO (both are complying with the Decommissioning Plan); therefore, Caltech assumes the direct impacts associated with this project will be similar to those document in the sections above.

- The installation of a Chlorine Oxide (ClO) monitor at a facility in the summit region. This is foreseeable because a ClO monitor is located in the CSO outbuilding, which will be removed by the proposed action, and the ClO monitor operator, the Naval Research Laboratory, has indicated that they will seek a new location for the ClO monitoring instrument in the Maunakea summit region. Caltech understands that a new ClO monitoring instrument will be installed within an existing facility and will require very little, if any, modifications to the facility that would be visible from its exterior. Based on that understanding, Caltech anticipates that direct impacts associated with this effort, if any, will be nominal.

- The storage of safety supplies and the regular parking of a vehicle at a facility other than the CSO is also foreseeable. Safety supplies utilized by the Rangers have historically been stored in the CSO's outbuilding; with the removal of that building as part of the proposed action, those supplies will have to be stored in another location in the summit region. In addition, a vehicle designated for emergency egress of injured, sick, or stranded people from the summit region has historically been parked at the CSO facility; with the decommissioning of the CSO facility, that vehicle will be parked outside another facility in the future. Caltech understands that space within an existing facility will be found for the storage of the safety supplies and that no modifications to the facility would be necessary. Caltech further understands that the vehicle will be parked within an existing parking area of an existing facility so that no new disturbance in the summit region is needed to accommodate this vehicle. Based on that understanding, Caltech anticipates that direct impacts associated with these adjustments, if any, will be nominal.

Although the TMT project has not been constructed, it is not treated as a foreseeable action in this analysis because that project's effects are accounted for in the EIS that this section uses as its starting point. The level of existing cumulative impact disclosed in this EA treats the TMT project as a past project, along with the development of access roads, trails, utilities, and the other astronomical facilities, including CSO.

The TMT EIS cumulative impact analysis concluded that:

- The existing level of cumulative impact to cultural, historic, biological, visual, and geologic resources is substantial, significant, and adverse.
- The existing level of cumulative impact to socioeconomic conditions and public services is substantial and beneficial.
- The existing level of cumulative impact to other resources is not substantial and is less than significant.

Cumulative effects may arise from single or multiple actions and may result in additive or interactive effects. Interactive effects may be countervailing, where the negative cumulative effect is less than the sum of the individual effects, or synergistic, where the net negative cumulative effect is greater than the sum of the individual effects. The following subsections consider whether the effects of the foreseeable projects list above, when considered together with the CSO Decommissioning Project, may result in significant cumulative impacts to area resources.

4.13.1 Archaeological Resources

As disclosed in the TMT EIS, the past actions in the summit region have resulted in a level of cumulative impact on archaeological and historic resources that is considered substantial, significant, and adverse.

Under any of the action alternatives considered in this report (ALT-2, ALT-3, and ALT-4), the removal of the CSO is anticipated to have beneficial effects on nearby archaeological and historic resources (Section 4.1.4). The decommissioning of the Hōkū Keʻa facility is expected to have similar, if not greater, beneficial effects because it will remove a non-contributing feature from the historic district that is visible from a greater number of contributing features than the CSO. Furthermore, it is located on the TCP Kūkahauʻula; that resource would directly benefit from its decommissioning. The other foreseeable actions are not anticipated to result in any effects on archaeological resources.

As such, the implementation of the proposed action and other foreseeable actions, in the context of the existing environment, would have a limited beneficial effect; however, the level of cumulative impact on archaeological and historic resources would continue to be substantial, significant, and adverse.

4.13.2 Cultural Resources

As disclosed in the TMT EIS, the past actions in the summit region have resulted in a level of cumulative impact on cultural resources that is considered substantial, significant, and adverse.

Under any of the action alternatives considered in this report (ALT-2, ALT-3, and ALT-4), the removal of the CSO is anticipated to have varying degrees of beneficial effects on nearby cultural resources and Maunakea's cultural landscape (Section 4.2.4). The decommissioning of the Hōkū Ke'a facility is expected to have similar, if not greater, beneficial effects because it will remove a facility situated on the TCP Kūkahau'ula. The other foreseeable actions are not anticipated to result in any effects on cultural resources.

As such, the implementation of the proposed action and other foreseeable actions would have a limited beneficial effect; however, the level of cumulative impact on cultural resources would continue to be substantial, significant, and adverse.

4.13.3 Biological Resources

The TMT EIS concluded that, based on the information available at the time it was prepared in 2010, it was not possible to determine the magnitude or significance of past human activity on wekiu bugs or other biological resources that inhabit the alpine stone desert ecosystem. The wēkiu bug was a candidate for listing as a threatened or endangered species at the time the TMT EIS was prepared. It is possible that a significance determination was not made because it was not known if the species would be listed, or not.

Since the TMT EIS was completed, the Department of Interior's U.S. Fish and Wildlife Service determined that the wēkiu bug would not be listed as threatened or endangered.

The proposed action's effect on biological resources and habitat are, under all of the action alternatives (ALT-2, ALT-3, and ALT-4), anticipated to be beneficial (Section 4.3.3). The decommissioning of the Hōkū Ke'a facility is expected to have similar beneficial effects because, although it would restore a smaller area than the proposed action, the restored area may be utilized by wēkiu bugs. The other foreseeable actions are not anticipated to result in any effects on biological resources.

The limited beneficial effect of implementing of the proposed action and other foreseeable actions in the context of the existing environment combined with the knowledge that wēkiu bugs (and other species that depend on the alpine stone desert habitat) are not listed as threatened or endangered species has led Caltech to determine that the level of cumulative impact on the alpine stone desert ecosystem is and would continue to be adverse, but less than significant.

4.13.4 Visual and Aesthetic Resources

As disclosed in the TMT EIS, the past actions in the summit region have resulted in a level of cumulative impact on visual resources that is considered substantial, significant, and adverse.

Implementing any of the action alternative considered (ALT-2, ALT-3, or ALT-4), will result in the removal of all aboveground structures from the CSO Site and a beneficial impact on the viewshed of the surrounding areas (Section 4.4.2). While effects to visual resources are, to some extent, subjective, the decommissioning of the Hōkū Keʻa facility is expected to have similar, if not greater, beneficial effects because it will remove a facility that has a larger viewshed (15 percent of the island) than the CSO (5 percent of the island). The visual effects of the other foreseeable actions will be limited to the vehicle for emergency egress from the summit being parked in a different location that may be slightly more visible than it was at the CSO site. Because that vehicle will be parked within an existing parking lot where other vehicles are typically present, the visual effects are anticipated to be minimal.

As such, the implementation of the proposed action and other foreseeable actions in the context of the existing environment would have a limited beneficial effect; however, the level of cumulative impact on visual resources would continue to be substantial, significant, and adverse.

4.13.5 Geology and Topography

As disclosed in the TMT EIS, the past actions in the summit region have resulted in a level of cumulative impact on geology and topography that is considered substantial, significant, and adverse. This determination was primarily due to the alteration of the cinder cone morphology in the summit region.

As discussed in Section 4.5—and regardless of which action alternative is implemented—the proposed action's impacts will be positive. The decommissioning of the Hōkū Keʻa facility is expected to have similar, and potentially greater, beneficial effects because it may restore some topography of a cinder cone. The other foreseeable actions are not anticipated to result in any effects on geology and topography.

Thus, the implementation of the proposed action and other foreseeable actions in the context of the existing environment would have a limited beneficial effect; however, the level of cumulative impact on geology and topography would continue to be substantial, significant, and adverse.

4.13.6 Water Resources

As disclosed in the TMT EIS, the past actions in the summit region have resulted in a level of cumulative impact on water resources that is considered negligible and less than significant.

As discussed in Section 4.6.2, the proposed action would result in no long-term impacts to groundwater or surface water because it involves the removal of facilities. The decommissioning of the Hōkū Keʻa facility is, similarly, not expected to have any effect on water resources. The other foreseeable actions are not anticipated to result in any effects on water resources.

Thus, the implementation of the proposed action and other foreseeable actions in the context of the existing environment would have a negligible effect on water resources and the level of cumulative impact on water resources would continue to be negligible and less than significant.

4.13.7 Solid and Hazardous Waste Management

As disclosed in the TMT EIS, the past actions in the summit region have resulted in a level of cumulative impact due to solid and hazardous materials and waste is small and less than significant.

Because of the nature of the proposed action, regardless of which action alternative is implemented, the proposed CSO Decommissioning Project will generate substantial quantities of waste, but only very limited volumes of that waste may be categorized as hazardous waste (Section 4.7). Overall, the proposed project will not result in a significant impact due to its solid and hazardous waste management. The decommissioning of the Hōkū Ke‘a facility is expected to similarly not result in significant impacts due to materials and wastes. The other foreseeable actions are not anticipated to result in any waste generation.

The implementation of the proposed action and other foreseeable actions in the context of the existing environment would have a limited effect due to solid and hazardous materials and waste and the level of cumulative impact would continue to be small and less than significant.

4.13.8 Traffic

As disclosed in the TMT EIS, the past actions in the summit region have resulted in a level of cumulative impact that is less than significant as the existing roads are sufficient to handle the level of traffic, and that project does not represent a significant impact to the roads and level of traffic.

Because the nature of the proposed action, and regardless of which action alternative is implemented, the proposed CSO Decommissioning Project will temporarily generate a modest number of vehicle trips daily during the deconstruction and site restoration operations. As discussed in Section 4.8.2, the impact of the proposed project will be less than significant. The decommissioning of the Hōkū Ke‘a facility is expected to cause similar temporary traffic impacts. The other foreseeable actions are not anticipated to result in any traffic increases or impacts.

The proposed project and foreseeable actions will result in a long-term reduction in the number of daily astronomy-related trips to the summit region. As such, the implementation of the proposed action and other foreseeable actions would have a limited beneficial effect and the level of cumulative impact related to traffic would continue to be less than significant.

4.13.9 Noise

As disclosed in the TMT EIS, the past actions in the summit region have resulted in a level of cumulative noise impact that is less than significant.

The CSO Decommissioning Project—regardless of action alternative—will eliminate an existing source of periodic noise (the astronomy facility) and result in a temporary increase in noise related to deconstruction and restoration. The decommissioning of the Hōkū Ke‘a facility is expected to result in similar temporary noise impacts but also eliminate the source of periodic noise (the astronomy facility). The other foreseeable actions are not anticipated to result in any changes to the sonic environment.

The implementation of the proposed action and other foreseeable actions, in the context of the existing environment, would have a nominal long-term benefit on the sonic environment and the level of cumulative noise impact would continue to be less than significant.

4.13.10 Air Quality

As disclosed in the TMT EIS, the past actions in the summit region have resulted in a level of cumulative impact on air quality—primarily related to vehicle traffic-related emissions—that is less than significant.

As discussed in Section 4.10.2, the proposed project's impacts on air quality will be less than significant. The decommissioning of the Hōkū Ke‘a facility is expected to have similar temporary and minimal impacts on air quality. The other foreseeable actions are not anticipated to result in any air quality impacts.

As such, the implementation of the proposed action and other foreseeable actions in the context of the existing environment would have a limited beneficial effect (the elimination of long-term vehicle trips to the summit) and the level of cumulative impact on air quality would continue to be less than significant.

4.13.11 Socioeconomic Conditions

As disclosed in the TMT EIS, the past actions in the summit region have resulted in a substantial and beneficial socioeconomic cumulative impact.

When the CSO facility ceased to operate in 2015, it eliminated some long-term, full-time jobs. The decommissioning of the facility will result in a limited number of short-term construction jobs. The discontinuation of the CSO facility will have a nominal adverse effect on the socioeconomic condition of Hawai‘i Island. The decommissioning of the Hōkū Ke‘a facility will have similar short-term construction effects, but because it long-term socioeconomic benefits are likely to be replaced by a new educational telescope at Halepōhaku, it would not have any long-term adverse effects on the island's socioeconomic condition. The other foreseeable actions are not anticipated to result in any socioeconomic impacts.

As such, the implementation of the proposed action and other foreseeable actions in the context of the existing environment would have a nominal adverse effect (the elimination of a few long-term jobs) and the level of socioeconomic cumulative impact would continue to be substantial and beneficial.

4.14 MITIGATION MEASURES

This section summarizes the measures that Caltech will take that go beyond compliance with applicable rules, regulations, and statutory requirements, and are intended to reduce the potential for significant impacts to sensitive resources. The mitigation measures that have been identified in this EA have been developed to avoid, minimize, and rectify or mitigate the CSO Decommissioning Project's potential adverse impacts to the natural and human environment.

Mitigation measures have been considered throughout the project planning process and will be incorporated into the project's deconstruction and restoration plans. Mitigation measures which are broadly intended to apply to all or nearly all activities include:

- Design all work to comply, or facilitate compliance with, applicable rules, regulations, and statutory requirements;
- Require: (*i*) archaeological; (*ii*) cultural; and (*iii*) invasive species monitors to be present during relevant and/or applicable activities;
- Prepare and implement: (*i*) cultural, (*ii*) natural resources, (*iii*) safety training for all on-site personnel and contractors; and
- Develop and institute: (*i*) invasive species monitoring; (*ii*) waste minimization, (*iii*) material storage and waste management, and (*iv*) spill prevention and response plans.

Table 4.13 provides a summary of the mitigation measures that Caltech will employ as part of the CSO Decommissioning Project, regardless of which action alternative (ALT-2, ALT-3, or ALT-4) is implemented, to ensure that potential impacts are less than significant.

Table 4.13 Summary of Mitigation Measures

Section	***Resource***	***Mitigation***
4.1	Archaeology	Archaeological monitoring per the terms of AMP.
4.2	Cultural Impact Assessment	Independent on-site cultural resources specialist monitor will be used while there is work performed during the deconstruction and restoration processes.
4.3	Biology	All persons involved with decommissioning activities, including planning, demolition, and site restoration, will participate in a mandatory training about the natural resources on Maunakea. In addition, Caltech will institute measures to: (*i*) minimize habitat disturbance; (*ii*) avoid introduction of non-native species; (*iii*) manage onsite material storage and disposal; and (*iv*) conduct invasive species monitoring.
4.4	Visual and Aesthetic Resources	n/a
4.5	Geology and Topography	BMPs including: (*i*) erosion and water quality measures; (*ii*) dust and debris management; and (*iii*) worker orientation regarding historic, cultural, ecological, and natural resources.
4.6	Hydrology	Follow or exceed HDOH-WB guidance including applicable provisions of *General Backfilling Scenarios for an Injection-Well Cesspool* (HDOH, 2004).
4.7	Solid and Hazardous Waste	Caltech will: (*i*) Prepare Phase II ESA assessing whether contaminants (i.e., hydraulic oil) are present in soil beneath the CSO and remediate, as necessary: (*ii*) train all construction personnel regarding environment, ecology, and natural resources of Maunakea; (*iii*) sort and properly recycle or dispose of construction waste; and (*iv*) implement a BMP Plan that covers waste management and incorporates sustainable practices as required by the CMP.
4.8	Traffic	Ridesharing will be implemented. In addition, will employ TMP guidance including: (*i*) temporary signage; (*ii*) changeable message boards; (*iii*) channelizing devices; (*iv*) flaggers and uniformed traffic control officers; (*v*) barricades; (*vi*) portable barriers; and (*vii*) escort vehicles. Caltech and its contractors will coordinate with CMS and MKOs to prevent conflicts between different operations (e.g., TMT construction) which may occur concurrently.
4.9	Noise	Adhere to HAR, Title 11, Chapter 46. Also, total number of vehicle trips for workers will be minimized via ride-sharing and/or vanpooling.
4.10	Air Quality	Follow BMPs related to: (*i*) erosion, (*ii*) dust, (*iii*) debris management; and (*iv*) requiring all vehicles and equipment to be maintained in good working condition.
4.11	Natural Hazards	Follow provisions of fire prevention, suppression, and emergency evacuation plan in coordination with HCFD, and adhere to NFPA's *Code 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations*.
4.12	Public Services	Follow provisions of fire prevention, suppression, and emergency evacuation plan in coordination with HCFD, and adhere to NFPA's *Code 241 Standard for Safeguarding Construction, Alteration, and Demolition Operations*.

Source: Compiled by Planning Solutions, Inc. (2020)

Chapter 5: CONSISTENCY WITH LAND USE PLANS, POLICIES, AND CONTROLS

This chapter discusses the relationship of the CSO Decommissioning Project to applicable land use plans, policies, and regulations at the County, State, and Federal level. Compliance with existing regulations and requirements, including via the implementation of mitigation measures discussed in Section 4.14, will help to ensure that the proposed action will not result in significant impacts on current land use policies and programs at the local, regional, or national level.

5.1 COUNTY OF HAWAIʻI

5.1.1 COUNTY GENERAL PLAN

The *Hawaiʻi County General Plan* (GP) is a policy document expressing the broad goals and policies for the long-term development of the Island of Hawaiʻi. The GP was adopted by ordinance in 1989 and revised in 2005. The GP itself is organized into thirteen broad domains, with policies, objectives, and standards for each, including: (*i*) economic, (*ii*) energy, (*iii*) environmental quality, (*iv*) flooding and natural hazards, (*v*) historic sites, (*vi*) natural beauty, (vii) natural resources and shoreline, (*viii*) housing, (*ix*) public facilities, (*x*) public utilities, (*xi*) recreation, (*xii*) transportation, and (*xiii*) land use.

There are also discussions of the specific applicability of each element to the nine judicial districts comprising the County of Hawaiʻi. The GP notes:

> *"The summit area of Mauna Kea has the worldwide distinction as the best international center for observational astronomy. ... The astronomical facilities located atop Mauna Kea are also part of the Hāmākua District.*
>
> *The facilities are located within the 11,228 acre Mauna Kea Science Reserve, which includes those lands situated above the 12,000 foot elevation, with the exception of areas within the Mauna Kea Ice Age Natural Area Reserve."*

The following sections of the GP contain the policies and goals most applicable to the CSO Decommissioning Project, followed by a discussion of their relationship to the proposed action; they are:

<u>*County General Plan Policies For Economic Goals - Chapter 2.2*</u>

> *Provide residents with opportunities to improve their quality of life through economic development that enhances the County's natural and social environments.*
>
> *Economic development and improvement shall be in balance with the physical, social, and cultural environments of the island of Hawaii.*
>
> *Strive for diversity and stability in the economic system.*
>
> *Provide an economic environment that allows new, expanded, or improved economic opportunities that are compatible with the County's cultural, natural and social environment.*

Strive for an economic climate that provides its residents an opportunity for choice of occupation.

Strive for diversification of the economy by strengthening existing industries and attracting new endeavors.

Strive for full employment.

Promote and develop the island of Hawaii into a unique scientific and cultural model, where economic gains are in balance with social and physical amenities. Development should be reviewed on the basis of total impact on the residents of the County, not only in terms of immediate short run economic benefits.

Discussion: While the CSO Decommissioning Project will result in some temporary employment and expenditures, it is modest in scope and will not make a significant impact on socioeconomic conditions within the County of Hawaiʻi. However, the proposed action is not inconsistent with the economic development goals identified above and will not obstruct or inhibit any other projects or industrial development. Further, the environmentally and culturally appropriate removal of the defunct observatory and restoration of the site will demonstrate that the scientific contributions of the CSO can be balanced with the cultural and environmental sensitivity of Maunakea's summit region in a careful and well managed way.

County General Plan Policies For Natural Beauty - Chapter 7.2 Goals

Protect, preserve and enhance the quality of areas endowed with natural beauty, including the quality of coastal scenic resources.

Protect scenic vistas and viewplanes from becoming obstructed.

Maximize opportunities for present and future generations to appreciate and enjoy natural and scenic beauty.

County General Plan Policies For Natural Resources and Shoreline - Chapter 8.2 Goals

(a) Protect and conserve the natural resources from undue exploitation, encroachment and damage.

(b) Provide opportunities for recreational, economic, and educational needs without despoiling or endangering natural resources.

(c) Protect and promote the prudent use of Hawaii's unique, fragile, and significant environmental and natural resources.

(d) Protect rare or endangered species and habitats native to Hawaii.

(e) Protect and effectively manage Hawaii's open space, watersheds, shoreline, and natural areas.

(f) Ensure that alterations to existing land forms, vegetation, and construction of structures cause minimum adverse effect to water resources, and scenic and recreational amenities and minimum danger of floods, landslides, erosion, siltation, or failure in the event of an earthquake.

Discussion: By removing the existing structures and supporting infrastructure currently occupying the site, the CSO Decommissioning Project will uphold the natural resource goals of the Hawaiʻi County General Plan. The deconstruction, removal, and site restoration process will return a portion of Maunakea's summit region closer to its pre-construction condition and has the potential to serve as an important template for the decommissioning of other astronomical facilities as their organizations choose to cease operation. The native plant and arthropod habitat restoration that is a part of the project will also serve to protect important native habitat and the monitoring that will accompany it has the potential to provide valuable insights into how to protect and effectively manage restored habitat.

> *County General Plan Policies For Land Use – Public Lands - Chapter 14.9.2 Goals*
>
> *(a) Utilize publicly owned lands in the best public interest and to the maximum benefit for the greatest number of people.*

Discussion: The CSO Decommissioning Project is intended to demonstrate the pono disposition of publicly owned land following astronomy use by returning the site, as closely as possible, to its pre-development condition. The proposed action is consistent with what those consulted have indicated is in the public's best interest at the CSO Site.

5.1.2 HĀMĀKUA COMMUNITY DEVELOPMENT PLAN (2018)

The *Hāmākua Community Development Plan* (HCDP) was adopted by the County of Hawaiʻi as Ordinance No. 2018-78. The purpose of the HCDP is to: (*i*) establish County policy; (*ii*) direct County actions; (*iii*) help guide policies and actions of the State and Federal governments; and (*iv*) focus and guide community action in the Hāmākua District. The HCDP prioritizes natural and cultural resource protection, restoration, and enhancement and addresses land use and community infrastructure goals. While the document is necessarily far ranging, several of the provisions most directly applicable to the CSO Decommissioning Project are identified and discussed below.

> *4.9. Preserving Sacred Places: Waipiʻo Valley and Mauna Kea*
>
> ***4.9.1 Community Objective***
>
> *This section of the CDP identifies Waipiʻo Valley and Mauna Kea as sacred places needing special attention. This section specifically addresses natural and cultural resource protections for both of these unique areas, but the section also addresses other elements of the CDP that are specific to these places.*
>
> ***Community Objective 1:*** *Protect, restore, and enhance watershed ecosystems, sweeping views, and open spaces from mauka forests to makai shorelines, while assuring responsible public access for recreational, spiritual, cultural, and sustenance practices.*
>
> ***Community Objective 4:*** *Protect and nurture Hāmākua's social and cultural diversity and heritage assets, including sacred places, historic sites and buildings, and distinctive plantation towns.*

Discussion: The CSO Decommissioning Project is intended to deconstruct and remove all structures and infrastructure from the site and then restore it, as closely as possible, to its pre-construction condition. This process acknowledges the reverence that many have for Maunakea and is consistent with the HCDP's desire to protect, restore, and enhance sacred places for the recreational, spiritual, and cultural benefit of the people of Hawaiʻi.

4. 9. 8 Mauna Kea: Kokua Action

Kokua Action 43:

Collaborate with Observatories to develop a site decommissioning plan for each observatory, in accordance with the Decommissioning Plan for Mauna Kea Observatories.

Discussion: The purpose of the CSO Decommissioning Project is to fulfill the terms of Caltech's Site Decommissioning Plan (2021), which was prepared in accordance with the Decommissioning Plan (2010), thus upholding this action item of the HCDP.

4. 9. 8 Mauna Kea: Community Action

Kokua Action 36:

Provide natural and cultural resource preservation orientation training for tour operators, rangers, VIS staff, and volunteers in coordination with native practitioners who practice on Mauna Kea.

Discussion: As indicated in Section 2.1 and Table 2.1, and per the CMP, all personnel working on the CSO Decommissioning Project will complete the orientation training developed by OMKM and now administered by CMS. As part of the CSO Decommissioning Project, and as discussed in Section 4.2.5, a cultural monitor (in addition to archaeological and invasive species monitors) will provide cultural orientation, protocols, and guidance to individuals conducting on-site deconstruction and site restoration tasks so that the work can be carried out in a manner appropriate to its sensitive location.

5.2 STATE OF HAWAIʻI

5.2.1 HAWAIʻI STATE PLAN, HRS CHAPTER 226

Adopted in 1978 and last revised in 1991, the *Hawaiʻi State Plan* is intended to guide the long-range development of the State by:

- Identifying goals, objectives, and policies for the State and its residents;
- Establishing a basis for determining priorities and allocating resources; and
- Providing a unifying vision to enable coordination between the various counties' plans, programs, policies, projects and regulatory activities to assist them in developing their county plans, programs, and projects and the State's long-range development objectives.

The *Hawaiʻi State Plan* is a policy document. It depends on implementing laws and regulations to achieve its goals. While not all sections of the *Hawaiʻi State Plan* are directly applicable to the CSO Decommissioning Project, the most relevant are identified and discussed below.

§226-4: State Goals. In order to guarantee, for the present and future generations, those elements of choice and mobility that insure that individuals and groups may approach their desired levels of self-reliance and self-determination, it shall be the goal of the State to achieve:

(1) A strong, viable economy, characterized by stability, diversity, and growth, that enables the fulfillment of the needs and expectations of Hawaii's present and future generations.

(2) A desired physical environment, characterized by beauty, cleanliness, quiet, stable natural systems, and uniqueness, that enhances the mental and physical well-being of the people.

(3) Physical, social and economic well-being, for individuals and families in Hawai'i, that nourishes a sense of community responsibility, of caring, and of participation in community life.

Discussion: The CSO Decommissioning Project consists of the deconstruction and removal of all structures and infrastructure and the restoration of the site, as closely as possible, to its pre-construction condition. As such, it will enhance the beauty, cleanliness, quiet, and stability of the unique summit region of Maunakea. Caltech believes that in doing so, it will fulfill its responsibility to the community and uphold these goals of the Hawaiʻi State Plan.

§226-6: Objectives and Policies for the Economy in General.

(B) To achieve the general economic objectives, it shall be the policy of this State to:

(15) Promote and protect intangible resources in Hawai'i, such as scenic beauty and the Aloha spirit, which are vital to a healthy economy.

Discussion: It is Caltech's view that the timely implementation of the CSO Decommissioning Project will enhance the cultural and scenic beauty of the Maunakea summit region, consistent with this policy, via the deconstruction and removal of the observatory-related structures and infrastructure and the restoration of the site, as closely as possible, to its pre-construction condition. Thus, the proposed action is supportive of this policy.

§226-11 Objectives and Policies for the Physical Environment - Land-based, Shoreline, and Marine Resources.

(A) Planning for the State's physical environment with regard to land-based, shoreline and marine resources shall be directed towards achievement of the following objectives:

(1) Prudent use of Hawaii's land-based, shoreline, and marine resources.

(2) Effective protection of Hawaii's unique and fragile environmental resources.

(B) To achieve the land-based, shoreline, and marine resources objectives, it shall be the policy of this State to:

(1) Exercise an overall conservation ethic in the use of Hawaii's natural resources.

> *(2) Ensure compatibility between land-based and water-based activities and natural resources and ecological systems.*
>
> *(3) Take into account the physical attributes of areas when planning and designing activities and facilities.*
>
> *(4) Manage natural resources and environs to encourage their beneficial and multiple uses without generating costly or irreparable environmental damage.*
>
> *(6) Encourage the protection of rare or endangered plant and animal species and habitats native to Hawaii.*
>
> *(8) Pursue compatible relationships among activities, facilities and natural resources.*
>
> *(9) Promote increased accessibility and prudent use of inland and shoreline areas for public recreational, educational and scientific purposes.*

Discussion: The CSO Decommissioning Project has been carefully planned and is intended to represent the prudent management of the site, shifting from an active astronomy facility to restored alpine stone desert ecosystem. With careful attention to the physical attributes of the site, Caltech is planning to restore and enhance the native habitat upon which native plants and animals of the alpine stone desert ecosystem depend; this is part of Caltech's broad commitment to the preservation of Hawai'i's natural resources. Finally, by serving as a well-managed example of the decommissioning process, the CSO Decommissioning Project may demonstrate the compatibility between scientific activities, facilities, and natural resources for other astronomical facilities.

5.2.2 State Land Use Law, HRS Chapter 205

Chapter 205, HRS established the State Land Use Commission and gives this body the authority to designate all lands in the State as Urban, Rural, Agricultural, or Conservation District. The counties make all land use decisions within the Urban District in accordance with their respective county general plans, development plans, and zoning ordinances. The counties also regulate land use in the State Rural and Agricultural Districts, but within the limits specified by HRS, Chapter 205.

The CSO Decommissioning Project is located in the State Conservation District. According to HAR §13-5-1, the intent of the Conservation District is to regulate land use within it:

> *"for the purpose of conserving, protecting, and preserving the important natural and cultural resources of the State through appropriate management and use to promote their long-term sustainability and the public health, safety, and welfare."*

The CSO was approved as a use within the Conservation District in 1982 by CDUP HA-1492. That permit places no conditions on the decommissioning of the CSO. The CSO Decommissioning Project is consistent with the range of land uses envisioned for the Conservation District and exemplifies the prudent management of conservation land by restoring its natural and cultural resources to the maximum extent practicable and promoting its long-term sustainability. A CDUP is being sought for the proposed project and this EA supports the application and informs the decision makers. The CDUA addresses the eight Conservation District use criteria. The proposed project will not commence until a permit is issued. The proposed action will contribute to conservation, protection, and preservation of the Maunakea summit region; therefore, it is an appropriate land use in the Conservation District.

5.2.3 COASTAL ZONE MANAGEMENT PROGRAM, HRS 205A

The objectives of the Hawaiʻi Coastal Zone Management (CZM) Program are set forth in Hawaiʻi Revised Statutes, Chapter 205A. The program is intended to promote the protection and maintenance of valuable coastal resources. All lands in Hawaiʻi are classified as valuable coastal resources. The State Office of Planning administers Hawaiʻi's CZM Program. A general discussion of the project's consistency with the objectives and policies of Hawaiʻi's CZM Program follows.

5.2.3.1 ***Recreational Resources***

Objective: Provide coastal recreational opportunities accessible to the public.

Policies:

1. *Improve coordination and funding of coastal recreational planning and management; and*
2. *Provide adequate, accessible, and diverse recreational opportunities in the coastal zone management area by:*
3. *Protecting coastal resources uniquely suited for recreational activities that cannot be provided in other areas;*
4. *Requiring replacement of coastal resources having significant recreational value including, but not limited to, surfing sites, fishponds, and sand beaches, when such resources will be unavoidably damaged by development; or requiring reasonable monetary compensation to the State for recreation when replacement is not feasible or desirable;*
5. *Providing and managing adequate public access, consistent with conservation of natural resources, to and along shorelines with recreational value;*
6. *Providing an adequate supply of shoreline parks and other recreational facilities suitable for public recreation;*
7. *Ensuring public recreational uses of county, state, and federally owned or controlled shoreline lands and waters having recreational value consistent with public safety standards and conservation of natural resources;*
8. *Adopting water quality standards and regulating point and nonpoint sources of pollution to protect, and where feasible, restore the recreational value of coastal waters;*
9. *Developing new shoreline recreational opportunities, where appropriate, such as artificial lagoons, artificial beaches, and artificial reefs for surfing and fishing; and*
10. *Encouraging reasonable dedication of shoreline areas with recreational value for public use as part of discretionary approvals or permits by the land use commission,*

board of land and natural resources, and county authorities; and crediting such dedication against the requirements of section 46-6.

Discussion: The proposed project will have no effect on coastal recreational resources. While some portion of the deconstruction, removal, and site restoration operations will be visible from nearby portions of the summit region, once complete, the restored site should be indistinguishable from adjacent areas and the project will not disrupt any ongoing use of the area or access to recreational opportunities.

5.2.3.2 ***Historic Resources***

Objective: *Protect, preserve, and, where desirable, restore those natural and manmade historic and prehistoric resources in the coastal zone management area that are significant in Hawaiian and American history and culture.*

Policies:

1. *Identify and analyze significant archaeological resources;*
2. *Maximize information retention through preservation of remains and artifacts or salvage operations; and*
3. *Support state goals for protection, restoration, interpretation, and display of historic resources.*

Discussion: The CSO Decommissioning Project is intended to restore, as closely as possible, the CSO Site to its natural, pre-construction condition. All work related to the project will occur in areas that have already been extensively disturbed. Section 4.1 describes the locations of historic resources in the project area, none of which are within the CSO Site. That section also outlines why it has been determined that no historic resources will be directly or adversely affected by the proposed project. The measures that Caltech will employ to protect and preserve historic resources, including those which could be inadvertently discovered during the decommissioning process, are also included in Section 4.1. SHPD will be sent a copy of this EA for review and their comments, if any, will be reproduced in the Final Environmental Assessment (FEA).

5.2.3.3 ***Scenic and Open Space Resources***

Objective: *Protect, preserve, and, where desirable, restore or improve the quality of coastal scenic and open space resources.*

Policies:

1. *Identify valued scenic resources in the coastal zone management area;*
2. *Ensure that new developments are compatible with their visual environment by designing and locating such developments to minimize the alteration of natural landforms and existing public views to and along the shoreline;*
3. *Preserve, maintain, and, where desirable, improve and restore shoreline open space and scenic resources; and*
4. *Encourage those developments that are not coastal dependent to locate in inland areas.*

Discussion: Coastal open space and scenic resources will not be adversely affected by the CSO Decommissioning Project. While the proposed deconstruction, removal, and site restoration operations will be visible from some public vantage points, this would be for only a brief time. Once restored, the site should be relatively indistinguishable from other unoccupied adjacent areas and with a much softer, more natural appearance than it has at the present time. The proposed action will require only modest alteration of natural landforms and is situated well away from public views of the shoreline.

5.2.3.4 ***Coastal Ecosystems***

Objective: *Protect valuable coastal ecosystems, including reefs, from disruption and minimize adverse impacts on all coastal ecosystems.*

Policies:

1. *Exercise an overall conservation ethic, and practice stewardship in the protection, use, and development of marine and coastal resources;*
2. *Improve the technical basis for natural resource management;*
3. *Preserve valuable coastal ecosystems, including reefs, of significant biological or economic importance;*
4. *Minimize disruption or degradation of coastal water ecosystems by effective regulation of stream diversions, channelization, and similar land and water uses, recognizing competing water needs; and*
5. *Promote water quantity and quality planning and management practices that reflect the tolerance of fresh water and marine ecosystems and maintain and enhance water quality through the development and implementation of point and nonpoint source water pollution control measures.*

Discussion: The proposed action will not interact with or affect coastal ecosystems or any other water body, as described in Section 4.6.2.

5.2.3.5 ***Economic Uses***

Objective: *Provide public or private facilities and improvements important to the State's economy in suitable locations.*

Policies:

1. *Concentrate coastal dependent development in appropriate areas;*
2. *Ensure that coastal dependent development such as harbors and ports, and coastal related development such as visitor industry facilities and energy generating facilities, are located, designed, and constructed to minimize adverse social, visual, and environmental impacts in the coastal zone management area; and*
3. *Direct the location and expansion of coastal dependent developments to areas presently designated and used for such developments and permit reasonable long-term growth at such areas, and permit coastal dependent development outside of presently designated areas when:*

i. *Use of presently designated locations is not feasible;*
ii. *Adverse environmental effects are minimized; and*
iii. *The development is important to the State's economy.*

Discussion: The CSO Decommissioning Project is not a coastal development and would not lead to any changes in the concentration or location of coastal developments. The work would be conducted entirely within the MKSR at an elevation of roughly 13,350 feet above sea level and will have only a positive effect on the visual environment in Maunakea's summit region. While the proposed action will have only a minor impact on the State's economy, Caltech has instituted a series of mitigation measures summarized in Table 4.13 to ensure that the potential adverse environmental impacts of the project are minimized.

5.2.3.6 ***Coastal Hazards***

Objective: *Reduce hazard to life and property from tsunami, storm waves, stream flooding, erosion, subsidence, and pollution.*

Policies:

1. *Develop and communicate adequate information about storm wave, tsunami, flood, erosion, subsidence, and point and nonpoint source pollution hazards;*
2. *Control development in areas subject to storm wave, tsunami, flood, erosion, hurricane, wind, subsidence, and point and nonpoint source pollution hazards;*
3. *Ensure that developments comply with requirements of the Federal Flood Insurance Program; and*
4. *Prevent coastal flooding from inland projects.*

Discussion: Section 4.11.1.3 confirms that the project is outside the designated Special Flood Hazard Area and not within the County of Hawai'i's Tsunami Evacuation Zone. The proposed project will not cause or contribute to coastal flooding.

5.2.3.7 ***Managing Development***

Objective: *Improve the development review process, communication, and public participation in the management of coastal resources and hazards.*

Policies:

1. *Use, implement, and enforce existing law effectively to the maximum extent possible in managing present and future coastal zone development;*
2. *Facilitate timely processing of applications for development permits and resolve overlapping or conflicting permit requirements; and*
3. *Communicate the potential short and long-term impacts of proposed significant coastal developments early in their life cycle and in terms understandable to the public to facilitate public participation in the planning and review process.*

Discussion: Caltech has initiated contact (see Chapter 7) and continues to work cooperatively with all government agencies with oversight responsibilities to facilitate efficient processing of permits and informed decision making by the responsible parties. In addition, Caltech has, via public outreach and this EA, attempted to communicate the potential impacts of the CSO Decommissioning Project to the public in clear and understandable terms.

5.2.3.8 ***Public Participation***

Objective: *Stimulate public awareness, education, and participation in coastal management.*

Policies:

1. *Promote public involvement in coastal zone management processes;*
2. *Disseminate information on coastal management issues by means of educational materials, published reports, staff contact, and public workshops for persons and organizations concerned with coastal issues, developments, and government activities; and*
3. *Organize workshops, policy dialogues, and site-specific mediations to respond to coastal issues and conflicts.*

Discussion: The public will have an opportunity to review and comment on the Draft EA, pursuant to the requirements of Hawaiʻi Administrative Rules §11-200.1. In addition to those requirements, Caltech plans to hold three public workshops during the Draft EA review period. Furthermore, the public participation objective will be addressed during the processing of the CDUA, which will include public notification and a public hearing.

5.2.3.9 ***Beach Protection***

Objective: *Protect beaches for public use and recreation.*

Policies:

1. *Locate new structures inland from the shoreline setback to conserve open space, minimize interference with natural shoreline processes, and minimize loss of improvements due to erosion;*
2. *Prohibit construction of private erosion-protection structures seaward of the shoreline, except when they result in improved aesthetic and engineering solutions to erosion at the sites and do not interfere with existing recreational and waterline activities; and*
3. *Minimize the construction of public erosion-protection structures seaward of the shoreline.*

Discussion: The project poses no risk to beaches. No structures are planned seaward of the shoreline, and no interactions with littoral processes would be involved.

5.2.3.10 ***Marine Resources***

Objective: *Promote the protection, use, and development of marine and coastal resources to assure their sustainability.*

Policies:

1. *Ensure that the use and development of marine and coastal resources are ecologically and environmentally sound and economically beneficial;*
2. *Coordinate the management of marine and coastal resources and activities to improve effectiveness and efficiency;*
3. *Assert and articulate the interests of the State as a partner with federal agencies in the sound management of ocean resources within the United States exclusive economic zone;*
4. *Promote research, study, and understanding of ocean processes, marine life, and other ocean resources in order to acquire and inventory information necessary to understand how ocean development activities relate to and impact upon ocean and coastal resources; and*
5. *Encourage research and development of new, innovative technologies for exploring, using, or protecting marine and coastal resources.*

Discussion: The proposed project does not have the potential to affect marine resources.

5.2.4 Consistency with Master Lease and Sublease

There are two layers of contractual agreements that have bearing on the CSO Decommissioning Project: (*i*) the Master Lease (ML); and (*ii*) Caltech's Sublease (CS).

5.2.4.1 ***Master Lease (ML)***

An ML was made on June 21, 1968, between the State of Hawai'i, by its BLNR, Lessor, and the University of Hawai'i, Lessee, for the use of the MKSR. With respect to improvements, the leases notes (BLNR, 1968):

> *Improvements. The Lessee shall have the right during the existence of this lease to construct and erect buildings, structures and other improvements upon the demised premises; provided, that plans for construction and plot plans of improvements shall be submitted to the Chairman of the Board of Land and Natural Resources for review and approval prior to commencement of construction. The improvements shall be and remain the property of the Lessee, and shall be removed or disposed of by the Lessee at the expiration or sooner termination of this lease: provided, that with the approval of the Chairman such improvements may be abandoned in place. The Lessee shall, during the term of this lease, properly maintain, repair and keep all improvements in good condition. (Lease, 1968)*

The ML expires on December 31, 2033; until then, it may be terminated at any time by the Lessee or for cause by the Lessor. Under the terms of the ML, DLNR's reserved rights include hunting and recreation, water, and trails and access. The lease allows for the construction of improvements (i.e., buildings, infrastructure and other improvements), with BLNR's explicit approval. Without a new lease or approval from the Chairman of BLNR to abandon them in place, permitted improvements within the MKSR must be removed prior to December 31, 2033. There is no specific provision in the ML related to decommissioning or site restoration.

5.2.4.2 ***Caltech Sublease (CS)***

The CS was made on December 20, 1983, between the University of Hawaiʻi, Sublessor, and California Institute of Technology, Sublessee, for the use of 0.75 acre area where the CSO was built. The CS states (CS, 1983):

> *"…upon the termination or expiration of this Sublease for any cause, Sublessee must select one of the following options:*
>
> *1. Negotiate with Sublessor for sale of the property to Sublessor.*
>
> *2. With concurrence of Sublessor, peaceably surrender the demised premises and all or part of the property in place and good repair, order, and clean condition, reasonable wear and tear excepted. In the event that part of the property is removed, Sublessee shall restore the demised premises, or any portion affected thereby, to even grade to the extent that improvements are removed. and shall repair any damage done to the improvements in the event that equipment is removed.*
>
> *3. Sell the assets to a third party acceptable to Sublessor, which acceptance shall not be arbitrarily or capriciously withheld. Such sale shall be contingent upon the execution of a new Sublease and Operating and Site Development Agreement between the third party and Sublessor.*
>
> *4. Remove the property at the expense of Sublessee provided such removal is completed within Eighteen (18) months after termination or expiration of Sublease. unless otherwise agreed to in writing between Sublessor and Sublessee. In the event of such removal, Sublessee shall restore the property, or any portion affected thereby, to even grade to the extent that improvements are removed, and shall repair any damage done to the improvements in the event that equipment is removed. In the event Sublessee fails to remove such property or debris and restore the demised premises within the time specified above, such property may be removed and the land restored to its original condition by Sublessor at the expense of Sublessee."*

5.2.4.3 ***Consistency with ML and CS***

With the exception of the No Action Alternative (ALT-1), all of the action alternatives call for levels of deconstruction, removal, and site restoration, that exceed the requirements found in the ML and SL.

5.2.5 Mauna Kea Comprehensive Management Plan (2009)

The CMP (2009), previously introduced in Section 1.1 and approved in 2009 by the BLNR, applies to the proposed project because the project site is within the UH Management Areas. The CMP identifies 103 "management actions" that apply to various management, operation, planning, and construction activities. The following sections discuss the proposed project's compliance with the management actions that apply to it.

5.2.5.1 ***Construction-Related Management Actions***

CMP management actions C-1 through C-9 provide "construction guidelines" for projects within the UH Management Areas. The desired outcome of these guidelines is to "minimize adverse impacts to resources during all phases of construction, through use of innovative best management practices." As detailed in Section 2.1.2.1, Caltech will implement BMPs and monitoring that fulfill the nine construction guideline management actions.

5.2.5.2 ***Decommissioning-Related Management Actions***

CMP management actions SR-1 and SR-2 apply to existing observatories, including the CSO, once they decide to decommission. Management action SR-3, the only other management action in this category, does not apply to the proposed project because it only applies to future astronomy facilities. The desired outcome of these management actions, and the component Decommissioning Plan, is:

> *"To the extent possible, reduce the area disturbed by physical structures within the UH Management Areas by upgrading and reusing buildings and equipment at existing locations, removing obsolete facilities, and restoring impacted sites to pre-disturbed condition."*

In describing management actions SR-1 and SR-2, the CMP states that:

> *Each observatory has specific provisions in its agreement related to what is to become of the structure at the end of its term. Unless and until existing observatories revise their agreements, they need only comply with existing terms. It is possible that some observatories will be upgraded or demolished prior to the end of the term.*

Demolition would be the responsibility of the terminating observatory. Observatories will be required to develop plans in coordination with IfA to be approved by CMS (identified as OMKM in the CMP) for site recycling, demolition and restoration. The plans are required to be in compliance with terms and conditions identified by CMS and the CMP, including all maintenance and construction management actions. In addition, the plans must consider the range of issues related to decommissioning including the impacts of demolition, waste management, substrate contamination, removal of underground storage tanks, habitat restoration, and cost.

Finally, the CMP stipulated that, in the event that an observatory considered decommissioning of their facility prior to the 2033 end of the lease, UH in consultation with DLNR and OMKM (now CMS) will initiate a discussion of a Site Decommissioning Plan and Site Restoration Plan to allow adequate time for decision-making, community input, and review.

The DP further provides a framework for observatories on Maunakea to ensure that the DLNR as landowner, the UH as Lessee and permittee, and the observatories as sublessees all have clear expectations of the decommissioning process and can plan appropriately for it. In principle, the DP: (*i*) defines decommissioning and the steps necessary to achieving it; (*ii*) outlines the terms of decommissioning contained in UH's ML and existing subleases; (*iii*) provides information on financial planning for decommissioning; and (*iv*) offers guidance for the practical course of action needed to implement decommissioning. The DP, as a subplan of the CMP, is consistent with the information and management actions set forth in it.

Per the DP (2010), Section 3.2 and Table 3.1 summarize the options for removal and levels of site restoration that can be considered in an observatory's Site Deconstruction and Removal Plan (SDRP) and Site Restoration Plan (SRP). Finally, the DP (2010) notes that, if less than full restoration is implemented, the observatory may be required to undertake other mitigation measures; this analysis must be incorporated into the SRP.

The CSO Decommissioning Project, as presented in this EA, is articulated in Caltech's SDP, which was in turn developed, reviewed, and revised according to the DP's guidance (2010). All of the action alternatives considered herein (ALT-2, ALT-3, and ALT-4) are intended to conform to the requirements of the CMP and the DP. The SDP is provided in Appendix A and includes an SDRP, SRP, Cost-Benefit Analysis, Funding Plan, and other information to comply with the CMP and DP. Therefore, the proposed project has complied with the CMP management actions SR-1 and SR-2 to date and Caltech is committed to compliance throughout project planning, permitting, and implementation.

5.3 FEDERAL LEGISLATION

5.3.1 NATIONAL HISTORIC PRESERVATION ACT

The National Historic Preservation Act is not applicable to the proposed project because it is not a federal undertaking.

5.3.2 CLEAN AIR ACT (42 U.S.C. §7506(C))

As discussed in Section 4.10, any emissions from construction vehicles or fugitive dust during the CSO Decommissioning Project are anticipated to be temporary and relatively minor. The contractors will employ BMPs to control fugitive dust emissions during the deconstruction, removal, and site restoration operations. Once these operations are complete, the restored former CSO Site will not produce any air emissions, will not alter air flow in the area, and will have no other measurable effect on the area's microclimate.

5.3.3 CLEAN WATER ACT (33 U.S.C. §1251, ET SEQ.)

The Clean Water Act, formally known as the Federal Water Pollution Control Act (33 U.S.C. §1251, et seq.) is the principal law governing pollution control and the water quality of the nation's waterways. The CSO Decommissioning Project, as discussed in Section 4.6, will not result in any impact to nearby surface waters or aquifers; consequently Caltech does not anticipate seeking any approvals from the U.S. Army Corps of Engineers under the Clean Water Act. Because the total disturbed area of the project is more than one acre, Caltech will obtain an NPDES permit (Section 1.5). In Hawai‘i, the HDOH-CWB is authorized to issue NPDES permits.

5.3.4 COASTAL ZONE MANAGEMENT ACT (16 U.S.C. §1456(C)(1))

Enacted as Chapter 205A, HRS, the Hawai‘i CZM Program was promulgated in 1977 in response to the Federal Coastal Zone Management Act of 1972. The CZM area encompasses the entire

State of Hawaiʻi, including all marine waters to the extent of the State's police power and management authority, as well as the 12-mile U.S. territorial sea and all archipelagic waters. Section 5.2.3 discusses the consistency of the CSO Decommissioning Project with the CZM Program's ten policy objectives.

5.3.5 ENDANGERED SPECIES ACT (16 U.S.C. §§1531-1544)

The Endangered Species Act of 1973, as amended 1976-1982,1984, and 1988 (16 U.S.C. §§1531-1544), provides broad protection for species of fish, wildlife, and plants that are listed as threatened or endangered in the United States or elsewhere. The act is not applicable to the proposed project because it does not involve a federal action or the taking of a listed species (Section 4.3).

5.3.6 FLOOD PLAIN MANAGEMENT (42 U.S.C. §4321, EXECUTIVE ORDER NO. 11988)

This Executive Order is not applicable to the proposed project because it does not involve development or activities within a flood plain. As described in Section 4.11.1.3, the CSO Decommissioning Project lies within Flood Zone X and is outside any special flood hazard zone.

Chapter 6: ANTICIPATED DETERMINATION

6.1 SIGNIFICANCE CRITERA

Hawai‘i Administrative Rule §11-200.1-14 establishes procedures for determining if an EIS should be prepared or if a Finding of No Significant Impact (FONSI) is warranted. HAR §11-200.1-14(d) provides that proposing agencies should issue an environmental impact statement preparation notice (EISPN) for actions that it determines may have a significant effect on the environment. HAR §11-200.1-13(b) lists the following criteria to be used in making that determination.

In most instances, an action shall be determined to have a significant effect on the environment if it:

1. Involves an irrevocable commitment to loss or destruction of any natural or cultural resource;
2. Curtails the range of beneficial uses of the environment;
3. Conflicts with the State’s long-term environmental policies or goals as expressed in Chapter 344, HRS, and any revisions thereof and amendments thereto, court decisions, or executive orders;
4. Substantially affects the economic or social welfare of the community or State;
5. Substantially affects public health;
6. Involves substantial secondary impacts, such as population changes or effects on public facilities;
7. Involves a substantial degradation of environmental quality;
8. Is individually limited but cumulatively has considerable effect on the environment or involves a commitment for larger actions;
9. Substantially affects a rare, threatened, or endangered species, or its habitat;
10. Detrimentally affects air or water quality or ambient noise levels;
11. Affects or is likely to suffer damage by being located in an environmentally sensitive area such as a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters;
12. Substantially affects scenic vistas and viewplanes identified in county or state plans or studies; or,
13. Requires substantial energy consumption.

6.2 FINDINGS

The potential effects of the proposed CSO Decommissioning Project and its action alternatives, as described in Chapter 2 and Chapter 3, respectively, were evaluated relative to these thirteen significance criteria. Caltech's findings with respect to each criterion are summarized in the following subsections.

6.2.1 Irrevocable Loss or Destruction of Valuable Resource

The CSO Decommissioning Project consists of the demolition and removal of infrastructure present on the site and the restoration of the area to, as closely as possible, its pre-construction condition. It does not involve the loss of any significant or valuable cultural or natural resources and is intended to benefit the cultural and natural resources in the area.

6.2.2 Curtails Beneficial Uses

The development and operation of the CSO was deemed a beneficial use of the environment when it was permitted in 1982. Caltech, the facility developer, operated the facility until choosing to cease operation on September 8, 2015. The facility has not been operational since then. Thus, the deconstruction, removal, and site restoration operations which are part of all of the action alternatives considered in this EA will not curtail any existing beneficial use of the CSO, and will allow for beneficial use of the former CSO Site as public open space and natural area.

6.2.3 Conflicts with Long-Term Environmental Policies or Goals

The CSO Decommissioning Project is consistent with all applicable plans, policies, and controls, as discussed throughout Chapter 5, including the *Hawaiʻi State Plan*, the *Hawaiʻi County General Plan*, and the BLNR-approved CMP. All of the action alternatives are consistent with the State's long-term environmental policies and goals as expressed in HRS, Chapter 344 and elsewhere in state law.

6.2.4 Substantially Affects Economic or Social Welfare

The proposed action will not have substantial effects on economic or social welfare. Its purpose is to allow Caltech to responsibly relinquish its sublease per the terms of that agreement and other applicable rules, regulations, and agreements.

6.2.5 Public Health Effects

The CSO Decommissioning Project will not adversely affect air or water quality, including water sources used for drinking or recreation. Neither will it generate other emissions that will have a significant adverse effect on public health.

6.2.6 Produce Substantial Secondary Impacts

The proposed action will not produce substantial secondary impacts. The CSO Decommissioning Project will not foster population growth, promote economic development, or stress public facilities or services. Instead, it is intended to allow Caltech to responsibly relinquish its sublease per the terms of that agreement and other applicable rules, regulations, and agreements.

6.2.7 Substantially Degrade the Environment

The proposed action will not have substantial long-term environmental effects. The work will temporarily elevate noise levels and generate limited nuisance airborne dust during construction, but these impacts will be localized and of limited duration. Adequate measures will be taken to control the intensity of construction noise and dust, and the effects will be brief and minimal.

6.2.8 Cumulative Effects or Commitment to a Larger Action

The CSO Decommissioning Project does not represent a commitment to a larger action and is not intended to facilitate substantial economic or population growth. It is intended solely to remove the CSO, restore the site, and allow Caltech to responsibly relinquish its sublease per the terms of that agreement and other applicable rules, regulations, and agreements.

6.2.9 Effects on Rare, Threatened, or Endangered Species

No rare, threatened, or endangered species are known to utilize the CSO Site, and once restoration is complete the area will function as habitat for native flora and fauna. In addition, the proposed action will not utilize a resource or habitat needed for the protection of rare, threatened, or endangered species.

6.2.10 Affects Air or Water Quality or Ambient Noise Levels

Noise levels and airborne emissions will temporarily increase during deconstruction, removal and site restoration activities. BMPs will be implemented and any effects will be brief, relatively minor, and restricted to immediately adjacent areas. Once the CSO Decommissioning Project is completed, it will not produce airborne emissions, waterborne pollution, or noise.

6.2.11 Environmentally Sensitive Area

The CSO Site is not in a flood plain, tsunami zone, beach, erosion-prone area, geologically hazardous land, estuary, fresh water, or coastal waters and will not have an effect on such areas. Further, the proposed action consists of deconstruction, removal, and site restoration activities that will restore the area, as closely as possible, to its pre-construction condition. Further, the CSO Decommissioning Project is not in any designated flood hazard or tsunami inundation zone.

6.2.12 Affects Scenic Vistas and View Planes

As discussed in Section 5.2.3.3, the proposed project is not visible from scenic vistas identified in county or state plans or studies and is not visible in viewplanes identified in county or state plans or studies; therefore, it will not substantially affect them.

6.2.13 Requires Substantial Energy Consumption

The deconstruction, removal, and site restoration operations proposed as part of the CSO Decommissioning Project will require the use of some energy. However, once these relatively brief operations are complete, the site will not require the use of any energy.

6.3 ANTICIPATED DETERMINATION

In view of the foregoing, Caltech and DLNR have concluded that the proposed project will not have a significant adverse impact on the environment. Consequently, DLNR anticipates issuing a FONSI for the proposed action.

Chapter 7: CONSULTATION AND DISTRIBUTION

7.1 SCOPING PERIOD CONSULTATION

A critical component of the CSO Decommissioning Project planning effort was developing and implementing an outreach program to inform the public and obtain their input on the proposed project's purpose, scope, potential impacts, and recommended mitigation measures. Outreach was substantial and included a variety of activities. Prior to the pre-assessment public scoping process presentations were made to:

- OMKM's Environmental Committee on November 8, 2017;
- Kahu Kū Mauna Council on November 14, 2017; and
- MKMB on November 28, 2017.

Thereafter, the broader public scoping process commenced on December 4, 2017, with an email distribution to 238 recipients containing the summary background information. A copy of this scoping message and background summary are provided in Appendix G. In addition, media press releases were distributed at that time, resulting in a front page story in the December 5, 2017, edition of the *Hawaiʻi Tribune-Herald* inviting input related to the CSO Decommissioning Project and the EA process. Table 7.1 identifies the parties that were called or sent an email and/or letter during the scoping process informing them of upcoming public meetings and/or requesting that they contact the project team to discuss the project.. Figure 7-1 reproduces the *Hawaiʻi Tribune-Herald* article.

Table 7.1 Parties Consulted in Early Scoping

Maunakea Observatories	
East Asian Observatory	Canada-France-Hawaiʻi Telescope
Harvard Smithsonian Center for Astrophysics	Gemini Observatory
National Radio Astronomy Observatory	NASA Infrared Telescope Facility
Subaru Telescope	Smithsonian Submillimeter Array
UH 2.2 Meter Telescope	UH Hilo Hōkū Keʻa
W.M. Keck Observatory	Very Long Baseline Array
Federal Agencies	
Environmental Protection Agency	National Oceanographic and Atmospheric Agency
National Resource Conservation Service	U.S. Army Pōhakuloa Training Area
U.S. Fish and Wildlife Service	U.S. Geological Survey
U.S. National Park Service	
State Agencies	
Department of Agriculture	Department of Accounting and General Services
Department of Business, Economic Development, and Tourism	Department of Land and Natural Resources
Department of Hawaiian Home Lands	Department of Health
Department of Transportation	Edwin H. Moʻokini Library
Environmental Center	Institute for Astronomy
Kauai Community College Library	Office of Environmental Quality Control
Office of the Governor	Office of Hawaiian Affairs
Office of Planning	Pālamanui Campus Library
Thomas H. Hamilton Library	University of Hawaiʻi
County Agencies	
Department of Environmental Management	Department of Parks and Recreation
Department of Public Works	Department of Research and Development
Department of Water Supply	Hawaiʻi County Fire Department
Hawaiʻi County Police Department	Office of the Mayor
Planning Department	
Elected Officials	
U.S. Senator Mazie Hirono	U.S. Senator Brian Schatz
U.S. Representative Colleen Hanabusa	U.S. Representative Tulsi Gabbard
State Senator Kai Kahele	State Senator Russell Ruderman
State Senator Josh Green	State Senator Lorraine Inouye
State Representative Mark Nakashima	State Representative Richard Onishi
State Representative Chris Todd	State Representative Joy San Buenaventura
State Representative Richard Creagan	State Representative Nicole Lowen
State Representative Cindy Evans	County Councilmember Valerie Poindexter
County Councilmember Aaron Chung	County Councilmember Maile David
County Councilmember Dru Kanuha	County Councilmember Karen Eoff
County Councilmember Sue Lee Loy	County Councilmember Eileen O'Hara
County Councilmember Jen Ruggles	County Councilmember Tim Richards

Community Organizations	
Arnott's Lodge and Hiking Adventures	Hawai'i Island Chamber of Commerce
Hawai'i Island Economic Development Board	Hawai'i Leeward Planning Conference
Hawaiian Eyes dba Hawaiian Haoles	'Imiloa Astronomy Center of Hawai'i
Jack's Tours	Japanese Chamber of Commerce
KAHEA	Kaneolehua Industrial Area Association
Kona-Kohala Chamber of Commerce	Mauna Kea Summit Adventure-Paradise Safaris
Meridian H.R.T.	PUEO
Robert's Hawai'i	Takikobo Hawai'i, Inc.
Individuals	
Michael Akau	Laura Aquino
Nick Agorastos	Rochelle Augustin-Beck
Kalepa Baybayan	Jackson Bauer
Mamo Bezilla	Cheryl Burghardt
Kualii Camara	Pua Case
Roberta Chu	Andrew Cooper
Greg Chun	Thomas Chun
Ian Cole	Susan Cordell
Kehaulani Costa	Donn Dela Cruz
Alika Desha	Jesse Eiben
Leningrad Elarinoff	Hank Fergerstrom
Kalani Flores	Heather Gallo
Grant Gerrish	Glennon T Gingo
Matthew Grauso	Richard Ha
Jay Hatayama	Clyde Hayashi
David Henkin	Nelson Ho
Wilma Holi	Stewart Hunter
Roger Imoto	Doug Ing
Wallace Ishibashi	Patrick Kahawaiolaa
Mike Kaleikini	CM Kaho'okahi Kanuha
Jim Kauahikaua	Springer Kaye
Moses Kealamakia, Jr.	Brannon Kealoha
Glen Kila	Jessica Kirkpatrick
Wendy Laros	Julie Leialoha
Bob Lindsey	George Martin
Joey Mello	Miles Miyasato
U'ilani Naipo	Sean Naleimaile
Christina Neal	Paul K. Neves
Max Newberg	Rob Pacheco
Shane Palacat- Nelsen	Cheyenne Perry
Kealoha Pisciotta	Brad Reil
Lukela Ruddle	Luis Salaveria
J. Leinaala Sleightholm	Hannah Springer
Heather Stever	Dale Suezaki
Craig Takamine	Anya Tagawa
Ron Terry	Donald Thomas
Marti Townsend	Mark Travalino
Cas Vanderwoude	Sage VanKralingen
Lehua Vincent	Dwight Vincente

Bill Walter	Deborah Ward
Keahi Warfield	Rick Warshauer
Brook Wilson	Ross Wilson
Joy S. Yoshina	Joan Yoshioka
Source: Compiled by Hookuleana, LLC (2020)	

Figure 7-1 CSO Decommissioning Project in the Hawai‘i Tribune-Herald

Hawaii Tribune Herald

Aloha Big Island

Tuesday, December 5, 2017 Proudly serving Hilo and the Big Island since 1923 75 cents

Preparing for removal

Caltech seeks feedback on dismantling of observatory atop Maunakea, site restoration

By TOM CALLIS
Hawaii Tribune-Herald

The California Institute of Technology is preparing to take removal of its submillimeter telescope atop Maunakea through the regulatory process.

The Caltech Submillimeter Observatory, which closed in 2015, will be the first to be dismantled under the Office of Maunakea Management's decommissioning subplan. No new telescopes will be built on the site.

The institute announced Monday it is starting a "public scoping period" to receive feedback on removal of the 10.4-meter telescope and site restoration. An environmental assessment and a conservation district use permit will be drafted.

Caltech said in a press release that it will consider different scenarios, and feedback on cultural, environmental and financial impacts will be incorporated into the plan.

See REMOVAL Page A9

The Caltech Submillimeter Observatory. The observatory closed in 2015 and officials now are starting the regulatory process for its removal from Maunakea.

Tribune-Herald file photo

REMOVAL From the front page

"We are grateful for the use of Maunakea for nearly three decades for astronomical research," said Sunil Golwala, CSO director and Caltech physics professor, in a written statement. "We are undertaking the decommissioning process respectfully and look forward to working with OMKM, University of Hawaii at Hilo, and the community."

Opened in 1987, CSO observed light emitted between the infrared and radio wavelengths. That is suited for observing molecular gases and small solid dust particles that fill dense regions where stars form, according to Caltech.

Caltech first announced its intent to remove the telescope in 2009.

At the time, it said the observatory was a cutting-edge facility for astronomical research and instrument development.

Contributions to science included detection of "heavy water" on comets and observation of "dusty planets," which optical telescopes are unable to see, Caltech said during the 2009 announcement.

It said then that the observatory was being closed because of the construction of the next-generation radio telescopes, such as the Cornell Caltech Atacama Telescope in Chile.

Final decommissioning plans will be approved by Caltech, the Maunakea Management Board, University of Hawaii and state Department of Land and Natural Resources.

Initially, Caltech anticipated the site would be returned to its natural state by 2018.

Planning, permitting and design is anticipated to take about two years, according to Ashley Kierkiewicz, senior account executive with Hastings & Pleadwell, which is handling communications for Caltech.

That includes about one year to complete the environmental process and six months to one year to complete the conservation district use application. Decommissioning can begin once a CDUP is issued, she said.

Caltech also hired M3 Engineering and Ho'okuleana LLC to help it with the decommissioning process.

Comments can be submitted to Peter Young of Hookuleana LLC at PeterYoung@hookuleana.com by Jan. 15.

Public meetings are planned as part of the EA process, Kierkiewicz said.

Caltech also is a partner with the W.M. Keck Observatory and Thirty Meter Telescope.

Email Tom Callis at tcallis@hawaiitribune-herald.com.

Source: *Hawai‘i Tribune-Herald* (2017)

Consistent with applicable laws and regulations, extensive consultation was conducted during the first four months of 2018 with government agencies, organizations, and individuals. A series of individual and small group meetings were held. A two-page summary of the proposed project was prepared and given to discussion attendees; a copy of the two-page background summary is provided as Appendix G. In those discussions, attendees were also encouraged to visit Caltech's website for project updates.[13] On January 14, 2018, a public presentation and discussion took place before the Hawaiʻi County Cultural Resources Commission. A PowerPoint presentation was provided to the audience, with background on the CSO and the decommissioning process as laid out in the CMP (2009) and DP (2010), followed by a question and answer period and a general discussion.

Feedback related to the CSO Decommissioning Project was generally consistent. The broad public outreach was appreciated, the removal of the telescope was received favorably, with most people feeling the project would have a positive effect. Many people providing input noted that the CSO Decommissioning Project was the first of its kind and that it had the opportunity to set a good example for other astronomy facility decommissioning projects to come. Principle concerns identified during outreach related to the handling of the closure and removal of the cesspool at the CSO Site and residual impact associated with the 2009 hydraulic fluid leak.

Repeated attempts were made to meet with individuals and representatives of groups that were part of or associated with the intervenors with the TMT contested case. After repeated non-response, an unsigned, apparent copy of a certified letter addressed to Governor David Ige and dated April 23, 2018, was sent to Hoʻokuleana, LLC, Caltech's consultant for public outreach related to the CSO Decommissioning Project. In part, that letter stated, relative to scoping and pre-EA consultation:

> *We appreciate the effort to reach out for comments. However, we believe its [sic] inappropriate for this to be happening at this time and we believe Caltech/CSO, and the University should wait until the legal questions including questions regarding the decommissioning and other agreements between the state's BLNR, University of Hawai'i and the other International governments have been resolved.*
>
> *The Court must be allowed to rule upon by those cases before the Court and before proceeding here. Because many of us are Plaintiffs in those Supreme Court Cases we wish to reserve our right to comment at a later date, when our comments are more appropriate and also when our comments cannot be used against us or our case.*

[13] Found online at cso.caltech.edu.

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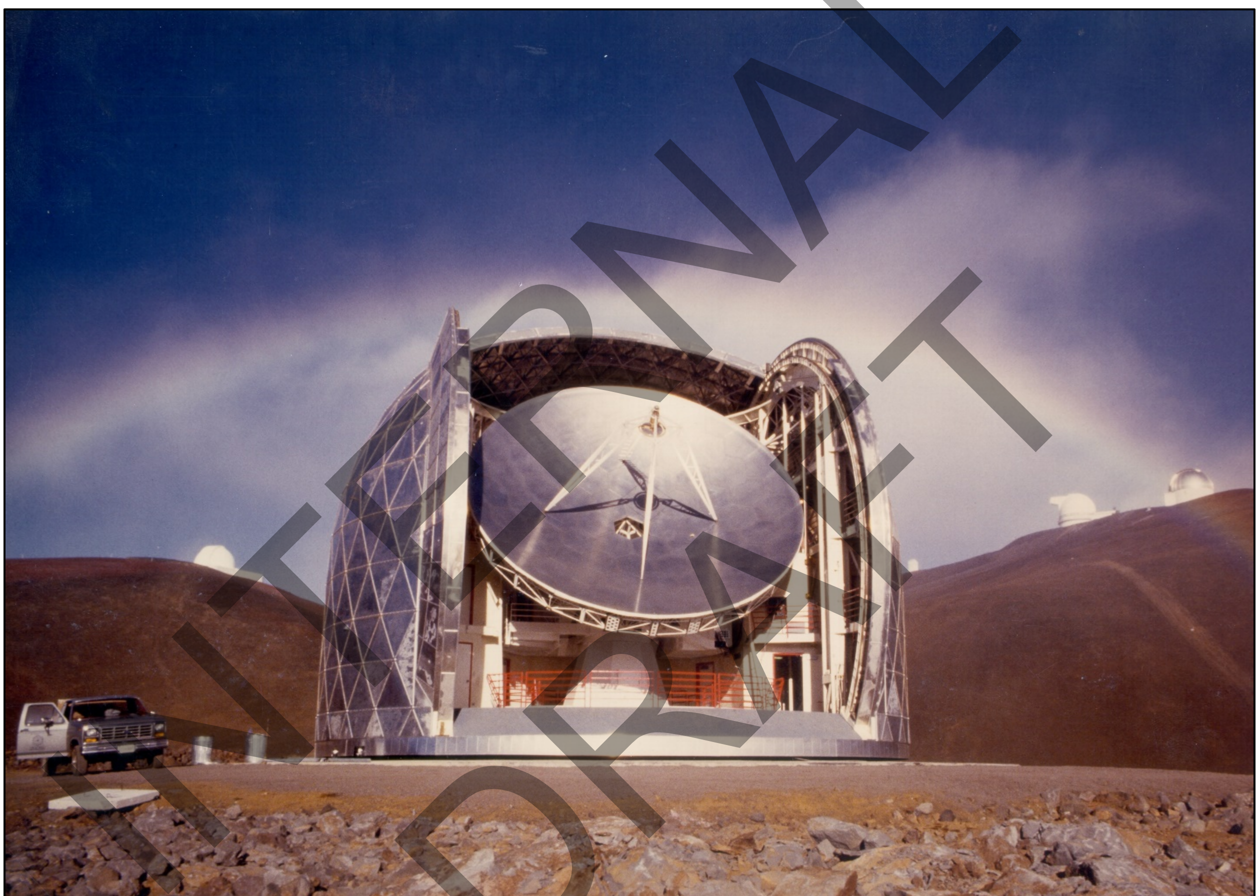
Appendix A. Site Decommissioning Plan

SITE DECOMMISSIONING PLAN FOR THE CALTECH SUBMILLIMETER OBSERVATORY



TMK: (3) 4-4-015:009 (por.)

FEBRUARY 24, 2021

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LIST OF ACRONYMS

AA	Archaeological Assessment
AMP	Archaeological Monitoring Plan
BLNR	Board of Land and Natural Resources
BMP	Best Management Practices
BOR	Board of Regents
BSA	Biological Site Assessment
Caltech	California Institute of Technology
CBA	Cost-Benefit Analysis
CDUA	Conservation District Use Application
CDUP	Conservation District Use Permit
CIA	Cultural Impact Assessment
CIT	California Institute of Technology
CMP	Mauna Kea Comprehensive Management Plan
CMS	Center for Maunakea Stewardship
CSO	Caltech Submillimeter Observatory
DHHL	Department of Hawaiian Home Lands
DLNR	Department of Land and Natural Resources
DOCARE	Division of Conservation and Resources Enforcement, DLNR
DOFAW	Division of Forestry and Wildlife, DLNR
DOH	Department of Health, State of Hawaiʻi
DP	Decommissioning Plan For The Mauna Kea Observatories
EA	Environmental Assessment
EDD	Environmental Due Diligence
EIS	Environmental Impact Statement
ESA	Environmental Site Assessment
FONSI	Finding of No Significant Impact
HAR	Hawaiʻi Administrative Rules
HCFD	Hawaiʻi County Fire Department
HIOSH	Hawaii Occupational Safety and Health Division
HRS	Hawaiʻi Revised Statutes
IfA	Institute for Astronomy

JCMT	James Clerk Maxwell Telescope
KKM	Kahu Kū Mauna
LBP	Lead-Based Paint
LCP	Lead-Containing Paint
LEI	Lehua Environmental, Inc.
MEP	Mechanical, Electrical, and Plumbing
MKMB	Mauna Kea Management Board
MKO	Maunakea Observatories
MKSR	Mauna Kea Science Reserve
MKSS	Mauna Kea Observatory Support Services
NAR	Natural Area Reserve, DLNR
NARS	Natural Area Reserves System, DLNR
NOI	Notice of Intent to Decommission CSO
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NRL	Naval Research Laboratory
OCCL	Office of Conservation and Coastal Lands, DLNR
OHA	Office of Hawaiian Affairs
OMKM	Office of Mauna Kea Management
OSHA	Occupational Safety and Health Administration
PTA	Pōhakuloa Training Area, Army
RAP	Remedial Action Plan
REC	Recognized Environmental Conditions
SAP	Environmental Site Assessment Phase II Sampling and Analysis Plan
SDP	Site Decommissioning Plan
SDRP	Site Deconstruction and Removal Plan
SHPD	State Historic Preservation Division, DLNR
SIHP	State Inventory of Historic Places
SRP	Site Restoration Plan
Sublease	Sublease Agreement between UH and Caltech
SWPPP	Storm Water Pollution Prevention Plan
TMK	Tax Map Key
TMT	Thirty Meter Telescope

UH	University of Hawaiʻi
UHH	University of Hawaiʻi at Hilo
VIS	Visitor Information Station

CHAPTER 1: INTRODUCTION TO THE SITE DECOMMISSIONING PLAN

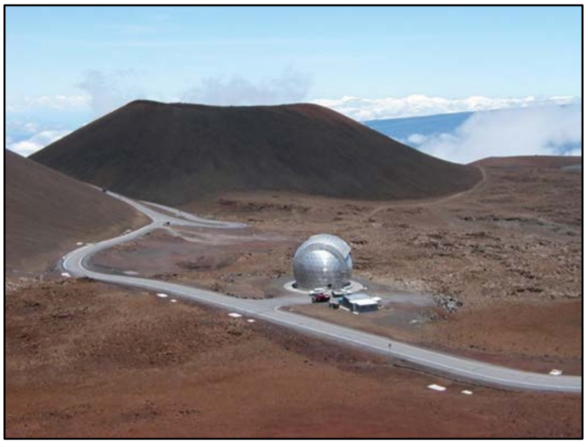
1.1 INTRODUCTION

The Caltech Submillimeter Observatory (CSO) facility is located on a small portion of TMK No. No. 4-4-015:009, which is known as the Mauna Kea Science Reserve (MKSR), near the summit of Maunakea in the Hāmākua District on the Island of Hawai‘i (see Figure 1-1). This facility is owned and operated by the California Institute of Technology (henceforth referred to as “Caltech”) on land subleased from the University of Hawai‘i (UH), which in turn leases the MKSR from the State of Hawai‘i, Board of Land and Natural Resources (BLNR). When the CSO was operational, it was a 10.4-meter (34 foot) diameter telescope engaged in astronomical observations in the terahertz radiation band (submillimeter wavelengths). The CSO saw first light in 1986 and was closed 29 years later on September 8, 2015. Caltech formally tendered its Notice of Intent (NOI) to decommission the CSO to the UH Office of Mauna Kea Management (OMKM, now the Center for Maunakea Stewardship) on November 18, 2015.[1] The current state of the CSO facility is shown in Figure 1.2.

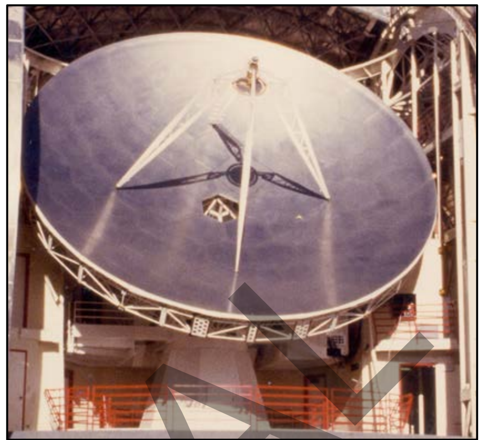
This Site Decommissioning Plan (SDP) describes the steps and processes that Caltech intends to take to decommission the CSO and restore the area pursuant to the *Mauna Kea Comprehensive Management Plan* (CMP, 2009), and specifically to its component *Decommissioning Plan for the Mauna Kea Observatories* (DP, 2010). The DP provides a framework for observatories on Maunakea, to ensure that the State of Hawai‘i, Department of Land and Natural Resources (DLNR) as landowner, the UH as lessee and permittee, and the observatories as sublessees all have clear expectations of the observatory decommissioning process and can plan appropriately for it. In principle, the DP: (*i*) defines decommissioning and the steps necessary to achieving it; (*ii*) outlines the terms of decommissioning contained in UH’s master lease and existing sub-leases; (*iii*) provides information on financial planning for decommissioning; and (*iv*) offers guidance for the practical course of action needed to implement decommissioning.

[1] On August 20, 2020, the University of Hawai‘i’s Board of Regents approved restructuring of the management of Maunakea by merging Mauna Kea Observatory Support Services (MKSS) with the Office of Mauna Kea Management (OMKM) and other UH responsibilities under one management entity identified as the Center for Maunakea Stewardship (CMS). While this document makes references to OMKM related to past reviews and approvals, all future decommissioning activities will be coordinated with CMS.

Figure 1-1: Caltech Submillimeter Observatory



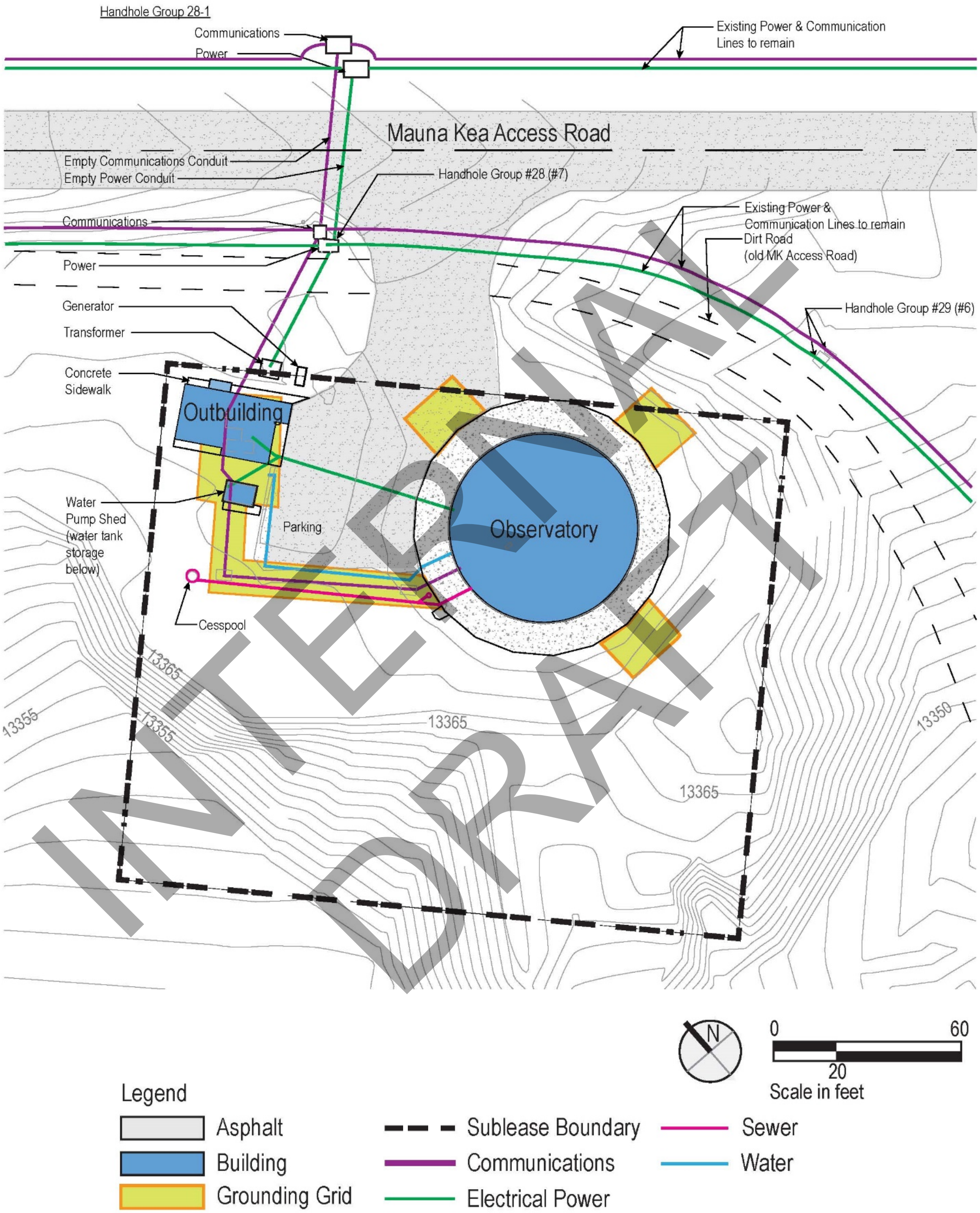
The CSO stands beside the Mauna Kea Access Road.



The CSO with dome open

Source: CSO

Figure 1-2: Current State of the CSO Facility



Source: M3 Engineering and Technology (2020)

As established in Section 4.2 of the DP, each observatory has unique circumstances, but the SDP must document the condition of the site to be decommissioned, outline the approach to decommissioning, and propose a plan for site restoration. In order to do that in an orderly way, the DP stipulates that an SDP shall be developed in stages, consisting of the following four sequential components:

1. Notice of Intent (NOI).
2. Environmental Due Diligence (EDD) review.
3. Site Deconstruction and Removal Plan (SDRP).
4. Site Restoration Plan (SRP).

Pursuant to Section 4.2.4 of the DP, an additional requirement is for a Cost-Benefit Analysis (CBA) across a range of viable alternative approaches to decommissioning, analyzing each alternative's potential benefits and impacts on natural and cultural resources during and after a facility's deconstruction, removal, and restoration of its site. Figure 1-4 presents the sequence of an SDP as a flow chart drawn from the DP.

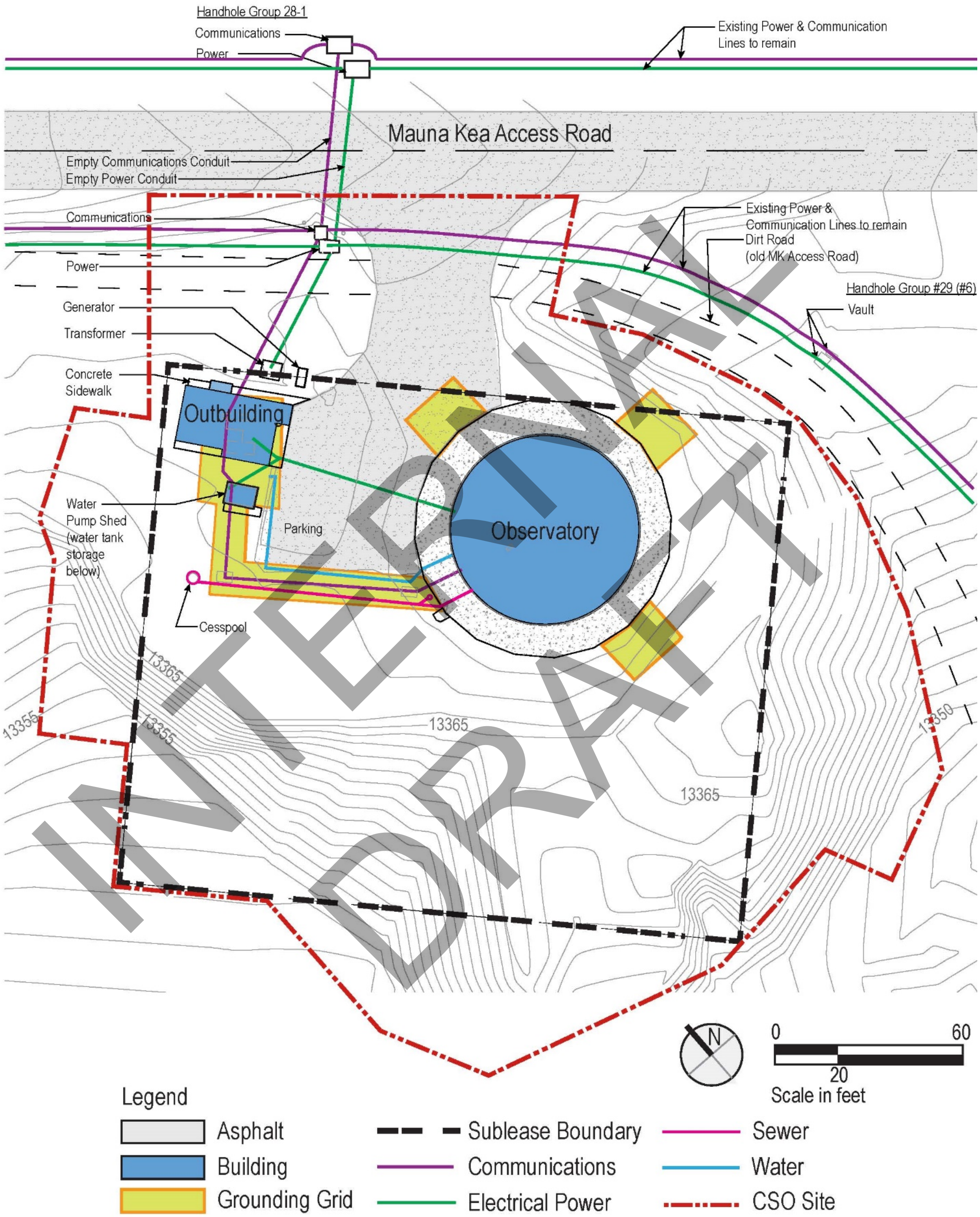
This SDP defines the CSO Site as the sublease area and other minor adjacent areas that were disturbed during the original construction or will be disturbed during the decommissioning of the CSO (Figure 1-3). This SDP also identifies a Preferred Alternative, which consists of complete facility and infrastructure removal and full restoration of the CSO Site.

All components of this SDP have been developed by Caltech in coordination with the Center for Maunakea Stewardship (CMS) and in accordance with the DP. CMS will, in turn, coordinate reviews by (*i*) Kahu Kū Mauna Council (KKM), an advisory group composed of members of the Native Hawaiian community, and (*ii*) the Mauna Kea Management Board (MKMB), an advisory group composed of members from the Hawaiʻi Island community. Both KKM and MKMB advise CMS, and the Chancellor of the University of Hawaiʻi at Hilo (UH Hilo) on matters related to Maunakea. In addition, CMS will coordinate reviews by its Environmental Committee and Decommissioning Review Committee. MKMB's recommendation is forwarded to the UH President. The Final SDP may require the approval of the UH Board of Regents (BOR). Lastly, the State of Hawaiʻi Board of Land and Natural Resources (BLNR) issue a Conservation District Use Permit (CDUP) for the decommissioning.[2]

Based on the guidance contained in the DP, the following subsections briefly characterize the purpose(s) and content of the components of the SDP. Readers should note that the use of terms such as *deconstruction*, *demolition*, *facility*, *infrastructure*, *removal*, and *restoration* in this SDP are the same as defined in the DP.

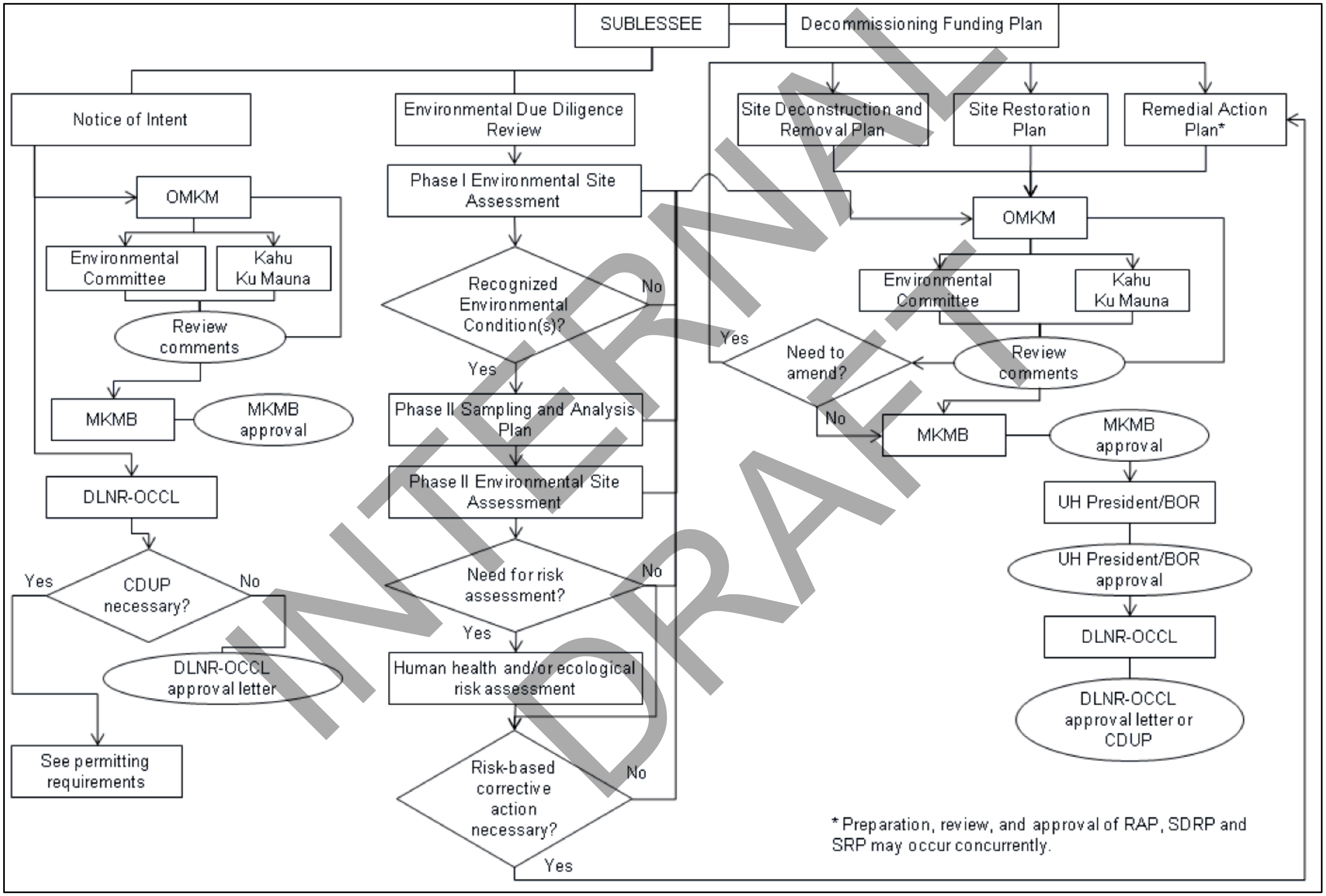
[2] The CDUP process is managed by DLNR's Office of Conservation and Coastal Lands (OCCL). In a letter dated February 19, 2016, OCCL indicated the CDUP for the decommissioning of CSO will be a Board Permit.

Figure 1-3: Extent of the CSO Site



Source: M3

Figure 1-4: Components of a Site Decommissioning Plan



Source: *Decommissioning Plan* (2010), Figure 1. Components of a Site Decommissioning Plan; page 19.

1.2 COMPONENTS OF THE SDP

1.2.1 Notice of Intent (NOI)

The DP stipulates that:

> *The first component of the decommissioning process is the preparation of a* Notice of Intent (NOI) … *The purpose of the Notice of Intent is to propose whether a site will be removed, continued for use as an observatory by a third party, or retrofitted for a different use. Intentions for site restoration should also be described in the Notice of Intent.* (DP 2010, Section 4.2.1, p. 20)

Caltech submitted its *Notice of Intent to Decommission CSO* (NOI) to OMKM on November 18, 2015. On March 22, 2016, Caltech submitted an addendum to that NOI consisting of an updated site plan of CSO. The NOI stated that Caltech's intent with the decommissioning process was total removal of all structures and full restoration of the site, followed by surrender of the sublease to UH. The NOI is further discussed in Chapter 2 and the NOI, its addendum, and documentation of its formal acceptance by OCCL, OMKM, and UH are included in Appendix A.

1.2.2 Environmental Due Diligence Review (EDD)

A Phase I Environmental Site Assessment (ESA) to identify any recognized environmental conditions (RECs) is the first step in the EDD review. When a REC is identified, an additional investigative analysis in the form of a Phase II ESA is typically required and subsequent steps may be necessary. All steps are subject to evaluation by UH and OCCL.

Caltech conducted a Phase I ESA in 2016 that identified a REC: hydraulic oil residue below the telescope and slab foundations. This residue is the result of a spill reported to the State of Hawai‘i Department of Health (DOH) in 2009 and possibly prior spills during the initial construction of CSO. Caltech has prepared a draft Phase II Sampling and Analysis Plan (SAP) per the DP-identified process. These are discussed in Chapter 3 and together make up the EDD review to date; the Phase I ESA is provided in Appendix B and the Phase II SAP is included in Appendix C.

1.2.3 Site Deconstruction and Removal Plan (SDRP)

The purpose of the SDRP is to document the proposed methods and activities for (*i*) demolishing, in part or total, the improvements on the subject site, (*ii*) grading and grubbing of the site, (*iii*) stockpiling of fill material(s), and (*iv*) all necessary waste recovery, reuse, and/or disposal operations. In its final form, the SDRP will include copies of required plans, drawings, permits, and authorizations required to implement it. The DP stipulates that the SDRP also include a CBA and schedule for implementation.

The CSO deconstruction and removal methods, activities, and schedule are outlined in Chapter 5. Because the DP stipulates that both the SDRP and SRP include a CBA, the CSO CBA is presented separately in Chapter 7 and addresses both the SDRP and SRP CBA requirements.

1.2.4 Site Restoration Plan (SRP)

The purpose of the SRP is to present specific targets for site restoration and to describe the methods planned for restoring disturbed areas after the deconstruction and removal activities characterized in the SDRP are complete. As with other components of the SDP, the SRP is unique to the observatory site, and considers the cultural, biological, and physical aspects of site being restored. The SRP must include provisions for monitoring the effectiveness of site restoration activities and characterizing the success and/or failure of restoration efforts. The DP indicates that principles of adaptive management are applicable to the SRP; however, there are no previous efforts that would inform the planned CSO effort on a lava substrate.

The DP indicates site restoration includes physical and ecological components. There are two integral objectives for site restoration: (*i*) restoring the look and feel of the site prior to construction of the observatory, and (*ii*) providing habitat for arthropod fauna. The CSO SRP in Chapter 6 provides and reviews available original observatory construction documents and presents the methods Caltech will use to restore the site to a condition consistent with pre-construction conditions and in harmony with adjacent areas. In support of the second objective noted above, the SRP in Chapter 6 evaluates the potential for native arthropod habitat restoration in consultation and coordination with CMS.

The DP indicates that the level of restoration attempted and the potential benefits and impacts of the restoration activities on natural and cultural resources during and post-activity are to be carefully evaluated, and a CBA provided. Because the DP stipulates that both the SDRP and SRP include a CBA, the all-inclusive CSO CBA is presented separately in Chapter 7.

1.3 PERMITTING, DISCLOSURE, AND ALTERNATIVES

This section provides an overview of land use requirements to implement the SDP. OCCL indicated in its letter dated February 19, 2016 (Reference No. HA-16-118), to OMKM that a Hawaiʻi Revised Statutes (HRS) Chapter 343 Environmental Assessment (EA) and a Conservation District Use Permit (CDUP) from the BLNR will be required. In that letter, it identified the EA and Conservation District Use Application (CDUA) as "next steps" in the decommissioning process and directed that the EA discuss the preferred alternative for deconstruction and removal of the CSO facility and restoration of the site. Caltech began consulting with other permitting authorities related to various aspects of the SDRP in early 2018.

1.3.1 Environmental Assessment (EA)

HRS Chapter 343 and its implementing regulations in HAR Chapter 11-200.1 govern EAs. UH has indicated that the CSO decommissioning project will be an "applicant action" with Caltech being the applicant and BLNR being the "approving agency." The EA will assess and disclose project impacts, including whether the proposed project will have a significant impact in the context of the 13 significance criteria in the regulations.

The primary relevance of the EA to this SDP is that the alternatives included in this SDP are the same alternatives that will be considered in the forthcoming Draft EA (DEA), and that the specific proposal for total removal of CSO facilities and full restoration of the site will be the Preferred Alternative in that report. Readers should also note that the CBA in this SDP (Chapter 7) is different in nature and scope than the EA's analysis of potentially significant impacts, and the two should not be conflated.

1.3.2 Alternatives Included in the SDP

Table 1-1 briefly summarizes the potential alternatives that will be considered in detail in this SDP and the forthcoming EA. This range of alternatives is detailed in Chapter 4 and includes the Preferred Alternative[3], which consists of complete facility and infrastructure removal and full restoration of the CSO Site. Alternatives have been developed based on the scenarios contained in the DP, as well as the specific examples of alternatives recommended for inclusion in EAs and EISs contained in HAR § 11-200.1-24(h). These recommendations include a "No Action" alternative, which would not fulfill the objectives of the SDP, but is useful as a baseline for comparison of impacts with the action alternatives. The range of alternatives presented here will also be evaluated in the CBA presented in Chapter 7 of this report.

In addition to the scope of decommissioning outlined in Table 1-1, the future decommissioning of shared infrastructure is a component of all action alternatives. Shared infrastructure consists of utility improvements shared by multiple Maunakea observatories or uses (e.g., utility conduits and lines that serve both CSO and nearby James Clerk Maxwell Telescope (JCMT). Caltech cannot remove the shared infrastructure because it needs to remain in place to service the other facilities and uses it supports. As part of its CSO decommissioning, Caltech will provide funds to UH equal to its pro-rated portion of cost estimates for the removal of the shared infrastructure. Those costs are included in decommissioning cost estimates and funding commitments in Chapter 7 and Chapter 8.

[3] The Preferred Alternative is the proposed "action" as that term is defined in HAR § 11-200.1-2.

Table 1-1: Alternatives Included in the SDP and EA

Alt No.	*Summary*	*Description*
ALT-1	No Action	Nothing would change from the existing state of the site. The observatory and all other above-ground improvements would remain unchanged from their current condition. All above- and below-ground infrastructure (including foundation, cesspool, etc.) would remain unchanged. There would be no restoration of topography or habitat.
ALT-2	Preferred Alternative or Action; complete facility and infrastructure removal with full restoration	The observatory, outbuilding, and other above-ground facilities would be completely removed. In addition, all subsurface infrastructure within the CSO Site, including but not limited to foundations and cesspool, would be completely removed. The topography of the site would be restored to its pre-construction condition to the extent practicable. Native arthropod habitat would be restored to the extent practicable.
ALT-3	Complete facility and infrastructure removal with moderate restoration	The facility and infrastructure removal would be the same as ALT-2. This alternative addresses the circumstance in which unanticipated factors, only evident after removal begins, preclude full restoration of the CSO Site but moderate restoration is feasible. The topography would not match pre-construction conditions but would be restored to a natural look and feel to the extent practicable. Native arthropod habitat would be restored but full restoration of topography would not be achieved.
ALT-4	Facility removal, infrastructure capping, and moderate restoration	This alternative addresses the circumstance in which unanticipated conditions, only evident after removal begins, preclude complete removal of subsurface infrastructure and full restoration. The observatory, outbuilding, and other above-ground facilities would be completely removed. The observatory and outbuilding foundations, cesspool, and other subsurface infrastructure would be removed to the extent practicable, but some portions would remain. Subsurface utilities on the CSO Site would be capped and abandoned in place. The site would be regraded such that the effects of all removal activity, including trenching to remove subsurface infrastructure, are not visible. The topography would not fully match pre-construction conditions but would be restored to a natural look and feel. Native arthropod habitat would be restored but full restoration of topography would not be achieved.

Source: Caltech (2020)

1.3.3 Anticipated Permitting Associated with Preferred Alternative

The anticipated permitting process required for the current Preferred Alternative after the SDP and EA are complete includes a CDUP Board Permit from BLNR, a National Pollutant Discharge Elimination System (NPDES) construction activities permit from DOH, and ministerial construction activity permits from the County of Hawaiʻi. During the EA process Caltech will consult with these and other agencies to confirm what permits will be required.

CHAPTER 2: NOTICE OF INTENT (NOI)

The NOI advises UH of Caltech's intent to decommission the CSO. It provides a detailed inventory of all the above-ground structures, foundations, and subsurface structures on the site, including drawings detailing the foundations and cesspool. It states that Caltech's intent is *total removal* of structures and infrastructure on the site and *full restoration* of the site followed by surrender of the sublease to UH.

Submittals and actions related to NOI to date, all of which are included in Appendix A, are listed below:

1. Caltech submitted its 'Notice of Intent to Decommission' CSO to the Office of Mauna Kea Management on November 18, 2015.
2. Caltech submitted on March 22, 2016, to OMKM an addendum consisting of updated site plan provided by dlb & Associates (2016).
3. In a February 15, 2016, letter to OMKM, addressing the NOI, DLNR-OCCL indicated that the CSO NOI appears "to be in compliance with the requirements of the Decommissioning Plan."
4. Kahu Kū Mauna reviewed the CSO NOI on April 12, 2016.
5. MKMB unanimously approved the CSO NOI at its meeting on May 11, 2016.
6. UH approved it on December 20, 2019 (Memorandum from Stephanie Nagata, Director, OMKM to David Lassner, President, UH, via Bonnie Irwin, Chancellor, UH Hilo; signed by Lassner and Irwin to indicate approval).

The NOI has not been modified since the 2016 addendum (Item 2 above). The scope of the SDP's preferred alternative is consistent with the NOI. Since 2016, deconstruction details have come into sharper focus as subsequent steps in the decommissioning planning process have progressed. The NOI has not been and will not be further amended. The new information is reflected in the detailed plans concerning site decommissioning in subsequent chapters of this SDP.

CHAPTER 3: ENVIRONMENTAL DUE DILIGENCE (EDD) REVIEW

3.1 INTRODUCTION

The EDD review commences with a Phase I ESA. The goal of a Phase I ESA is to identify recognized environmental conditions (RECs), which is defined by *ASTM Standard E1527-13* as:

> *"the presence or likely presence of any hazardous substances or petroleum products on a property: (1) due to release to the environment; (2) under conditions indicative of a release to the environment; or (3) under conditions that pose a material threat of a future release to the environment.* De minimis *conditions are not recognized environmental conditions."*

If RECs are identified in the Phase I ESA, then a Phase II ESA is typically required. If sample collection is required, a Phase II Sampling and Analysis Plan (SAP) is prepared first. The DP outlines potential subsequent steps that may be required to address RECs if they persist.

Caltech conducted a Phase I ESA that identified a REC. Subsequently, Caltech prepared a Draft Phase II SAP. The Phase II SAP can only be implemented during the deconstruction of the CSO; sample results will inform a Phase II ESA that will be prepared during deconstruction. The Phase II ESA may recommend subsequent measures to address the REC; those measures would be implemented during site restoration. The following sections provide detail on each of these elements; the Phase I ESA is included in Appendix B and the draft Phase II SAP is included in Appendix C.

3.2 CSO PHASE I ENVIRONMENTAL SITE ASSESSMENT

Caltech contracted with ENPRO Environmental to conduct the Phase I ESA (Appendix B). The following sections summarize the Phase I ESA and its review and approval by UH.

3.2.1 Phase I ESA Summary

The Phase I ESA's §1.1 *Findings and Conclusions* states

> ***This assessment has revealed no evidence of* recognized environmental conditions (RECs) *in connection with the* property *except for the following:***
>
> > *REC 1 Hydraulic Fluid Release. This finding is considered a recognized environmental condition because, despite the release being cleaned up to the satisfaction of the Department of Health there is a No Further Action status pending further soil testing under the slab after the decommissioning of the observatory.*

The Phase I ESA indicates that there may have been two hydraulic fluid releases at the site. One release was identified in 2009, which was reported to the State of Hawai'i DOH. The Phase I report states, "Cleanup of the May 2009 hydraulic oil release has been completed to the satisfaction of the Department of Health. However, a *No Further Action* designation is pending additional investigation and cleanup to be undertaken when the observatory decommissions." During the remedial actions associated with 2009 release, evidence of an earlier release was observed and, as summarized in a letter from OCCL to CSO (OCCL, 2009), the second release possibly occurred, "during the construction phase before the slab was poured more than 20 years ago. It has been recommended that the cleanup of this material be deferred until the decommissioning of the CSO facility."

The Phase I ESA recommends that soil samples be collected and analyzed for contaminants associated with hydraulic fluid to assess whether the spill has been fully remediated. The implementation of this recommendation by Caltech is discussed in Section 5.1.11.

3.2.2 Phase I ESA Review and Approval by UH

Caltech submitted the Phase I ESA to OMKM on June 14, 2018.[4]

Following Kahu Kū Mauna, Environmental Committee, and Decommissioning Design Review Committee review and comment, MKMB considered the Phase I ESA at its September 27, 2019, meeting and approved it.

UH approved the Phase I ESA on December 20, 2019 (Memorandum from Stephanie Nagata, Director, OMKM to David Lassner, President, UH, via Bonnie Irwin, Chancellor, UH Hilo; signed by Lassner and Irwin to indicate approval).

3.3 REMAINING EDD REVIEW TASKS

The Phase I ESA identified a need for sampling and analysis of the region affected by the hydraulic spill during deconstruction when the ground under the foundation becomes accessible. A draft Phase II SAP is included in Appendix C, will be reviewed by the State of Hawaiʻi Department of Health (DOH), CMS, and UH, and then will be implemented during CSO deconstruction. The Phase II SAP objective related to the hydraulic oil release is to assess whether contaminants associated with it are present in soil beneath the CSO foundation slab. To achieve these objectives, soil samples will be collected per the Phase II SAP during the CSO deconstruction and removal phase of the decommissioning.

Stakeholders have indicated to Caltech a concern regarding the potential for the CSO cesspool to have adversely impacted the subsurface. Therefore, although the cesspool is not a REC and there is no regulatory or DP requirement to investigate the cesspool, Caltech has incorporated an investigation of it into the Phase II SAP. Soil samples will be collected beneath the cesspool per the Phase II SAP during the CSO deconstruction and removal phase of the decommissioning. Those samples will be analyzed for contaminants potentially present at film processing sites and mercury, even though film was never processed and mercury never used at CSO.

Each soil sample collected will consist of roughly 3.3 pounds (1.5 kilograms) of soil and will be shipped to certified laboratory on the U.S. mainland. The soil samples must be shipped, handled, and disposed of per the laboratory's permit and cannot be returned to Maunakea. It will take roughly two weeks for the samples collected during the deconstruction and removal phase to be analyzed by the laboratory and the results provided to Caltech's environmental consultant. The

4 Caltech submitted the Phase I ESA on March 30, 2016. OMKM raised concerns regarding the accuracy of its geology/hydrology review. The resubmission of the Phase I ESA incorporated a Letter of Clarification from ENPRO regarding this topic in response to this concern. The Phase I ESA itself remained unchanged.

consultant is expected to require two weeks from receipt of analytical results to prepare a Phase II ESA report summarizing the implementation of the SAP and assessing any remaining human health or ecological risks. To the degree possible, the deconstruction sequence will be managed such that the sampling can be done and then, while the samples are analyzed and results considered, other deconstruction activities can continue. The Phase II ESA will state whether a Remedial Action Plan (RAP) is necessary to mitigate any remaining risks to human health and/or the environment.

3.4 OTHER ENVIRONMENTAL CONCERNS

Caltech contracted with Lehua Environmental, Inc. (LEI) to conduct a survey of asbestos, lead paint and mold in the CSO structures (Lehua HazMat Report, 2019; Appendix D). LEI found:

- No asbestos in the samples collected.
- Lead was detected at less than 5,000 mg/kg in the majority of the paint chip samples collected, making them lead-containing paint (LCP). Lead in excess of the EPA/HUD guideline of 5,000 mg/kg was detected in some paint chip samples, which means paint represented by those samples is considered to be lead-based paint (LBP).
- No mold or fungi of concern.

The SDRP (see Chapter 5) includes Best Management Practices (BMPs) that will be implemented during deconstruction to address the LCP and LBP (Section 5.1.2.3).

CHAPTER 4: ALTERNATIVES

4.1 PURPOSE AND NEED

Caltech's purpose is to comply with end-of-sublease conditions in the sublease between Caltech and UH for the site where the CSO is located. The "Sublease Agreement among the California Institute of Technology, the University of Hawaiʻi, and the State of Hawaiʻi, Department of Land and Natural Resources, Sublease H09176" (CSO Sublease 1983) offers four options on termination or expiration of the sublease:

1. Sale to UH
2. Surrender with concurrence of UH
3. Sale to a third party acceptable to UH
4. Remove the property and restore the site to even grade at the expense of Caltech

In order to proceed with any end-of-sublease option, Caltech needs to address applicable CMP guidance, specifically its DP, so that it may obtain the necessary approvals and permits, which are government actions, that will allow for the decommissioning of the CSO to proceed. The DP outlines removal options and restoration levels and states that "For decision making purposes, the starting point for determining the scope and extent of removal shall be total removal" and "The starting point for determining the level to which a site is to be restored shall be total restoration to the pre-construction condition."

4.2 IDENTIFICATION OF FEASIBLE ALTERNATIVES

This section identifies a long list of potential alternatives based on the sublease conditions, the scenarios contained in the DP, as well as the specific examples of alternatives recommended for inclusion in EAs and EISs contained in HAR § 11-200.1-24.

Of the four end-of-sublease options outlined in the CSO Sublease, only the fourth, removal and restoration, is considered feasible because (*i*) UH has indicated they are not interested in purchasing the property in its entirety from Caltech, (*ii*) no third party has indicated an interest in buying the property in its entirety from Caltech, and (*iii*) although UH has not explicitly stated it, Caltech assumes that UH would not approve the surrender of the property in its entirety.[5]

The DP identifies two options for removal and three levels of restoration that can be considered:

- Removal options per the DP consist of:
  - <u>Infrastructure capping</u> (also referred to as "partial removal") involves removal of above ground facilities, with or without utilities, and leaves all or part of the underground portion of the facility in place. Under this option, varying degrees of infrastructure removal and capping can be considered.
  - <u>Complete infrastructure removal</u> (also referred to as "total removal" or "full removal") involves removal of the entire facility, including underground

[5] Surrendering is akin to the No Action alternative (ALT-1), except that it requires UH approval.

utilities, pilings, and foundation to the extent practicable under normal engineering deconstruction practices.

- Restoration levels per the DP consist of:
  - <u>Minimal restoration</u> is the removal of all manmade materials and grading of the site, leaving the area in safe condition.
  - <u>Moderate restoration</u> goes beyond minimal to include enhancing the physical habitat structure to benefit the native arthropod community.
  - <u>Full restoration</u> (also referred to as “total restoration”) would return the site to its original pre-construction topography, as well as restoring arthropod habitat.

On behalf of Caltech, M3 Engineering and Technology Corporation (M3), which employs architects and engineers that specialize in observatories, has evaluated the feasibility of complete infrastructure removal and full restoration of the CSO Site. M3’s analysis indicated a high level of confidence that complete infrastructure removal and full restoration is feasible and they have developed a plan to do so. Therefore, the full range of removal and restoration options is considered feasible, from complete infrastructure removal and full restoration at one end of the spectrum (the “starting point” per the DP) to infrastructure capping and minimal restoration at the other end. A simple integration of the options results in the following feasible alternatives:

1. **No Action**
2. **Complete facility and infrastructure removal with full restoration**
3. **Complete facility and infrastructure removal with moderate restoration**
4. Complete facility and infrastructure removal with minimal restoration (this DP alternative most closely parallels the CSO Sublease fourth option)
5. Complete facility removal, infrastructure capping, and full restoration
6. **Complete facility removal, infrastructure capping, and moderate restoration**
7. Complete facility removal, infrastructure capping and minimal restoration

OCCL and UH suggest alternatives that include retention of the outbuilding to support safety-related goals in the CMP also be considered. This introduces a third removal option and, when integrated with the restoration levels, results in the following feasible alternatives being added to those listed above:

8. Partial facility removal (outbuilding retention), infrastructure capping, and full restoration over about 80% of the Site
9. Partial facility removal (outbuilding retention), infrastructure capping, and moderate restoration over about 80% of the Site
10. Partial facility removal (outbuilding retention), infrastructure capping, and minimal restoration over about 80% of the Site

4.3 REASONABLE ALTERNATIVES FOR DETAILED CONSIDERATION

The full range of feasible alternatives (Section 4.2) was reduced to a reasonable set for detailed consideration in this SDP and the forthcoming EA. Those alternatives are in **bold** above, were introduced in Table 1-1, and are detailed in the sections below. The other alternatives listed in Section 4.2 were screened out and rejected from detailed consideration for the reasons described in Section 4.4.

4.3.1 ALT-1: No Action

Under the "No Action" alternative (i.e., ALT-1) nothing would change from the existing state of the site. No effort would be made to remove the improvements and infrastructure (the observatory, outbuilding, driveway, foundation, cesspool, utilities, etc.) and no effort would be made to restore any part of the site.

The No Action alternative does not address the purpose and need. It is only being considered in detail to provide a baseline for comparison with the other, action alternatives.

4.3.2 ALT-2: Complete Facility and Infrastructure Removal with Full Restoration

The complete facility and infrastructure removal with full restoration alternative (ALT-2) is, per the DP, the starting point for CSO decommissioning decision-making purposes. ALT-2 is consistent with the purpose and need (Section 4.1), Caltech's intent as outlined in the NOI (see Chapter 2 and Appendix A), and is the Preferred Alternative. Under this alternative, the following would be achieved at the CSO Site:

- Removal of the following using methods outlined in the SDRP presented in Chapter 5:
    - The observatory, outbuilding, and other above-ground facilities would be completely removed.
    - The observatory and outbuilding foundations, cesspool, and other subsurface infrastructure on the CSO Site would be completely removed. The bulk of the subsurface infrastructure did not require excavation into the existing lava flow during construction. That infrastructure, and the fill around it, can be readily removed. There are locations where excavation into the lava flow took place during CSO construction, for example, the cesspool. The cesspool and other infrastructure, and fill around them, where excavation into the lava flow occurred, can also be readily removed but doing so will create cavities that will be addressed in the restoration process.
- Site restoration, as follows, using the methods outlined in Chapter 6, the SRP:
    - The topography would be returned to its pre-construction condition to the greatest extent possible. This will be achieved by removing fill placed on the lava flow during construction to the greatest extent possible. Cavities in the lava flow, where excavation occurred during construction (e.g., the cesspool), will be filled with a portion of the fill placed on the lava flow during construction, which is native to Maunakea.

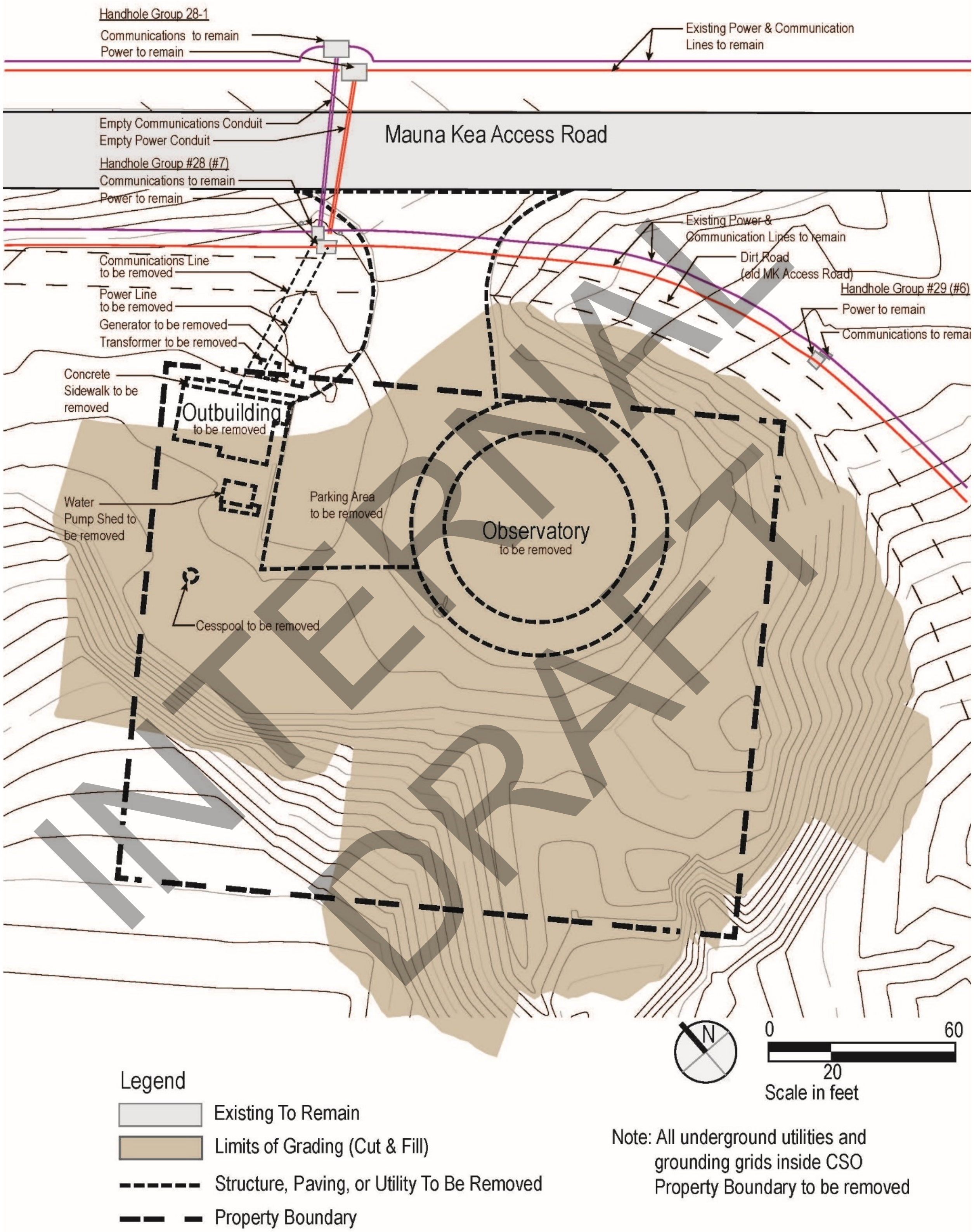
- The habitat would be restored to accommodate arthropod fauna to the greatest extent possible. In areas where cavities in the lava flow have been filled, rocks will be piled instead of attempting to recreate the flow. This would return the entire site to a condition consistent with the surrounding environment.

- Biological monitoring to characterize the effectiveness of restoration efforts as discussed in Chapter 6, the SRP.

In addition, Caltech will provide funds to UH to support the future decommissioning of shared infrastructure. Shared infrastructure consists of utility improvements shared by multiple Maunakea observatories or uses. One example are the electrical and communication lines that cross under the CSO driveway between handhole #28 and #29 (Figure 4-1 and Figure 4-2). Caltech cannot remove the shared infrastructure because it needs to remain in place to service the other facilities and uses it supports. The funds Caltech will provide to UH equal its pro-rated portion of cost estimates for the removal of the shared infrastructure.

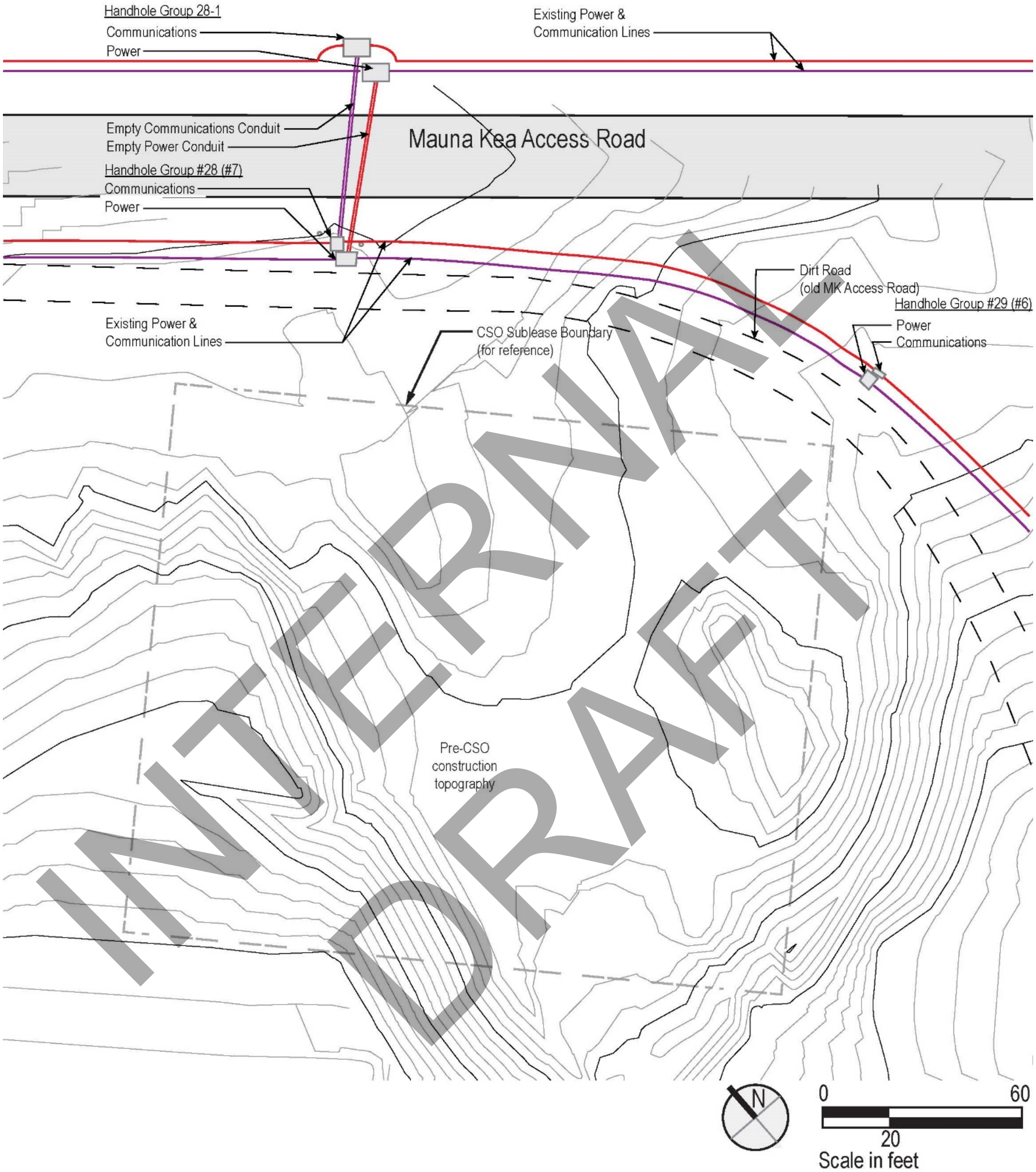
Figure 4-1 illustrates the ALT-2 scope of work and Figure 4-2 illustrates anticipated site conditions following the implementation of the ALT-2 removal and restoration scope of work.

Figure 4-1: ALT-2 Scope of Work



Source: M3

Figure 4-2: ALT-2 Post-Decommissioning



Source: M3

4.3.3 ALT-3: Complete Facility and Infrastructure Removal with Moderate Restoration

This alternative addresses the circumstance in which unanticipated factors, evident only after removal and restoration begins, preclude full restoration of the CSO Site. If such unanticipated factors or conditions are encountered during deconstruction or restoration activities, Caltech will coordinate with construction monitors (Section 5.1.1), CMS, and IfA due to its role as scientific cooperation lead. Caltech, in consultation with CMS and IfA, will select the appropriate course of action.[6] Because full restoration across the entire site would not be achievable, the restoration would be considered moderate. Even though only moderate restoration would be achieved on a portion of the site, Caltech would perform full restoration over the maximum extent of the site achievable. For example, if 40 percent of the site cannot be fully restored for some currently unanticipated reason, Caltech would conduct moderate restoration on that 40 percent and full restoration on the remaining 60 percent.

Under this alternative, the following would be achieved within the CSO Site:

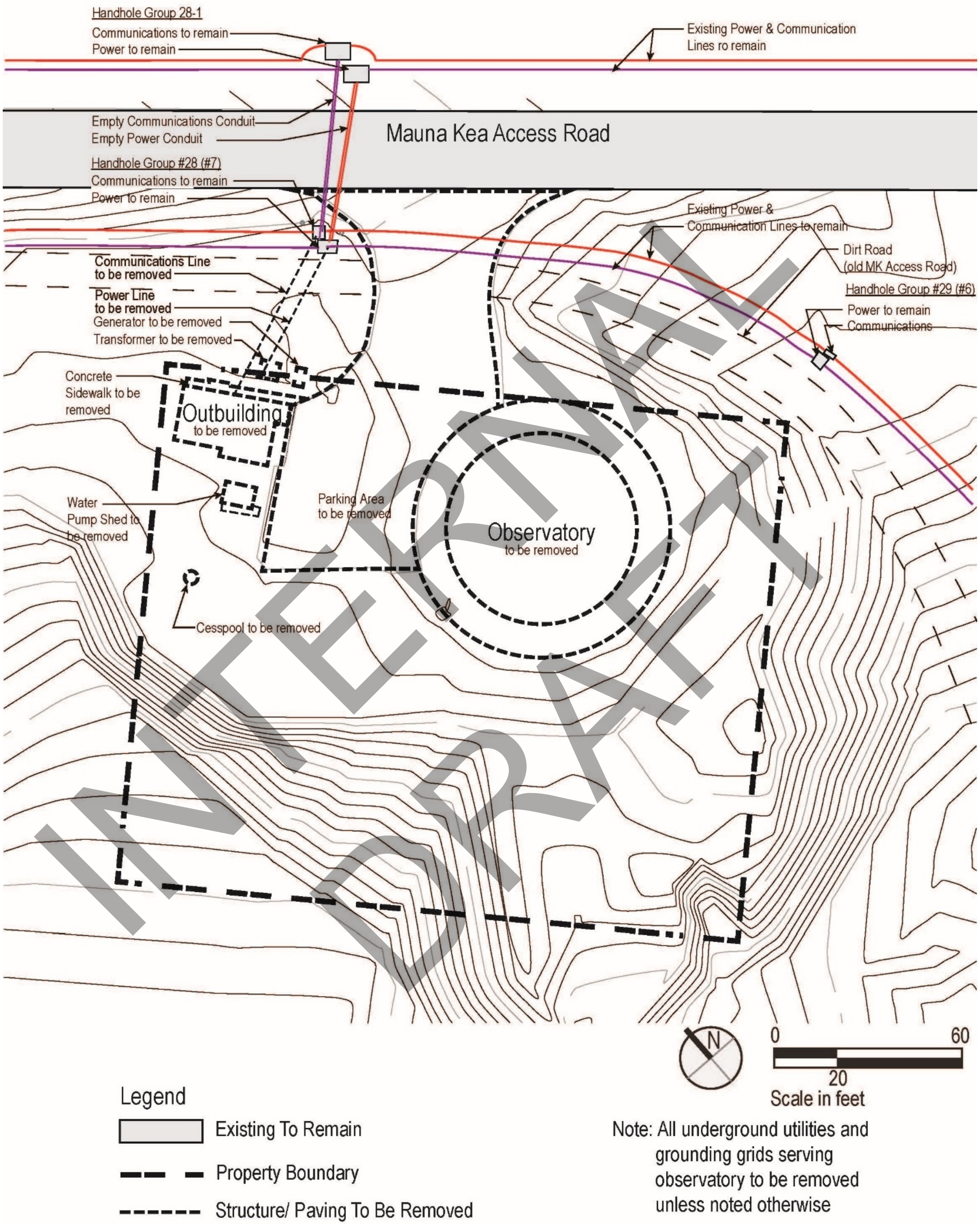
- Removal would be the same as ALT-2 and would use the methods outlined in Chapter 5, the SDRP:
  - The observatory, outbuilding, and other above-ground facilities would be completely removed.
  - The observatory and outbuilding foundations, cesspool, and other subsurface infrastructure on the CSO Site would be completely removed.
- Restoration as follows using methods outlined in Chapter 6, the SRP:
  - The portion of the site that could not be fully restored would be graded, leaving the area in safe condition, but not matching the pre-construction topography.
  - The portion of the site that could be fully restored, if any, would be returned to its pre-construction topography to the greatest extent possible.
  - The habitat would be restored across the entire site to accommodate arthropod fauna to the greatest extent possible.
- Biological monitoring to characterize the effectiveness of restoration efforts as discussed in Chapter 6, the SRP.

In addition, Caltech will provide funds to UH to support the future decommissioning of shared infrastructure. Shared infrastructure consists of utility improvements shared by multiple Maunakea observatories or uses. One example are the electrical and communication lines that cross under the CSO driveway between handhole #28 and #29 (Figure 4-3 and Figure 4-4). Caltech cannot remove the shared infrastructure because it needs to remain in place to service the other facilities and uses it supports. The funds Caltech will provide to UH equal its pro-rated portion of cost estimates for the removal of the shared infrastructure.

Figure 4-3 illustrates the ALT-3 scope of work and Figure 4-4 illustrates anticipated site conditions following the implementation of the ALT-3 removal and restoration scope of work, which is that the CSO fill remains and topography is not restored (e.g., the highly unlikely, worst-case possibility under this alternative).

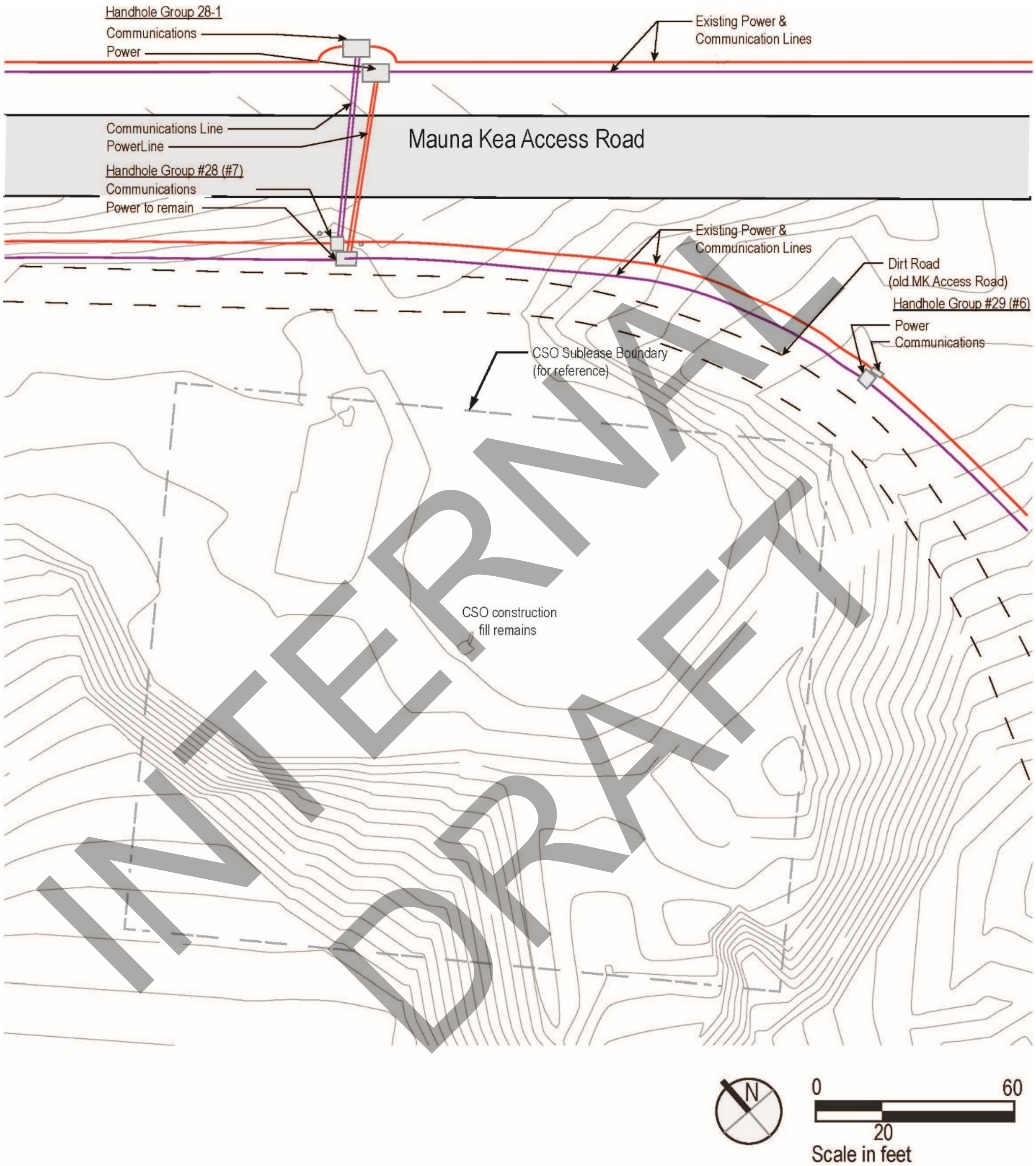
[6] The appropriate course of action will depend on the factor or condition encountered. Possible courses of action include, but are not limited to, (*i*) identifying a remedy that allows for complete removal and full restoration, (*ii*) implementing ALT-3, or (*iii*) implementing ALT-4.

Figure 4-3: ALT-3 Scope of Work



Source: M3

Figure 4-4: ALT-3 Post-Decommissioning



Source: M3

4.3.4 ALT-4: Facility Removal, Infrastructure Capping, and Moderate Restoration

This alternative addresses the circumstance in which unanticipated factors, evident only after removal and restoration begins, preclude complete removal and full restoration. Because complete removal would not be achievable, the removal would be considered infrastructure capping; and because full restoration across the entire site would not be achievable, the restoration would be considered moderate. Even though some infrastructure would be capped and left in place, Caltech would remove its infrastructure to the maximum extent achievable. Similarly, even though only moderate restoration would be achieved on a portion of the site, Caltech would perform full restoration over the maximum extent of the site achievable.

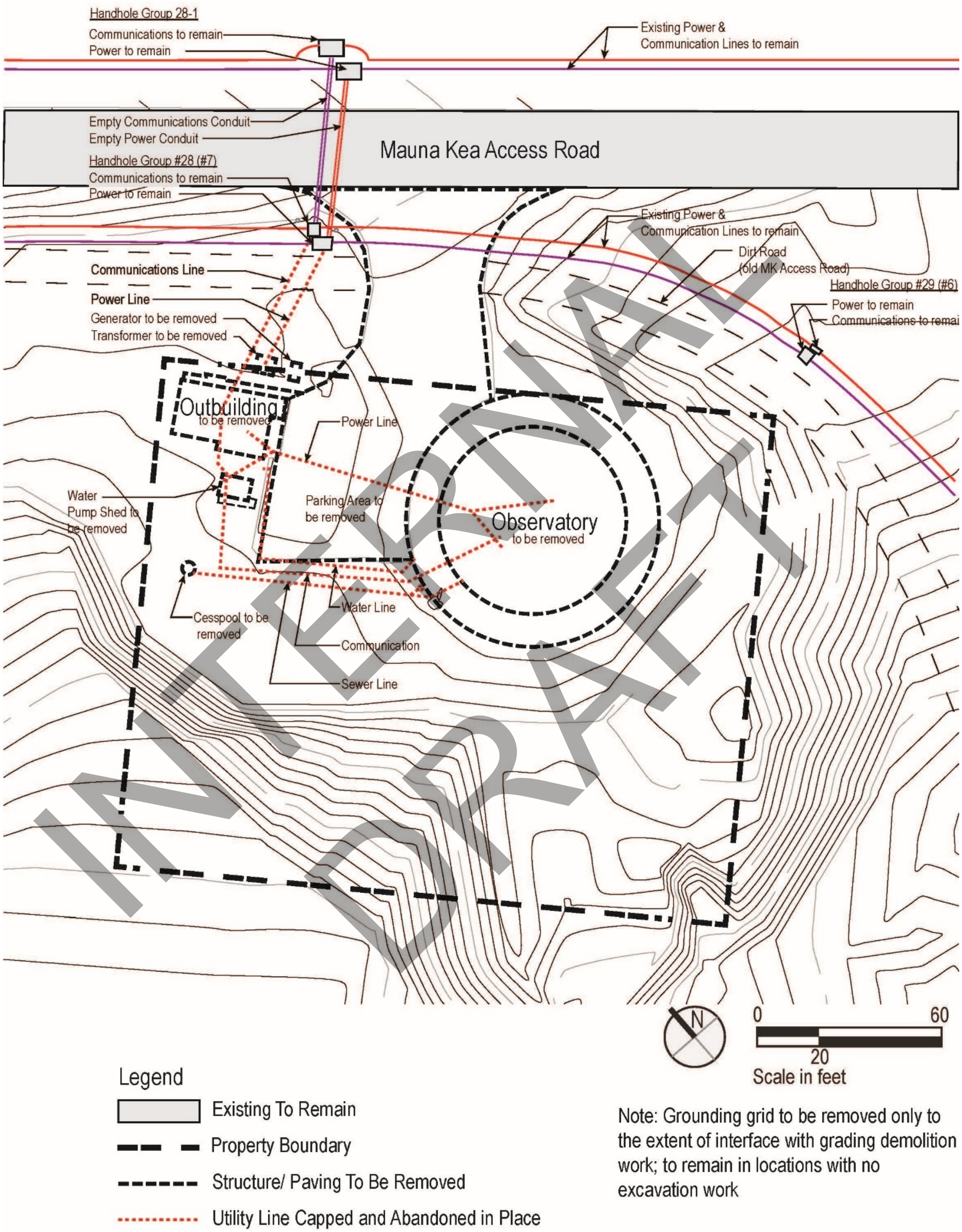
Under this alternative, the following would be achieved within the CSO Site:

- Removal would use the methods outlined in Chapter 5, the SDRP, and consist of:
  - The observatory, outbuilding, and other above-ground facilities would be completely removed.
  - The observatory and outbuilding foundations, cesspool, and other subsurface infrastructure at the CSO Site would be removed to the maximum extent achievable, but some portions would remain.
- Restoration would be similar to ALT-3 and use methods outlined in Chapter 6, the SRP:
  - The portion of the site that could not be fully restored would be graded, leaving the area in safe condition, but not matching the pre-construction topography.
  - The portion of the site that could be fully restored, if any, would be returned to its pre-construction topography to the greatest extent possible.
  - The habitat would be restored across the entire site to accommodate arthropod fauna to the greatest extent possible.
- Biological monitoring to characterize the effectiveness of restoration efforts as discussed in Chapter 6, the SRP.

In addition, Caltech will provide funds to UH to support the future decommissioning of shared infrastructure. Shared infrastructure consists of utility improvements shared by multiple Maunakea observatories or uses. One example are the electrical and communication lines that cross under the CSO driveway between handhole #28 and #29 (Figure 4-5 and Figure 4-6). Caltech cannot remove the shared infrastructure because it needs to remain in place to service the other facilities and uses it supports. The funds Caltech will provide to UH equal its pro-rated portion of cost estimates for the removal of the shared infrastructure.

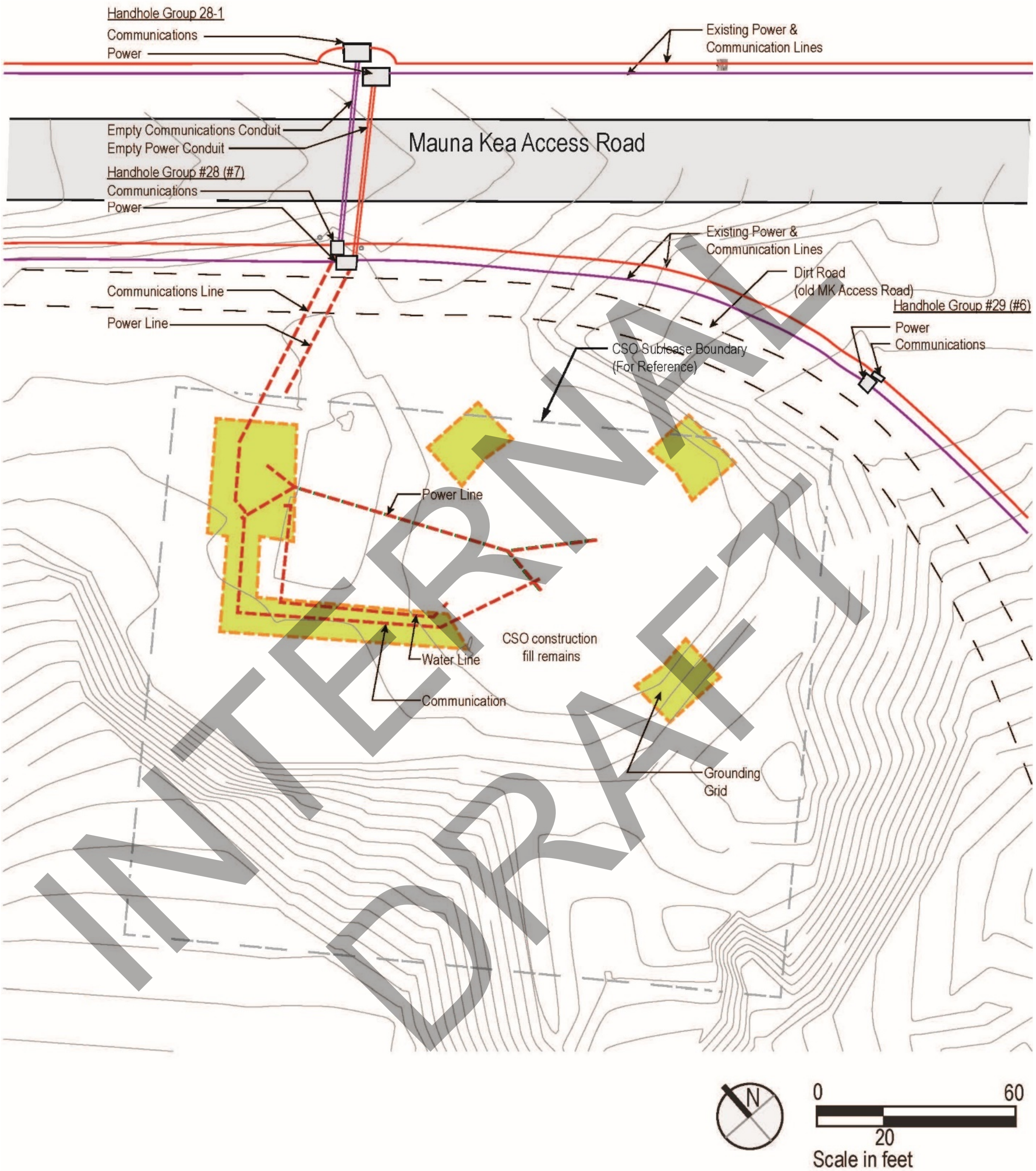
Figure 4-5 illustrates one example of the potential ALT-4 scope of work, which includes the removal of the cesspool and water tank, but utility conduits are capped and left in place. Figure 4-6 illustrates one possible site condition following the implementation of the ALT-4 removal and restoration scope of work, which is that the CSO fill remains and topography is not restored (e.g., the highly unlikely, worst-case possibility under this alternative).

Figure 4-5: ALT-4 Scope of Work Example



Source: M3

Figure 4-6: ALT-4 Post-Decommissioning Example



Source: M3

4.4 ALTERNATIVES CONSIDERED BUT REJECTED

Several of the alternatives considered feasible (Section 4.2) were screened out and will not be analyzed in detail in this SDP or the subsequent EA. They are:

- Complete facility and infrastructure removal with minimal restoration (this DP alternative most closely parallels the CSO Sublease fourth option)
- Complete facility removal, infrastructure capping, and full restoration
- Complete facility removal, infrastructure capping and minimal restoration
- Partial facility removal (outbuilding retention), infrastructure capping, and full restoration over about 80% of the Site
- Partial facility removal (outbuilding retention), infrastructure capping, and moderate restoration over about 80% of the Site
- Partial facility removal (outbuilding retention), infrastructure capping, and minimal restoration over about 80% of the Site

These alternatives were screened out because, although they address the purpose and need to varying degrees, they are inconsistent with Caltech's intent, which was clearly stated in the NOI (Chapter 2 and Appendix A) that was reviewed and accepted by UH and DLNR. In addition, early stakeholder consultations regarding their inclusion indicated limited support for or interest in them.

Specific to the three alternatives that include retention of the outbuilding to support safety-related goals in the CMP (those that include "partial facility removal"), UH has indicated that they believe these goals can be satisfied through other management actions. Contributing factors to the screening out of alternatives that included its retention included (*i*) it never had and is inappropriate to retrofit with restroom or water facilities, and (*ii*) it was designed to house specific equipment, not for human occupancy. Furthermore, assessments included in technical reports indicate that the benefits associated with CSO's decommissioning would be notably curtailed if the outbuilding were retained.

For these and other lesser reasons encountered during initial screening of the alternatives listed in Section 4.2, Caltech has rejected the six listed above and will not evaluate them in detail in this SDP or the subsequent EA.

CHAPTER 5: SITE DECONSTRUCTION AND REMOVAL PLAN (SDRP)

As introduced in Section 1.2.3, the purpose of this SDRP is to document the proposed methods and activities for (*i*) demolishing, in part or total, the infrastructure on the subject site, (*ii*) stockpiling of removed fill material(s), and (*iii*) all necessary waste recovery, reuse, and/or disposal operations. Per the DP, The SDRP will be augmented as planning progresses to include copies of all required plans, drawings, permits, and authorizations.

5.1 SITE DECONSTRUCTION AND REMOVAL METHODOLOGY

All the action alternatives considered in both this SDP and the forthcoming EA involve varying levels of removal of manmade structures and infrastructure. Some alternatives, including ALT-2 and ALT-3 involve complete facility and infrastructure removal, while ALT-4 would entail removal of all facilities with some capping of underground infrastructure. However, while acknowledging these differences, the following subsections outline the deconstruction activities required to remove the above-ground facilities and underground CSO infrastructure in sequential order and are generally applicable to all action alternatives.

The deconstruction and removal process is laid out in detail and includes numerous precautions and protocols for safe and sensitive work by the contractor.

5.1.1 Best Management Practices and Decommissioning Monitoring

All general contractors, subcontractors, and suppliers involved in deconstruction and restoration activities will be required to adhere to Best Management Practices (BMPs) and other commitments in this SDP, commitments included in the forthcoming EA, commitments in permit applications, and conditions in permit approvals. The principal purpose of these BMPs and other commitments is to identify the safety, environmental, and resource protection requirements and constraints related to these activities. The BMPs will include measures to comply with applicable aspects of the CMP and other guidance, including (*i*) worker orientation regarding historic, cultural, ecological, and natural resources; (*ii*) invasive species prevention and control program protocols; (*iii*) safety and accident prevention, including fire prevention related to use of cutting torches; (*iv*) spill prevention and response; (*v*) materials storage and waste management; (*vi*) erosion and water quality measures;[7] (*vii*) dust and debris management; (*ix*) private and company vehicle use and parking; and (*viii*) coordination with/reporting to CMS and the Maunakea Observatories (MKOs), including related to radio use and other possible impacts to maintenance and operations. The specifics of the BMPs will be developed after the EA for the proposed project is complete. To the extent possible, the BMPs will address input received and concerns raised throughout the project planning process. All BMPs will be implemented during both the deconstruction and removal phase and the site restoration phase.

A fulltime decommissioning manager, independent of the general contractor, will ensure that BMPs and other commitments are being implemented throughout the decommissioning process.

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[7] Physical erosion and water quality BMPs, such as perimeter controls, will not use of any biological material or non-native rock or cinder.

The decommissioning manager will work with archaeological, cultural, and biological monitors required at varying times during deconstruction. The three types of specialist monitors are described below:

- Archaeological monitor. As recommended in the Archaeological Assessment (AA) prepared for the proposed project (ASM, 2018), an Archaeological Monitoring Plan (AMP) will be prepared in accordance with HAR Chapter 13-279 and approved by SHPD prior to deconstruction activities starting. The AMP will be included in the CDUA for the proposed project. The archaeological monitor will be present during ground-altering activity (e.g., digging trenches, removal of underground foundations and utilities, and removal of existing fill material).
- Cultural monitor. As recommended in the Cultural Impact Assessment (CIA) prepared for the proposed project (ASM, 2020), a cultural monitor will be present during ground-altering activity. A Cultural Monitoring Plan that incorporates recommendations in the CIA will be prepared and included in the CDUA for the proposed project.
- Biological monitor. As recommended in the Biological Setting Analysis (SRGII 2019), a biological monitor will conduct monthly surveys for non-native species throughout the deconstruction process in order to identify any such introductions and formulate a response if necessary. Biological monitoring will address other components of the invasive species prevention and control program, such as vehicle and material inspections, throughout the deconstruction process. A Biological Monitoring Plan that incorporates recommendations in the BSA will be prepared and included in the CDUA for the proposed project.

All third-party deconstruction monitors will participate in regularly scheduled deconstruction meetings led by the general contractor to keep abreast of the progress of decommissioning activities and to schedule monitoring efforts. The independent monitors will interface with the general contractor to confirm that deconstruction activities follow the established protocols. It is also anticipated that each of the monitors will contribute the project's worker orientation program. Among other benefits, archaeological and cultural monitoring will help to ensure that negative impacts do not occur on archaeological, historic, or cultural resources during site decommissioning. Input on the scope of the AMP and other monitoring plans will be sought through the SDP and EA process.

Regular communications through deconstruction meetings and notices will be necessary to conduct a safe and environmentally sensitive removal of the CSO while maintaining normal public access to the mountain. These lines of communications will include: (*i*) the general contractor, (*ii*) CMS's assigned internal decommissioning manager, (*iii*) the CSO's independent decommissioning manager, (*iv*) third-party monitors, (*v*) Mauna Kea Observatories Support Services, (*vi*) Maunakea Rangers, and (*vii*) representatives of the other observatories.

5.1.2 Deconstruction Preliminary Activities

5.1.2.1 Deconstruction Mobilization and Staging

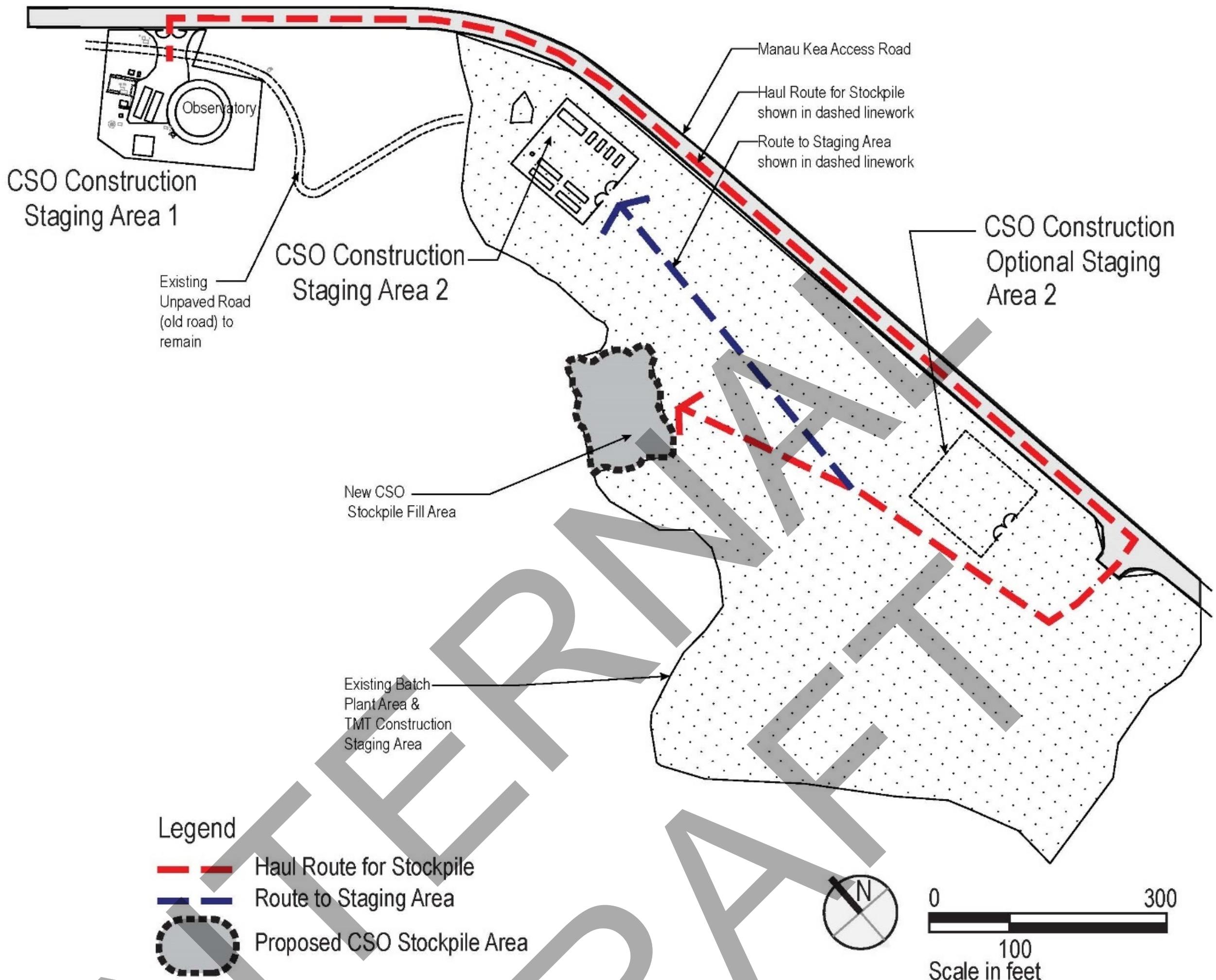
Prior to commencement of deconstruction, proper installation of support infrastructure and procedures will promote safe and efficient conduct. The initial phase of deconstruction will consist of:

- The installation of temporary construction fencing around the perimeter of the work and staging areas.
- Placement of BMPs, including dust and erosion control materials at appropriate locations established in the Storm Water Pollution Prevention Plan (SWPPP), which will be a component of the NPDES general construction permit. Dust and erosion control BMPs will be maintained and the SWPPP updated as appropriate throughout the deconstruction period.
- Installation of portable office trailers and portable toilets at Staging Area 2 within the nearby Batch Plant and a portable toilet at the CSO Site.

The temporary construction fencing is intended to visually define the spatial extent of deconstruction activity and to limit access to the CSO Site and staging areas to authorized individuals only. The perimeter fencing can also allow for the work site to be, within established limits, expanded or contracted during the course of the decommissioning process to properly segregate deconstruction activity from areas accessible by the public. This fencing will also serve dust and erosion control functions. The requirement for fencing will be included in the deconstruction specifications distributed as part of the bidding process for general contracting firms. These specifications will require that the general contractor provide calculations for securing the fencing against wind loads at the project site as determined by the applicable building code.

As originally constructed, the CSO site consists primarily of fill from other locations on Maunakea. Depending on the decommissioning alternative that Caltech ultimately implements (see Table 1-1), the fill will remain onsite or be removed and transported to an approved alternative location in the "Batch Plant" area. In either instance, appropriate BMPs related to dust and erosion control will be prioritized from the outset. Figure 5-1 depicts the planned staging and haul routes during deconstruction for all action alternatives considered in this SDP. All vehicle and foot traffic will follow that route along the Mauna Kea Access Road; the dirt road will not be utilized.

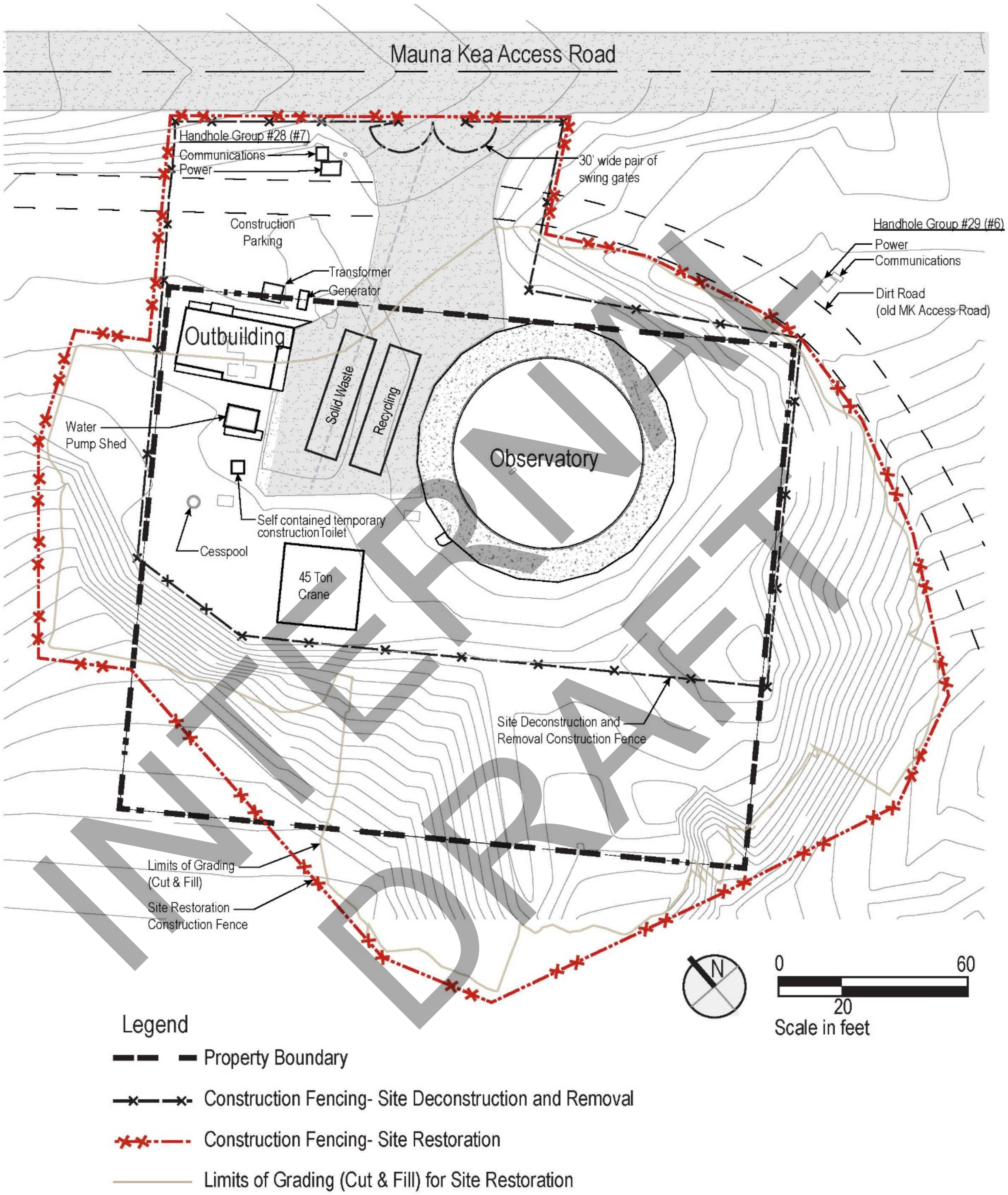
Figure 5-1: Conceptual Plan View of Overall Deconstruction Staging



Source: M3 (2020)

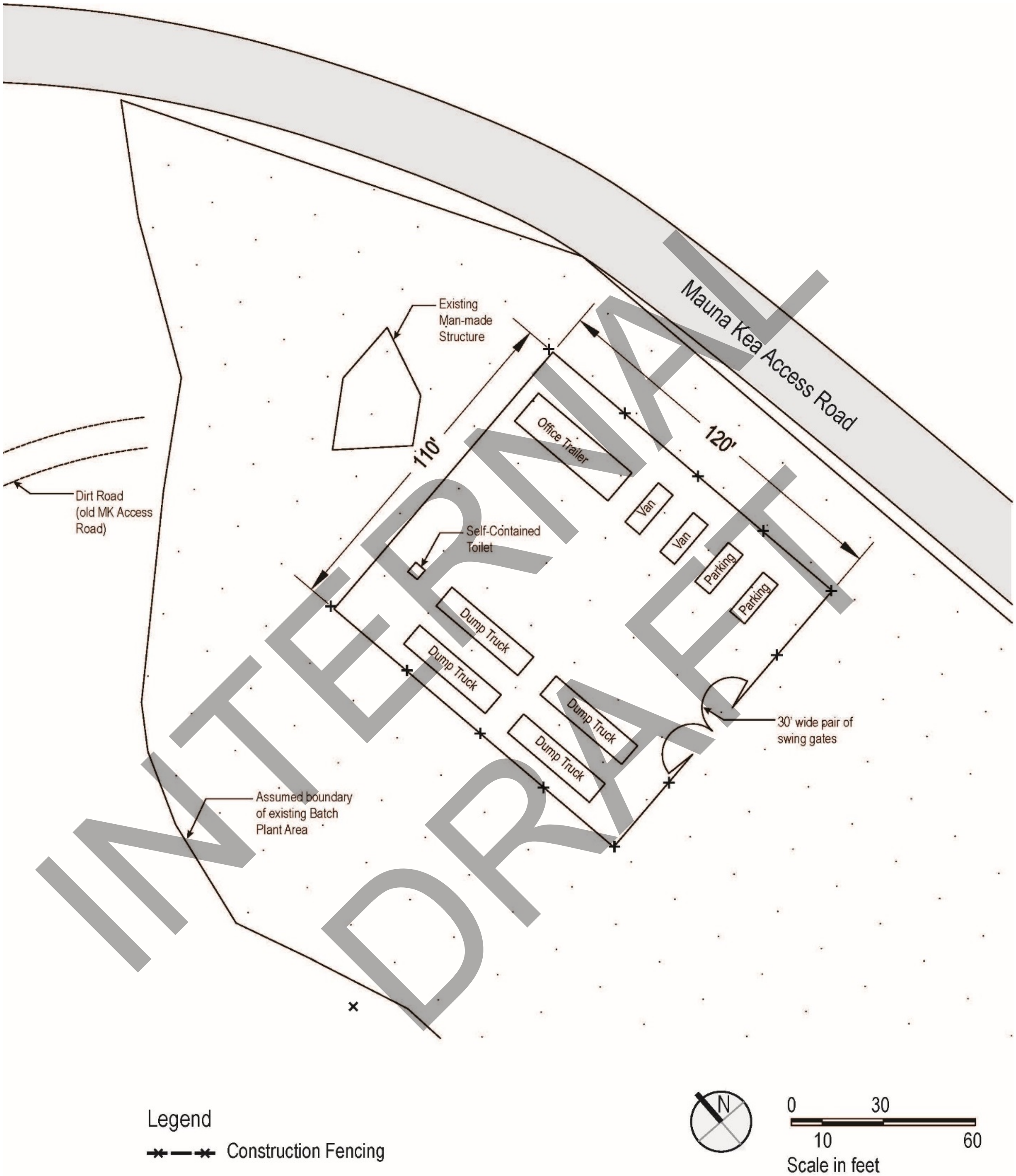
As shown in Figure 5-1, the staging will be partitioned into three areas: (*i*) Staging Area 1 on the CSO Site; (*ii*) at one of two locations within Staging Area 2 in the Batch Plant adjacent to the Mauna Kea Access road; and (*iii*) the 135′ x 100′ CSO fill stockpiling area within the Batch Plant. Figure 5-2 depicts a conceptual plan view of the Staging Area 1 on the CSO Site; Figure 5-3 provides a conceptual plan view of Staging Area 2. No grading of the Batch Plant would be required prior to establishing the staging area.

Figure 5-2: Plan View of Deconstruction Staging Area 1



Source: M3 (2020)

Figure 5-3: Conceptual Plan View of Deconstruction Staging Area 2



Source: M3 Engineering and Technology (2020)

Once fencing is emplaced, additional dust and erosion control BMPs will be placed around the perimeter of the CSO Site and staging areas.

An office trailer will be stationed at Staging Area 2 throughout the decommissioning process (see Figure 5-3). The trailer will be provided by the general contractor, with space provided for an independent decommissioning manager onsite daily. It will also afford adequate space for third-party archaeological, cultural, and biological monitors that will be present, as appropriate, during the site deconstruction and restoration phases of the project (see Section 4.1.1).

Temporary power interconnections for all deconstruction activities will also occur during mobilization and staging. Electrical power will be drawn from the closest remaining power source, likely Handhole Nos. 28 or 29 (see Figure 5-2). Water for deconstruction purposes will be provided via the existing tank and pump (see Figure 4.2) before being removed during latter stages of the deconstruction and removal process and/or a temporary above-ground water tank at Staging Area 2.

5.1.2.2 Demolition Preparation and Fire Prevention

Once the site has been secured and staged, the first deconstruction task will be to prepare the existing structures for demolition. All power and plumbing lines serving the observatory will be taken out of service by deenergizing or capping the lines, respectively, at the nearest point of remaining service. This point will likely be at Handhole Nos. 28 (see Figure 5-2). Caltech anticipates that this modest task can be carried out in a single day with a limited crew of subcontractors.

The Hawaiʻi County Fire Department (HCFD) is the primary agency responsible for fire prevention, fire control, and emergency medical services in the County of Hawaiʻi. Caltech has been in communication with the HCFD regarding the CSO decommissioning and will continue to coordinate with them during its implementation. The National Fire Prevention Association's (NFPA) *NFPA 241: Standard for Safeguarding Construction, Alteration, and Demolition Operations* (2004) notes:

> *"A.5.4.1 Failure to remove scrap and trash accumulations provides fuel for the rapid expansion of a fire that might otherwise be confined to a small area. These accumulations also provide a convenient fuel source for malicious fires."*

The HCFD has indicated that during deconstruction, Caltech and its contractors may stage trailers to sort and deposit aluminum, steel, and deconstruction waste onsite. Caltech anticipates using roll-off trailers or similar container that can be securely covered, brought to the site, and stationed there during demolition. The contractor will be responsible for sorting and depositing deconstruction waste in the appropriate onsite container. HCFD has also stated that:

- Up to four locations may be designated onsite for deconstruction material sorting and collection, and that up to three roll-off trailers may be used, as appropriate, at any time during deconstruction.
- A truck may deliver an empty roll-off container up to a designated open location and haul away the full container while still complying with the total limit of three roll-off containers noted above.
- Recyclable material and deconstruction waste will be properly separated at all times during the deconstruction process.

5.1.2.3 Lead Paint and Mold

Between January 22 and 23, 2019, Lehua Environmental Inc. (LEI) performed site reconnaissance to identify and inventory: (*i*) asbestos-containing material (ACM), (*ii*) lead-containing paint (LCP), (*iii*) lead-based paint (LBP), and (*iv*) mold-impacted areas of the CSO Site. This survey is discussed in Section 3.4 and included in Appendix D.

LEI recommended the following:

1. Manage and/or remove and dispose of hazardous and regulated materials in accordance with applicable local, state, and federal regulations, prior to renovation and/or demolition activities that may disturb these materials.
2. Remove and dispose of all loose and flaking (i.e., poor condition) LCP and LBP that may be disturbed during renovation/demolition activities in accordance with applicable local, state, and federal regulations.
3. Spot remove and dispose of LCP and LBP in areas that have the potential to become airborne or otherwise create dust (e.g., from sanding, drilling, friction, etc.) during renovation/demolition activities.
4. Any remediation and demolition contractor(s) must take appropriate measures to comply with applicable EPA, Occupational Safety and Health Administration (OSHA) and Hawaiʻi Occupational Safety and Health Division (HIOSH) regulations pertaining to the handling of lead-containing materials and worker protection.
    - Note that OSHA and HIOSH regulate activities that disturb paint which contain any detectable concentration of lead.
    - Note that detectable levels of lead in the paint were found throughout the Subject Site.
5. Have air monitoring conducted for airborne lead by qualified personnel during any lead paint disturbance and general renovation activities of areas that were determined to contain this contaminant.
6. Conduct multi-incremental sampling of soils surrounding the CSO Site prior to and after any exterior lead paint disturbance activities.
7. Previously water damaged ceiling tiles located throughout the CSO Site should be removed. These tiles may be identified by water staining and/or discoloration.

Caltech will direct appropriately trained personnel to implement all seven recommendations prior to starting demolition of the buildings.

5.1.3 Telescope Demolition

Caltech has been, and continues to, actively pursue the possibility of reusing the existing CSO telescope for further scientific research at an astronomical site other than Maunakea. If this effort is successful, the removal of the telescope will occur prior to the deconstruction activities presented in this plan. However, at the time this SDP was prepared, no candidate site for relocation had yet been funded. If no relocation is funded prior to deconstruction, demolishing and removing the telescope will occur as part of the decommissioning of the CSO Site. The steel telescope structure will be cut using cutting torches and saws into transportable pieces and recycled as scrap material. All the support equipment that remained onsite is specific to the CSO telescope and will be disposed of appropriately if the telescope is subject to demolition.

5.1.4 Mechanical, Electrical, and Plumbing (MEP) Demolition

General demolition work will begin with the removal of interior building components. The demolition of observatory mechanical, electrical, and plumbing (MEP) building systems will be first and will include removal of all power, lighting, water, waste, and communication lines integrated throughout the observatory facility and outbuildings.

Removing these "guts" of the facility will be mostly performed by means of individuals utilizing various handheld cutting equipment. All MEP material removed from the facility will be placed in the appropriate onsite container to be trucked off-site to the designated landfill or recycled.

5.1.5 Partition/Built-In Demolition

To complete the interior demolition and prepare for the removal of the outer shell itself, all interior partitions, ceilings, and built-in units will be disconnected from the structure and removed. Working within the tightly confined shell of the observatory structure will require that the majority of interior demolition work be done by means of individuals utilizing appropriate cutting equipment. All material is to be considered waste and placed in the appropriate onsite container for later removal off-site to the designated landfill.

5.1.6 Skin Removal

The enclosure skin of the outer shell of the observatory consists of individual thin triangular aluminum panels fastened to the supporting steel tube structure (see Figure 5-4). During deconstruction, the panels of the skin will be cut into manageable pieces using saws and cutting torches, and removed with the use of a crane and lift.

Figure 5-4: CSO's Aluminum Panel Skin

Source: Caltech (2020)

It is anticipated that the individual facets will be removed on a one-by-one basis rather than through simultaneous removal of multiple panels by multiple workers. All aluminum panels are considered recyclable material and will be placed in the appropriate onsite container for removal off-site to the designated recycling center.

5.1.7 Structure Demolition

With the building interiors, including MEP, and exterior skin removed, the structural skeleton of the observatory will be ready for dismantling (see Figure 5-5). The dismantling process will be performed with a manlift for cutting steel members into manageable pieces using cutting torches and saws and a crane for lifting these pieces from the structure to a flatbed truck for removal off-site. All steel deconstruction waste is planned to be recycled.

Figure 5-5: CSO's Internal Structure During Construction

Source: Caltech (1985)

5.1.8 Paving Removal

To prepare for underground demolition work, existing asphalt paving will be removed. Demolished paving will be loaded on to a dump truck for removal to a designated off-site landfill.

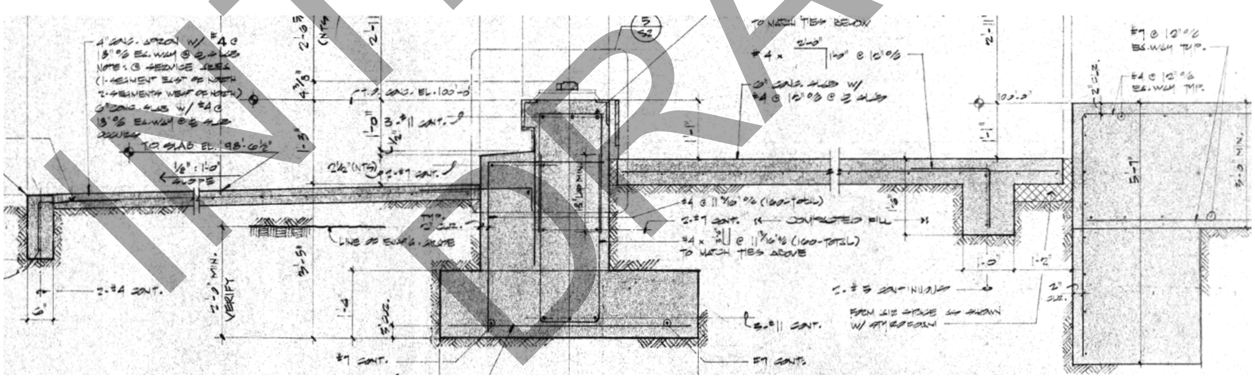
5.1.9 Foundation and Grounding Grid Removal

The CSO does not have a basement level and the structural footings underpinning the observatory consist of shallow spread footings. For this reason, total foundation removal is included in all alternatives. The CSO's foundations can be seen in Figure 5-6 and Figure 5-7, with the latter showing how the depth and thickness of the foundation varies from the center to the apron.

Figure 5-6: Photograph of CSO's Foundation During Construction

Source: Caltech (1985)

Figure 5-7: Section Drawing Illustrating a Portion of CSO's Foundation



Source: CSO Foundation Plan by H. Robert Hoggan & Associates dated 12/5/83.

The reinforced concrete foundation will be broken or cut, removed from the ground, and placed in roll-off bins. The portions of the grounding grid near the CSO's foundation will be removed during this phase; construction drawings indicate that the grounding grid is roughly one foot below grade and, therefore, all within the fill material placed on the CSO Site during construction. All material removed will be designated as deconstruction waste material and will be removed from the CSO Site and transported to an approved landfill, with the exception of recyclable material such as copper piping or grounding mats, which will be transported to a designated recycling center.

5.1.10 Cesspool

As part of the decommissioning of the CSO Site, the cesspool will be closed. Caltech, in preparation for this closure, has consulted with the DOH, Planning and Design Section, Wastewater Branch (DOH-WB), to identify alternative courses of action for closure and backfilling of the cesspool. As part of this consultation, DOH-WB provided information from *General Backfilling Scenarios for an Injection-Well Cesspool*, summarized as follows:

- Backfilling and permanently abandoning an injection-well cesspool constitutes an injection-well closure.
- Prior to any method of backfilling, each injection-well cesspool should be cleared to its original constructed depth, and all sediments, sludge, and organic materials in the cesspool should be removed and disposed of properly.
- Backfilling with a cement mixture or flowable fill may stop short of reaching the ground surface in order to accommodate topsoil, landscaping, grading, underground utilities, or foundation considerations.
- All backfilling methods should not leave behind a depression in the ground. The final ground surface should be shaped or graded to prevent tripping or falling, as well as water ponding.
- An official injection-well closure indicates that the injection-well has been cleaned out and permanently filled and sealed with an inert material having stability and physical strength.

Because backfilling the cesspool with cement would permanently leave CSO infrastructure material onsite, contrary to its stated intention to totally remove all infrastructure and fully restore the site, CSO has explored other options for closure of the cesspool that would return the area more closely to its pre-construction condition. On March 1, 2018, Caltech representatives met with Sanitarian Amy Cook of HDOH, Environmental Services (HDOH-ES) to discuss options for the closure of the CSO cesspool, including whether excavation below the cesspool was warranted or if fill from the CSO Site, rather than cement, was an acceptable fill alternative. In that meeting, HDOH-ES acknowledged Caltech's intention to remove all manmade structures from the site and stated that they were not aware of any instances of excavating below or beyond a cesspool base, except to enlarge a cesspool. In addition, HDOH-ES indicated that use of natural material from the CSO Site to fill the cavity left by removal of the cesspool was acceptable. (Amy Cook, pers. comm., March 1, 2018).

Based on its consultation with HDOH-WB and HDOH-ES, for all action alternatives Caltech now plans to: (*i*) pump out all sludge remnants in the cesspool, (*ii*) test the sludge for potential contaminants and dispose of it properly, (*iii*) trench around the outer perimeter of the concrete cesspool cylinder to its depth; (*iv*) remove the concrete cesspool structure and dispose of it properly; and then (*v*) use structural fill from the CSO Site[8] to fill the void to a depth even with the surrounding native lava flow surface and compact the fill during the backfilling process to

[8] This structural fill to be used is the fill placed on the lava flow during CSO construction and is native to Maunakea (Intera, 2019).

minimize settling in the future. CSO will continue to coordinate with the HDOH and comply with the instructions provided by it during closure of the cesspool.

5.1.11 Phase II ESA

Following removal of the underground concrete slab (see Section 5.1.9) and cesspool (Section 5.1.10), Caltech will perform sampling and analysis per the Phase II SAP (see Section 3.3, Appendix C).

5.1.12 Outbuilding and Secondary Above-Ground Infrastructure

Under all alternatives, the outbuilding and secondary above-ground infrastructure will be removed. This includes the outbuilding, a smaller nearby building housing a water pump, a generator mounted on a concrete pad, and a transformer mounted on a concrete pad.

All building materials, including concrete pads and slabs, will be deconstructed and placed in roll-off bins. All material removed will be designated as deconstruction waste material and will be removed from the CSO Site and transported to an approved landfill, with the exception of recyclable material such as copper piping, if any, which will be transported to a designated recycling center.

5.1.13 Remaining Underground Infrastructure

Underground improvements to be demolished include: (*i*) utility lines, (*ii*) water tank, and (*iii*) remaining grounding grid and other ancillary subsurface infrastructure. Under all alternatives, except ALT-4, all the utility conduits from Handhole #28, which provides service to CSO (see Figure 5-2), and throughout the CSO Site will be removed. In concert with these activities, the remaining grounding grid will be removed. It may be discovered that it is not feasible to remove a portion of these facilities, which is accounted for by ALT-4. Under ALT-4 they would be removed to the maximum extent feasible but some portion would be capped and left in place.

All building materials, including conduit and tank, will be removed from the ground and placed in roll-off bins. All material removed will be designated as deconstruction waste material and will be removed from the CSO Site and transported to an approved landfill, with the exception of recyclable material such as copper piping and wire (including the grounding grid), which will be transported to a designated recycling center.

5.1.14 Backfill and Finish Grading

Following the removal of all infrastructure, removal of remaining fill material will take place using heavy, medium, and small equipment and hand tools. The temporary construction fencing will be repositioned (Figure 5-2) to surround the site restoration work area prior to this fill removal activity. As the fill is removed, a quantity of roughly five cubic yards of fine ash material and small rocks, consistent with the size and material of the rocks scattered in the nearby undisturbed areas, will be segregated using a screen or similar method and stockpiled on site or at the staging area until needed for restoring the arthropod habitat (Section 6.5.2.1).

No fill imported from a non-Maunakea source will be brought to the CSO Site. The level of backfill will vary depending on the level of removal and the corresponding level of restoration implemented. Excess fill material will be stockpiled at the Batch Plant Staging Area and available for use by CMS in the future. The stockpile location is shown in Figure 5-1. The stockpiles will be approximately five feet in height and cover an area of approximately 100′ x 135′, tightly arrayed in overlapping piles.

Once all the excess fill material has been removed, the reserved fine ash and small rocks will be layered on top of summit-native rock to leave a visual appearance consistent with the original condition of the Site. Because the CSO Site is located on a lava flow, it will not be possible to fully reconstruct the preexisting flow in excavated areas. Rather, restoration will use rocks and fill, compacting as necessary for long-term stability, to return those areas to a natural condition consistent with the surrounding topography.

5.1.15 Demobilization

Upon completion of the backfill and the site restoration processes (Chapter 5) that can be completed with the temporary construction fence in place, the general contractor will remove the fencing, soil erosion and dust control BMPs, and the office trailer from the CSO Site for its final restoration as stipulated in the SRP (see Chapter 6).

5.2 DECONSTRUCTION DURATION, PERSONNEL, AND SITE LOGISTICS

5.2.1 Deconstruction Duration and Personnel

Table 5-1 summarizes the type and purpose of major equipment that will be used and temporarily stationed on the CSO Site or adjacent deconstruction staging/stockpiling areas (see Figure 5-1) during the decommissioning process. Table 5-2, Table 5-3, and Table 5-4 identify the deconstruction activity and sequencing for each of the action alternatives (i.e., ALT-2, ALT-3, and ALT-4) considered in the SDP (see Table 1-1). These tables include all the general deconstruction activities noted in the preceding sections of this SDRP for the deconstruction and removal of the CSO, but are distinguished from each other by the duration, type of equipment, onsite deconstruction personnel, and estimated number of total daily vehicle-trips up and down the mountain. Though the total deconstruction duration of each alternative varies, all alternatives considered in this SDP can be completed within one season if provided with continuous access throughout that period.

Table 5-1: Summary of Major Equipment Present During CSO Decommissioning

Type	***Purpose***
Office Trailer	Provides adequate workspace for deconstruction superintendent and independent, archaeological, cultural, and biological monitors.
Roll-off Waste Containers	Sorted storage for deconstruction waste and recyclable materials.
Thirty-ton Crane	Securely lifting dismantled observatory skin, structural members, and cesspool.
Lift(s)	Provide deconstruction-worker access to upper portions of the CSO structure.
Water Truck	Dust control per erosion and water contamination prevention BMP sub-plan.
Trackhoe with Hammer	Demolition and removal of concrete foundations.
Backhoe	Removal of underground utility interconnections.
Loader	Depositing demolition material into appropriate waste containers and for regrading of CSO Site.
Flatbed Trailer and/or Dump Truck(s)	Transporting equipment up and down the summit and for removal of waste material off-site to the designated landfill or recycling center and for moving excess fill material to the Batch Plant.
Soil Compacter	Compacting soil during backfill operations.
Toilets	Portable toilets and/or incorporated into the office trailer.

Source: M3 (2020)

Table 5-2: ALT-2 Deconstruction Activity

Deconstruction Activity	***Duration (working days)***	***Crew Size Max./Day***	***Equipment***	***Deconstruction Vehicular Trips:***			
				Large Vehicle		***Small Vehicle***	
				Max/Day	***Total***	***Max/Day***	***Total***
Mobilization	4	3	Office Trailer, Water Truck	2	3	1	29
Demolition Prep	1	6	-	-	-	2	2
MEP Demolition	20	5	1 Crane, 1 Flatbed w/Tractor, 2 Dump Trucks	3	6	1	20
Partition / Built-In Demolition	10	5	2 Dump Trucks	2	2	1	10
Skin Removal (Aluminum)	15	6	1 Manlift, 1 Crane, 1 Flatbed w/Tractor	1	2	1	15
Structure Demolition (Steel)	33	11	1 Crane, 1 Manlift, 2 Flatbed w/Tractors	2	11	2	63
Paving Demolition (Asphalt)	3	2	1 Loader, 4 Dump Trucks	5	14	1	3
Underground Removal	25	7	1 Backhoe, 1 loader, 2 Dump Trucks	3	27	2	32
Backfill	13	5	1 loader, 1 Compactor	1	2	1	13
Demobilization	2	4	-	2	3	-	-
Finish Work	10	8	1 loader, 1 Compactor, 4 Dump Trucks	*	*	2	20
Habitat Restoration	5	2	-	-	-	1	5
Daily Superintendent / Site Monitors	-	4	-	-	-	4	549
Total Duration / Trips	141	-	-	-	70	-	776

Note: * there will be 25 trips a day and 242 total large vehicle trips during finish work; however, these trips will be entirely within the summit region as fill material is moved from the CSO Site to the Batch Plant (Figure 5-1).
Source: M3 (2020)

Table 5-3: ALT-3 Deconstruction Activity

Deconstruction Activity	*Duration (Working Days)*	*Crew Size Max/Day*	*Equipment*	*Deconstruction Vehicular Trips:*			
				Large Vehicle		*Small Vehicle*	
				Max/Day	*Total*	*Max/Day*	*Total*
Mobilization	4	3	Office Trailer, Water Truck	2	3	1	27
Demolition Prep	1	6	-	.	-	2	2
MEP Demolition	20	5	1 Crane, 1 Flatbed w/Tractor, 2 Dump Trucks	3	6	1	20
Partition / Built-In Demolition	10	5	2 Dump Trucks	2	2	1	10
Skin Removal (Aluminum)	15	6	1 Manlift, 1 Crane, 1 Flatbed w/Tractor	1	2	1	15
Structure Demolition (Steel)	33	11	1 Crane, 1 Manlift, 2 Flatbed w/Tractors	2	11	2	63
Paving Demolition (Asphalt)	3	2	1 loader, 4 Dump Trucks	5	14	1	3
Underground Removal	25	7	1 Backhoe, 1 Loader, 2 Dump Trucks	3	27	2	32
Backfill	13	5	1 Loader, 1 Compactor	1	2	1	13
Demobilization	2	4	-	2	3	-	-
Finish Work	3	4	1 Loader	-	-	1	3
Habitat Restoration	5	2	-	-	-	1	5
Daily Superintendent / Site Monitors	-	4	-	-	-	4	536
Total Duration / Trips	134	-	-	-	70	-	729
Source: M3 (2020)							

Table 5-4: ALT-4 Deconstruction Activity

Deconstruction Activity	***Duration (Working Days)***	***Crew Size Max/Day***	***Equipment***	***Deconstruction Vehicular Trips:***			
				Large Vehicle		***Small Vehicle***	
				Max/Day	***Total***	***Max/Day***	***Total***
Mobilization	4	3	Office Trailer, Water Truck	2	3	1	25
Demolition Prep	1	6	-	-	-	2	2
MEP Demolition	20	5	1 Crane, 1 Flatbed w/Tractor, 2 Dump Trucks	3	6	1	20
Partition / Built-In Demolition	10	5	2 Dump Trucks	2	2	1	10
Skin Removal (Aluminum)	15	6	1 Manlift, 1 Crane, 1 Flatbed w/Tractor	1	2	1	15
Structure Demolition (Steel)	33	11	1 Crane, 1 Manlift, 2 Flatbed w/Tractor s	2	11	2	63
Paving Demolition (Asphalt)	2	2	1 Loader, 4 Dump Trucks	5	14	1	3
Underground Removal	21	6	-	3	20	4	29
Backfill	9	5	1 Loader, 1 Compactor	1	2	1	9
Demobilization	2	4	-	2	3	-	.
Finish Work	3	4	1 Loader	-	.	1	3
Habitat Restoration	5	2	-	-	-	1	5
Daily Superintendent / Site Monitors	.	4	.	.	-	4	480
Total Duration / Trips	125	-	-	-	63	-	684

Source: M3 (2020)

Deconstruction activity related to the decommissioning of CSO will have a modest and temporary impact on the use of the Mauna Kea Access Road. Table 5-2, Table 5-3, and Table 5-4 indicate the estimated deconstruction duration, crew size, quantities of deconstruction waste and recycling, and deconstruction vehicular use for each decommissioning alternative identified in this SDP.

The following general notes are equally applicable to Table 5-2, Table 5-3, and Table 5-4:

1. Duration total is based on the total days for sequential activities and durations account for unusual conditions present at the high elevation CSO Site.
2. Crew total is a maximum per day, as determined by the highest number of individuals identified for any one sequential activity. Alternative total includes the highest number of individuals for any one activity plus supervision and monitoring personnel.

3. Fill material will utilize regraded site material.
4. Equipment list represents the type and number on site at any one time.
5. Maximum vehicles onsite per day/total number of trips. One (1) trip is defined as the combination of ascending and descending the mountain within a day. If a trip is split, such as delivery of the office trailer and its subsequent removal at a later date, then a trip is defined as one (1) ascending and one (1) descending for that deconstruction activity (i.e., a total of two vehicle trips). Total for maximum per day were determined by the higher number of trips/day for any one sequential activity. Permanently staffed deconstruction personnel will travel up to the site individually on a daily basis (i.e., 4 vehicles/day) with parking spaces onsite for each; subcontractor crews will carpool from Halepōhaku on a daily basis. The crane delivered to the site, starting with MEP Demolition, will remain onsite for the duration of the deconstruction process. The one (1) trip for crane delivery is accounted for under MEP Demolition.
6. Dump truck trips for stockpile of removed fill are within summit region via the path identified in Figure 5-1. No fill removal will traverse down Mauna Kea Access Road past the Batch Plant.
7. Concurrent activities are identified to reduce the overall deconstruction duration.

5.2.2 Deconstruction Logistics

Figure 5-1 depicts the likely configuration of deconstruction staging logistics, indicating the locations for each of the major pieces of equipment and vehicles used during the various stages of deconstruction; Figure 5-2 and Figure 5-3 provide additional detail. The basic configuration of the staging areas would be similar for each of the decommissioning alternatives, but the general contractor may propose a slightly different approach depending on the decommissioning alternative implemented and other activities in the summit region. A clear path for HCFD access will be maintained at all times during deconstruction activities with portable firefighting equipment maintained on site at all times.

Use of the adjacent Batch Plant site for deconstruction staging is also being proposed by the Thirty Meter Telescope (TMT). Construction for TMT may be concurrent with the deconstruction activities of the CSO. The CSO decommissioning effort will make use of the Batch Plant site for temporary deconstruction staging activities and permanent stockpiling of excess fill removed from the Site. TMT currently has a stockpiling permit for use of the Batch Plant. CSO will also be required to obtain a stockpiling permit from the County of Hawaiʻi Planning Department. The CSO decommissioning project will coordinate use of the Batch Plant with any concurrent construction projects.

The number of deconstruction personnel onsite will vary for each deconstruction activity. The total number of deconstruction workers on any given day will typically consist of the: (*i*) general contractor superintendent; (*ii*) independent deconstruction monitors and potentially other monitors (archaeological, cultural, and biological); and (*iii*) general contractor and subcontractor's crew. The anticipated numbers of personnel for each decommissioning alternative and their estimated number of vehicle trips are provided in Table 5-2, Table 5-3, and Table 5-4. One vehicle-trip is defined as the combination of one ascent to, and one descent from, the summit of Maunakea.

Vanpools are to be provided for subcontractor personnel leaving from and returning to Halepōhaku on a daily basis. Should parking be limited at Halepōhaku for subcontractor crew parking, crew members can convene in Hilo and vanpool directly up to the site, stopping only at Halepōhaku for a short duration (~30 minutes) to acclimate to the higher elevation. Deconstruction crews will not have access to Halepōhaku astronomy support common building dining and toilet facilities. Stopping at Halepōhaku on the return trip at the end of the day will not be necessary.

Deconstruction vehicles on site will be limited to current deconstruction activity only. No parking (day or overnight) will occur on the CSO Site and all BMPs related to vehicle use will be followed. Limited day parking will be available at the designated portion of the Batch Plant for CSO deconstruction. This designated portion will be for the sole use of the CSO deconstruction team and its location and access will be coordinated with other concurrent summit region construction projects, if any. This limited parking will be for the exclusive use of the general contractor, vans that transport subcontractor crews, independent deconstruction monitor and potentially other monitors (archaeological, cultural, and biological), and inspectors. Overnight parking in the summit region will be limited to large deconstruction vehicles, such as a water truck and dump trucks (up to four maximum) and located within the secure fencing at both the CSO Site and at CSO's designated staging area at the Batch Plant. Overnight parking for large deconstruction vehicles in the summit region reduces the daily overall number of deconstruction vehicle trips on the Mauna Kea Access Road.

As shown in Table 5-2, Table 5-3, and Table 5-4, it is not anticipated that the CSO deconstruction activity will see a significant number of deconstruction vehicles on a daily basis along the Mauna Kea Access Road under any of the action alternatives considered in this SDP. Planning for the deconstruction activities shows a limited number of small vehicles carrying personnel traveling between Saddle Road and Halepōhaku and even fewer (via vans) traveling on the unpaved portion of the road up to the CSO Site. Personnel trips will mainly occur at the start and end of the day and generally not interfere with observatory, maintenance, and other vehicles during the day.

Larger deconstruction vehicles, such as flatbeds for delivery of equipment and dump trucks for removal of recyclable and solid waste material, will also be limited and can be coordinated with CMS, other observatories, tour groups, and Rangers for off-peak hours, as necessary. Dump trucks for removal of existing fill on site will have a short haul route on the paved portion of the Mauna Kea Access Road between the CSO Site and the stockpile locations at the Batch Plant (Figure 5-1) and, therefore, there is limited potential for conflicts between CSO deconstruction and other vehicles. Flagpersons with radios can be provided to control general and deconstruction traffic between the CSO Site and the Batch Plant when fill material transport operations are ongoing.

With the small number of CSO deconstruction vehicle trips along the Mauna Kea Access Road daily, it is not anticipated that additional road maintenance work will be necessary beyond the current regular road maintenance efforts provided above Halepōhaku. However, should it be found that additional road maintenance is necessary due to CSO decommissioning activities, Caltech would reimburse CMS for additional road maintenance costs incurred.

Temporary Mauna Kea Access Road closures or restrictions (from Saddle Road to the summit region) will be necessary to deliver and return wide-load deconstruction equipment such as trailers and crane(s). The necessary road closures will be coordinated with HDOT, CMS, Rangers, summit observatories, tour groups, and other observatory and summit construction activities. Notifications will be sent in advance of any road closures to these parties and made public. Road closures will be scheduled to occur during off-peak times.

Caltech does not anticipate that any of the larger deconstruction vehicles for the CSO deconstruction will require towing or braking assistance from other vehicles. Most large deconstruction vehicle trips will be for moving fill material between the CSO Site and the designated stockpile locations at the adjacent Batch Plant, approximately 1,200 feet apart (Figure 5-1).

CHAPTER 6: SITE RESTORATION PLAN (SRP)

6.1 INTRODUCTION

The DP defines the purpose of the SRP as follows:

> *"The purpose of a Site Restoration Plan is to present specific targets for site restoration and to describe the methodology for restoring disturbed areas after the demolition/construction activities described in the Site Deconstruction and Removal Plan are completed. Each SRP shall be specific to the site and consider cultural, biological, and physical aspects of site restoration. Each SRP shall include a provision for effectiveness monitoring to characterize success and/or failure of restoration efforts."*

It also goes on to provide definitions for three levels—minimal, moderate, and full—of site restoration that can be considered. As outlined in Chapter 4, only moderate and full restoration are being considered in detail for the CSO decommissioning (see Table 1-1).

This SRP incorporates consideration of the cultural, physical, and biological aspects of site restoration, providing a survey of the existing condition of these resources and presenting an analysis of how the intent, process, or outcome of site restoration may impact these resources. Finally, the CBA (see Chapter 7) weighs these potential impacts in order to determine the balance between cost(s) and benefit(s) for each alternative.

Figure 6-1 depicts the condition of the CSO Site prior to the facility's construction in the 1980s.

Figure 6-1: CSO Site Prior to Construction

Note: The "CIT" label refers to the California Institute of Technology and identifies the CSO site.

Source: Caltech (1985)

6.1.1 Introduction to Topographic Site Restoration Methodology

Details regarding topographic site restoration are provided in Section 6.5.1. This introductory overview is provided context for the analysis included in this Chapter that informed Caltech's decision-making regarding site restoration. Caltech has established that only modest excavations into the native ground were made during construction. Fill was placed over the native ground where the observatory and most other infrastructure was built. Thus, it appears that it will be feasible to fully restore the look and feel of geophysical site topography, per the recommendations of the DP. Restoration of the CSO Site's topography to pre-construction condition will principally consist of removing the excess fill placed during construction. There will be only modest quantities of backfilling required for the site restoration, primarily for the cavity left after cesspool removal, which will use the fill material (Section 5.1.10).

6.1.2 Introduction to Biological Site Restoration Methodology

Details regarding biological site restoration are provided in Section 6.5.2. This introductory overview is provided context for the biological analysis included in this Chapter (Section 6.3) that informed Caltech's decision-making regarding site restoration. Pre-construction and contemporary biological surveys indicate that it also seems feasible to fully restore the habitat and recover a population of flora and fauna, including arthropods, similar to surrounding areas (SRGII, 2019). This SRP describes the methodology for habitat restoration, which will consist of surface treatment of the restored topography to mimic the surrounding areas (i.e., active habitat restoration) followed by passive recruitment of native flora and fauna, including the arthropod community (i.e., passive habitat restoration).

Should unforeseen circumstances arise during decommissioning that render full restoration impossible (ALT-3 and ALT-4, see Sections 4.3.3 and 4.3.4, respectively), moderate restoration will include surface treatments (i.e., active habitat restoration) followed by passive recruitment of native flora and fauna (i.e., passive habitat restoration).

Per the DP, three years of biological monitoring will be conducted to characterize the effectiveness of habitat restoration and inform future decommissioning efforts on Maunakea.

6.1.3 Introduction to Archaeological-Cultural Site Decommissioning Considerations

The archaeological and cultural surveys undertaken to inform this SDP have documented Maunakea's cultural landscape and have catalogued the specific cultural resources present in the vicinity of the CSO Site (see Section 6.4). Based on those surveys, there are no known specific historic properties (archaeological sites) that will be directly affected by site restoration. Archaeological and cultural monitoring (Section 5.1.1) will help to ensure that no negative impacts on previously unidentified archaeological, historic, or cultural resources will occur during site restoration activities. Considerations related to specific historic properties are discussed in Section 6.4.2.

The related issue of how site restoration may affect the cultural landscape, which is not a specific historic site, is more complex. For those who value the more broadly defined cultural landscape, the positive or negative impact(s) of site restoration depends on the intent and outcome of the decommissioning effort. Considerations related to the cultural landscape are presented in Section 6.4.1.

6.2 PHYSICAL SITE RESTORATION

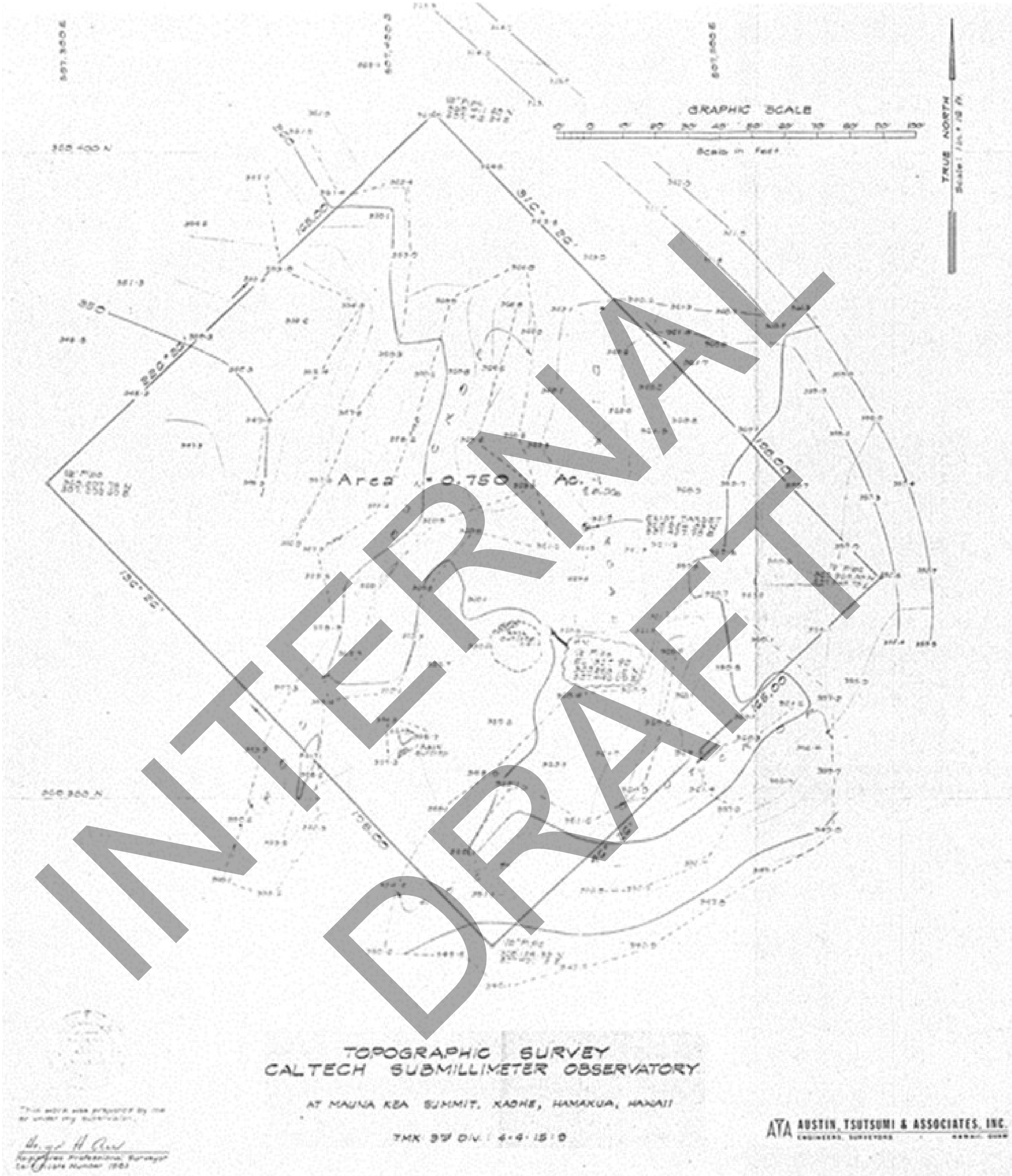
6.2.1 Pre- and Post-CSO Topography

Austin, Tsutsumi & Associates, Inc, undertook a pre-construction site topographical survey, presumably prepared in 1982-1983 and noted as received January 21, 1983; the survey is provided in Figure 6-2. M3 Engineering and Technology, Caltech's decommissioning planning contractor, digitized this prior survey and overlaid it with an updated site survey performed by dlb & Associates in 2016 (see Figure 6-3), with corrections for relative calibrations, to determine more accurately the amount of fill added and excavation done during construction. A comparison of the two surveys indicates that:

- Pre-construction grading and excavation cut approximately 495 cu. yds. of material from the site and filled with approximately 2,830 cu. yds. material, yielding a net fill of 2,335 cu. yds.;
- The maximum depth of the fill is about 10 feet, on the downhill side of the facility;
- The deepest foundation, under the telescope, is about 4 feet below grade and entirely in fill; and
- The cesspool extends approximately 13.5 feet below grade, with the upper 9 feet in fill and the lower 4.5 feet in the pre-construction topography.

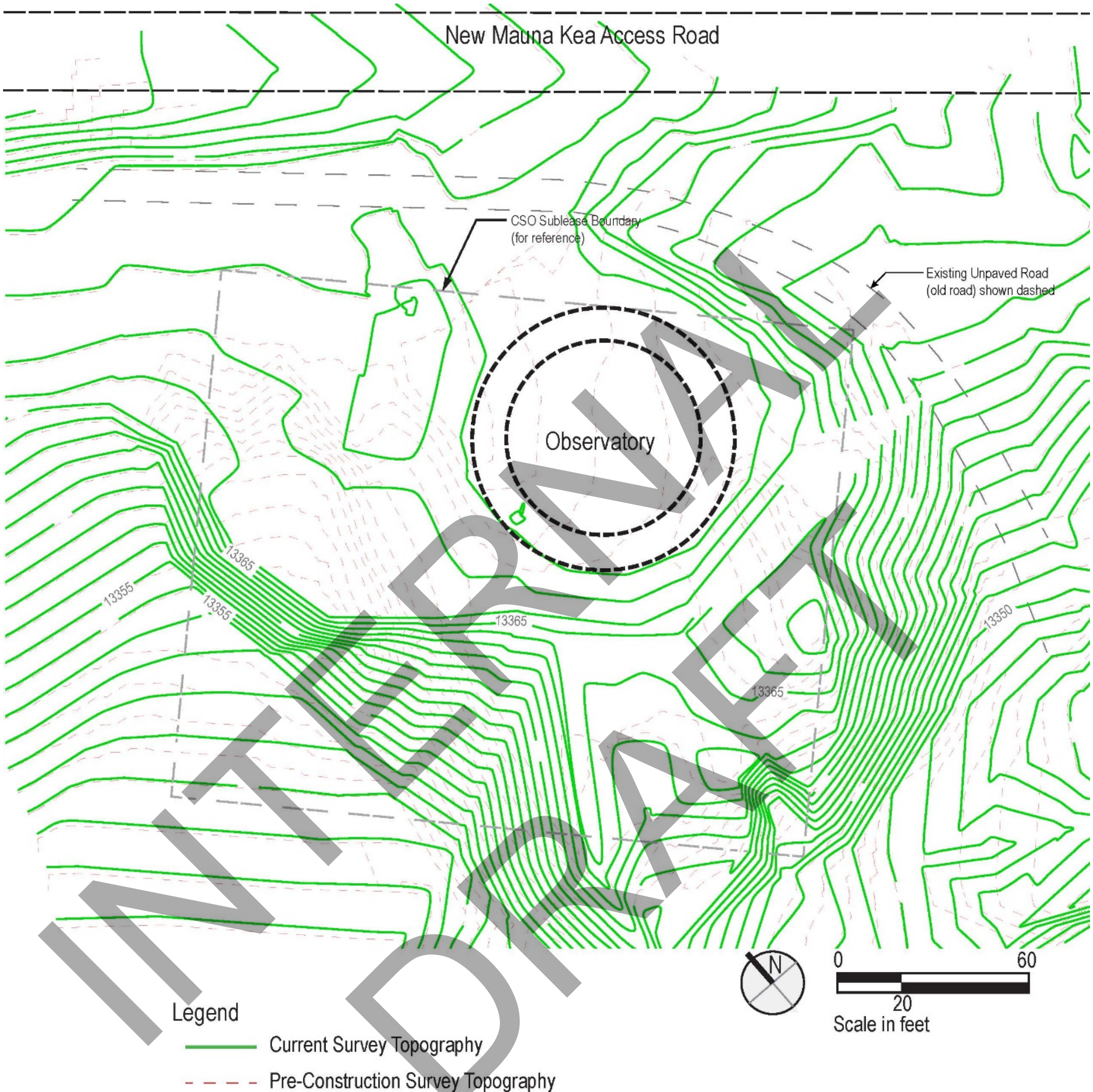
Because restoration of the pre-construction topography would primarily require removal of fill from the site, with only modest excavation and backfill for the cesspool, there appear to be no engineering obstacles to full restoration of the pre-construction topography.

Figure 6-2: Pre-Construction Topographical Survey of Site (1982)



Source: Austin, Tsutsumi & Associates, Inc (1982)

Figure 6-3: Comparison of Pre-Construction and 2016 Topographical Surveys



This figure reproduces information not legible in the 1982 pre-construction topographical conducted by Austin, Tsutsumi and Associates, Inc.
Source: dlb & Associates (2016)

6.2.2 Geological Source of Fill

Geological analysis of fill used during construction can provide information about its source, which in turn has substantial implications for the success of biological and cultural site restoration. The following subsections describe the available information related to onsite fill.

6.2.2.1 <u>Pre-Construction Geological Analysis</u>

During the planning and preparation for the observatory, Caltech retained Dames & Moore to conduct a pre-construction geological and hydrological study of the CSO Site. Their report, *Geologic and Hydrologic Factors*, was incorporated as Appendix B of the *A 10-Meter Telescope for Millimeter and Submillimeter Astronomy at Mauna Kea, Hamakua, Hawaii: Final Environmental Impact Statement* (Group 70, 1982). That report states:

> *The principal rock type of the summit area of Mauna Kea is hawaiite which commonly forms clinkery aa lava flows or cinder cones up to 600 feet high with ejecta fragments up to 10 feet in size. These hawaiites range from non-vesicular and dense to extremely vesicular and less dense. The surfaces of lava flows are frequently striated (which signify overriding glacier movement) and inter-stratified with glacial debris (characterized by loose rock fragments), which in turn are inter-layered with cinder, ash and other volcanic pyroclastic materials...*
>
> *Based on available photographs and interviews with University of Hawaii researchers (Woodcock; Laws; West, personal communications, 1982), the proposed site is interpreted to be an aa lava flow which vented in the vicinity of the Site (probably from one of the summit cones) and flowed primarily northwest with one lobe extending to the south. From the existing topography, the southern lobe of this flow appears to have moved about 2,000 feet downhill from the Site – about half the distance to Lake Waiau. However, the flow surface has been subject to subsequent glaciation and the original flow paths of the lava are obscured. This aa flow overlies a slightly older flow (possibly part of the same eruption period) which also moved to the south and southwest -- surrounding Lake Waiau and filling the area between Puu Waiau, Puu Poliahu and Puu Hau Kea and partially covering the north and west rim of Puu Waiau.*

With respect to anticipated specific site work in the construction of CSO, Dames & Moore noted:

> *The proposed earthwork for the site is minimal – limited to minor levelling, removal of lava fragments, and footing excavations up to 4 feet deep at the telescope site. Estimated total excavation is only about 100 cubic yards. The excavated lava rock will be utilized mostly for footing backfills.*

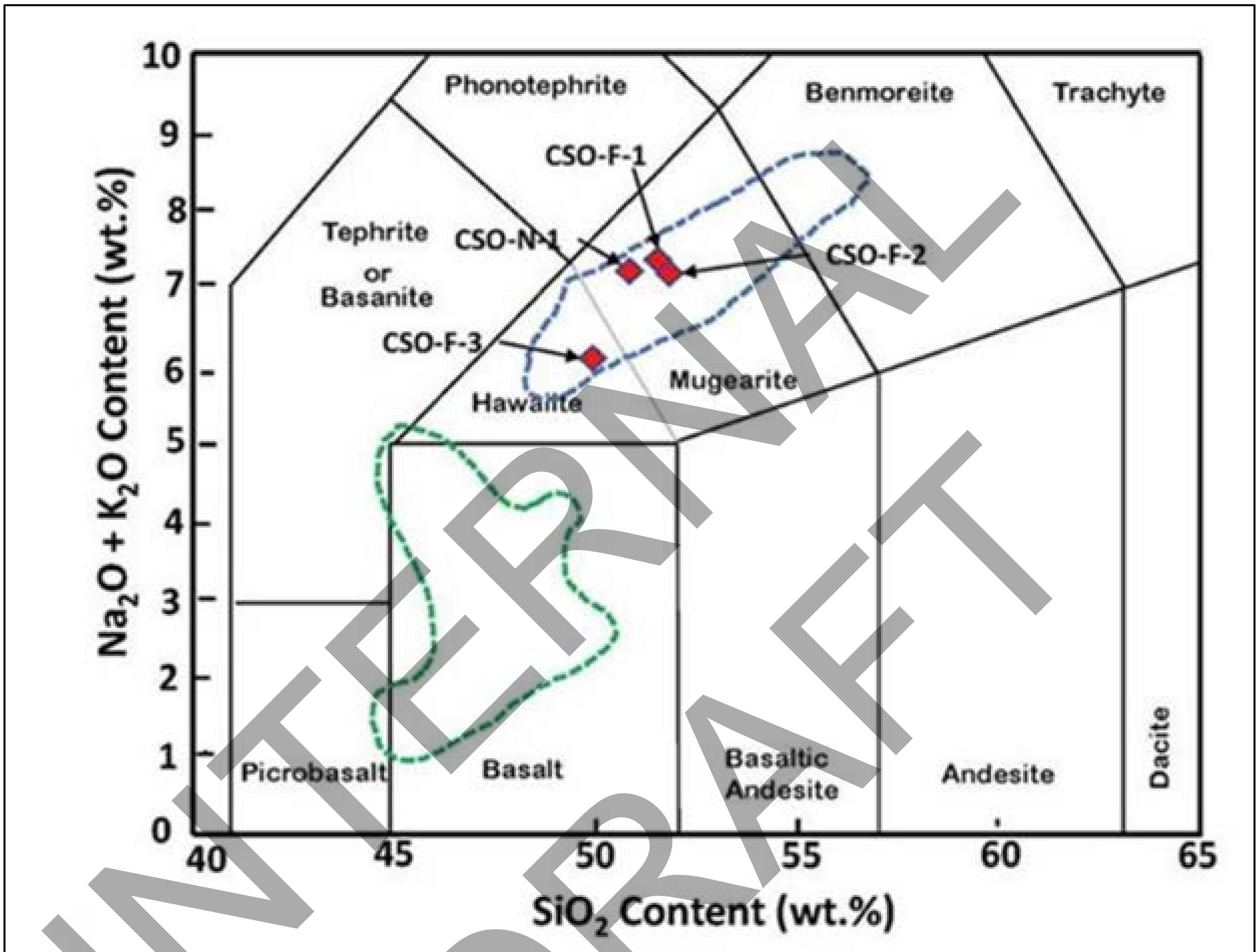
Final grading and construction plans amended the excavation plan, necessitating no excavation for the telescope footings but requiring excavation for the cesspool and a larger excavation volume overall. Review of the available documentation from the construction of the observatory do not document the origin of the fill that was used on the CSO Site.

6.2.2.2 <u>Contemporary Geological Analysis</u>

In the absence of clear information indicating the source of the fill used during construction on the CSO Site, Caltech retained geoengineering consultant Intera, Inc. to sample and analyze the fill. Their report, *Hydrogeological and Geological Evaluation: Decommissioning of the California Institute of Technology Submillimeter Observatory* (Intera Inc., 2019), describes their methods and findings.

Figure 6-4, reproduced from the Intera, Inc. (2019) report, provides a geochemical comparison of the CSO Site fill material (samples CSO-F-1, CSO-F-2, and CSO-F-3) to a reference sample (sample CSO-N-1) of volcanic material from an adjacent ʻaʻā lava flow.

Figure 6-4: Geochemical Analysis of Composition and Origin of CSO Fill



Notes: 1. Diagram was used by Wolfe et al. (1997) to compositionally classify Mauna Kea lavas. The green dashed line denotes the approximately extent and range of geochemically analyzed older Hāmākua Volcanics and the blue dashed line denotes the approximately extent and range of geochemically analyzed younger Laupāhoehoe Volcanics as reported by Wolfe et al. (1997, p. 17, Figure 5). The four samples collected and analyzed for this investigation (red diamonds) all fall within the Laupāhoehoe Volcanics extent.

2. Samples CSO-F-1, CSO-F-2, and CSO-N-1 are fairly closely clustered, suggesting that they are very likely “related”, possibly even produced by the same eruptive event. Sample CSO-F-3 does not cluster with the other three (3) samples and is compositionally different enough to suggest that it is not related to the other three (3) samples. [It is] …a Hawaiite, while the other three (3) samples are mugearite. This Hawaiite sample may represent a piece of tephra from one of the adjacent cinder cones.

Source: Intera, Inc., *Hydrogeological and Geological Evaluation* (2019)

That report goes on to provide the following conclusion based on this comparison (Intera, Inc., 2019):

> *“Based on the lithologic descriptions and geochemical analyses of the three (3) fill samples and one (1) sample from an adjacent a’a lava flow, the fill material at the CSO Site is determined to be sourced from Laupāhoehoe Volcanics which underlies Maunakea summit area. Much of the CSO Site fill was likely originally sourced from an excavation in a Laupāhoehoe lava flow during widening of the main road.*

> *Other components of the fill are probably tephra from one of the nearby Laupāhoehoe cinder cones."*

Based on the analysis and results of this geological investigation it appears to be clear that the fill used on the CSO Site during construction was native to the summit area of Maunakea (i.e., "native fill") and was not transported to the site from a more distant source. Consequently, the use of this native fill for backfill during decommissioning does not present a hazard of negative cultural or biological impacts.

6.3 BIOLOGICAL SITE RESTORATION

This section discusses the biological, ecological, and environmental restoration of the CSO Site. To provide the necessary context for a discussion of biological habitat restoration, it reviews: (*i*) the biological inventory conducted prior to CSO construction; (*ii*) the contemporary biological survey of the CSO Site conducted during preparation of this SDP; and (*iii*) an assessment of the potential impacts to biology during and after site restoration.

6.3.1 Pre-Construction Biological Inventory

During the planning and preparation for the observatory, Caltech retained Dr. Francis G. Howarth of the Bishop Museum to conduct a pre-construction biological survey and assessment of the CSO Site. The resulting report, *A Provisional Assessment of the Arthropod Fauna of the Area to be Impacted by the Proposed University of Hawaii/California Institute of Technology 10-Meter Telescope Near the Summit Mauna Kea, Hawaii*, was incorporated as Appendix C of the *A 10-Meter Telescope for Millimeter and Submillimeter Astronomy at Mauna Kea, Hamakua, Hawaii: Final Environmental Impact Statement* (Group 70, 1982). The report begins with an overview of what was known about fauna at the summit at that time:

> *The major component of the fauna of the aeolian ecosystem on the summit of Mauna Kea is composed of arthropods. Currently, about 12 species appear to be maintaining populations in this ecosystem. These include 3 spiders, 4 mites, 2 springtails, 1 bark louse, and 2 true bugs. … Some of these species could be associated with the algae, mosses, or lichens which grow near the summit.*

The report states that the two true bugs include one in the genus *Nysius*, the endemic wēkiu bug, while the other is the non-native *Geocoris pallens*. The report indicated that wēkiu bugs were not observed at the CSO Site during the survey, but that the season and weather conditions during the survey reduced the likelihood of them being found. Arthropods that were found in the field at the CSO Site included a native Hawaiian lycosid wolf spider and an anystid mite. Two springtails and four mites were found in the soil samples collected during the survey.

6.3.2 Contemporary Biological Inventory

During the planning and preparation for the decommissioning of the CSO Site, Caltech retained Sustainable Resources Group International, Inc. (SRGII) to conduct a biological survey of the site and prepare a report (*Biological Setting Analysis: Caltech Submillimeter Observatory Decommissioning*; SRGII, 2019) characterizing the existing biota and identifying biological considerations related to site restoration. The report characterizes the ecosystem at the CSO Site as alpine stone desert, with limited potential for the development of plant and animal communities. The following summarizes the survey's findings:

- Lichens, Mosses, and Vascular Plants. Eleven clumps of lichens were observed. The most abundant vascular plant in and near the survey site was the endemic grass pili uka (*Trisetum glomeratum*). Most pili uka clumps were growing on topographically disturbed areas and one individual was found growing in a crack in the pavement driveway. Several individual ‘iwa ‘iwa (*Asplenium adiantum-nigrum*) ferns were found just outside of the east-to-south boundary of the subleased lands, none were found within the subleased lands. No other plant species were recorded. The species observed were typical of the alpine stone desert ecosystem; none are listed as threatened or endangered species.

- Arthropods. The majority of species recorded during the survey were species not native to the aeolian desert on Maunakea. The exceptions were one native spider species (*Lycosa hawaiiensis*), one native moth species (*Agrotis kuamauna*), and one fly species from an unknown origin (*Bradysia sp.*). Arthropods from the *Aphis* genera were found in traps but could not be identified to the species level; all *Aphis* species in Hawai‘i are non-native and some have been previously recorded in the aeolian desert on Maunakea. One member of the survey team, who samples arthropods regularly in the UH managed areas on Maunakea, reported previously noting native spiders and caterpillars at or near the CSO site although they were not common in this recent survey. Wēkiu bugs were not found at the CSO Site during the study and the report indicates that they are not found on lava flows or areas dominated by compacted ash/silt. Studies conducted on Maunakea have indicated that environments like the CSO Site are not likely to be prime wēkiu bug habitat currently or after restoration (Kirkpatrick 2018, Kirkpatrick & Klasner 2015, UH Hilo 2010, Englund et al. 2007, Porter and Englund 2006). None of the arthropods present in the alpine stone desert on Maunakea are listed as threatened or endangered species.

- Birds and Mammals. No birds or non-human mammals were observed during the study. The report noted that what appeared to be dog feces was observed at the CSO Site and that two endangered birds, ‘ua‘u (*Pterodrama sandwichensis* or Hawaiian Petrel) and ‘akē‘akē (*Oceanodroma castro* or Band-rumped Storm Petrel), may utilize the lower elevation alpine shrublands and grasslands on Maunakea, but there have been no recorded detections of birds or burrows in the vicinity of the CSO Site. Similarly, the endangered ‘ōpe‘ape‘a (*Lasiurus cinereus semotus* or Hawaiian hoary bat) has not been detected in the vicinity of the CSO Site but may occur at high elevations.

6.3.3 Impacts of Biological Site Restoration

With the exception of ALT-1 (i.e., the No Action alternative), all of the alternatives considered in this SDP (see Table 1-1) contemplate total facility removal, partial or full infrastructure removal, and moderate or full site restoration. Removal and restoration can impact biological resources in two periods: (*i*) during removal and site restoration activities, also referred to as “process impacts;” and (*ii*) after restoration activities, also referred to as “outcome impacts.” Both phases of site restoration (i.e., during/process and after/outcome) are given further consideration in the following subsections.

6.3.3.1 Site Decommissioning Process Impacts

The *Biological Setting Analysis* (SRGII, 2019) provides an extensive analysis of the potential impacts related to the process of removing the observatory and restoring the CSO Site. In contrast to the action alternatives, and as a baseline for comparison with them, the *Biological Setting Analysis* concludes that (SRGII, 2019):

> *"Under a No Action Alternative, biological resources would remain unimpacted [relative to status quo], and both native and non-native species would continue to occupy the project footprint."*

Thus, there would be no decommissioning process impact relative to status quo under ALT-1 because the site would not be disturbed and the species would continue to occupy the site as they did during CSO operation and continue to do so since CSO ceased operation.

The following points summarize SRGII's assessment of the potential for impacts during the decommissioning process under the action alternatives:

- The process of site decommissioning will disturb the CSO Site and potentially adversely impact lichens, mosses, vascular plants, and arthropods, as well as the habitat that supports them, but these impacts will be temporary and not considered significant.
- No native birds or mammals frequent the CSO Site or nearby areas.
- The best management practices (BMPs) and monitoring during site deconstruction and restoration described in Section 5.1.1 will minimize impacts.
- These impacts will be limited to the CSO Site and staging and stockpiling areas, leaving broader populations on the summit unaffected.
- Recolonization of the CSO Site by native species, once site restoration is complete, is almost certain to occur.
- The process of restoration, because it involves a range of equipment coming onto the CSO Site from elsewhere, can present a threat of introduction of non-native vascular plans and arthropods. However, utilization of the BMPs described in Section 5.1.1 will minimize this potential, and the extreme summit conditions render the survival and establishment of non-native species unlikely.
- Significant adverse impacts due to the introduction or establishment of non-native species are not anticipated.
- The site restoration process presents the risk of exposing flora and fauna to potentially hazardous biological material from the cesspool and chemicals, such as the documented hydraulic fluid spill and hydrocarbons from motorized equipment, as those substances are being removed. However, observing the BMPs discussed in Section 5.1.1 will minimize this risk and no significant adverse impacts relating to exposure are anticipated as a result.

6.3.3.2 Restoration Outcome Impacts

The *Biological Site Assessment* indicates that the planned scope of topographical site restoration is adequate for the restoration of the biological community (SRGII, 2019):

> *"Geological analysis has confirmed that [fill material from the site to be used for backfilling] is consistent with other material at the summit. The only non-native species present in the fill would be those that are already part of the existing environment. Estimates of the volume of earthen material needed to backfill and finish the site indicate more material is available than needed. This phase of the restoration process aims to create the topographic conditions that provide sufficient conditions for passive restoration of the biological community."*

As the discussion of methodology will indicate, the anticipated outcome of full restoration of the CSO Site, per ALT-2 (Section 4.3.2) is that all prior habitat will be recovered, allowing native flora and fauna to reestablish themselves over time. Thus, the after restoration (outcome) impact of full site restoration would be entirely positive. Other action alternatives that incorporate moderate site restoration (i.e., ALT-3 and ALT-4) will yield more modest benefits because, although they would enhance the physical habitat structure to benefit the native arthropod community, they would not restore the topography, which is likely necessary for the establishment of native flora.

Under ALT-1 (No Action) there would be no restoration of the CSO Site. Thus, the benefits of the action alternatives outlined above would not occur, there would be no negative or positive biological impacts relative to status quo, and negative biological impacts relative to the pre-construction conditions (e.g., the presence of structures and hardscape displacing habitat) would endure.

6.4 ARCHAEOLOGICAL-CULTURAL CONSIDERATIONS AND IMPLICATIONS

During CSO Site decommissioning planning, Caltech retained ASM Affiliates to conduct an Archaeological Assessment (AA) and a Cultural Impact Assessment (CIA) to identify archaeological and cultural resources present in the area and to assess the potential for impacts during decommissioning activities, also referred to as "process impacts," and after decommissioning is complete, also referred to as "outcome impacts." The resulting reports, *An Archaeological Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Maunakea* (ASM Affiliates, 2018) and the *Cultural Impact Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Maunakea* (ASM Affiliates, 2020) are, collectively, the primary sources of the information and analysis contained in the following subsections of this SDP. Together, they offer two complementary approaches to cultural considerations: (*i*) specific archaeological, historical, or cultural resources; and (*ii*) Maunakea's summit region cultural landscape.

The AA is based on a pedestrian survey of the study area, which is defined as the areas, "where ground disturbance may be anticipated to occur during the decommissioning process" (ASM Affiliates, 2018). This survey sought to identify archaeological or historic sites which were not previously identified in prior surveys, confirm previously identified properties nearby, and take photographs from "a visual effects study area that includes the viewshed of the CSO facility" (ASM Affiliates, 2018). As such, the AA is most directly relevant to the consideration of specific archaeological, historical, or cultural resources.

The CIA: (*i*) summarizes the literature on the cultural significance of Maunakea, (*ii*) reviews prior studies of similar type, and (*iii*) reports on prior and contemporary consultations with Native Hawaiian practitioners and community members. It is primarily relevant to cultural landscape, though it references some of the specific cultural resources that the AA identifies.

The AA and CIA assess the potential for impacts both during site decommissioning (process) and after it is complete (outcome). For reference, Figure 6-5 provides a depiction of the AA's direct effect and visual study areas overlaid; the visual study area is the area within the summit region from which the CSO Site can been seen. Figure 6-6 zooms in on the direct effect study area; the direct effect study area is the area that could be disturbed by CSO decommissioning activities. The AA involved a pedestrian study of the direct effect study area and visiting nearby historic properties within the visual effects study area in May 2018. The CIA effort included:

- Reviewing previous Maunakea cultural studies.
- Contacting the Office of Hawaiian Affairs (OHA) main office on Oʻahu and their West Hawaiʻi branch office.
- Sending consultation requests to 38 individuals or groups.
- Receiving responses from eight of those sent requests.[9]
- Having four of those responding consent to participate in the CIA (Harry Fergerstrom, Kohala Hawaiian Civic Club, Laʻiʻōpua 2020 Association, and Jimmy Medeiros, Sr.).
- Reviewing information from an informal meeting regarding the proposed decommissioning between Peter Young of Hoʻokuleana LLC and three kūpuna that have knowledge concerning Maunakea cultural practices and have demonstrated interest in Maunakea land uses.
- Attending two meetings of Kahu Kū Mauna.

The AA and CIA indicated:

- The CSO Site, direct effect study area, and visual effect study area are within the Mauna Kea Summit Region Historic District (SIHP Site 50-10-23-26869), which encompasses the area from the summit down to a relatively pronounced change in slope that creates the impression of a summit plateau. All known archaeological sites and historic properties within the district area are considered to contribute to the district.
- No archaeological sites that contribute to the historic district are within the CSO Site or direct effect study area.
- Eleven historic properties that contribute to the historic district are within the visual effects study area. SIHP Site 50-10-23-16164, a shrine, is 188 meters to the south-

[9] One of the eight who responded and consented is not listed in CIA Tables 4 or 5 because they were responding to an earlier invitation to consult on the project.

southwest of the CSO Site. A photograph from that site to the CSO Site is provided in Figure 6-7.

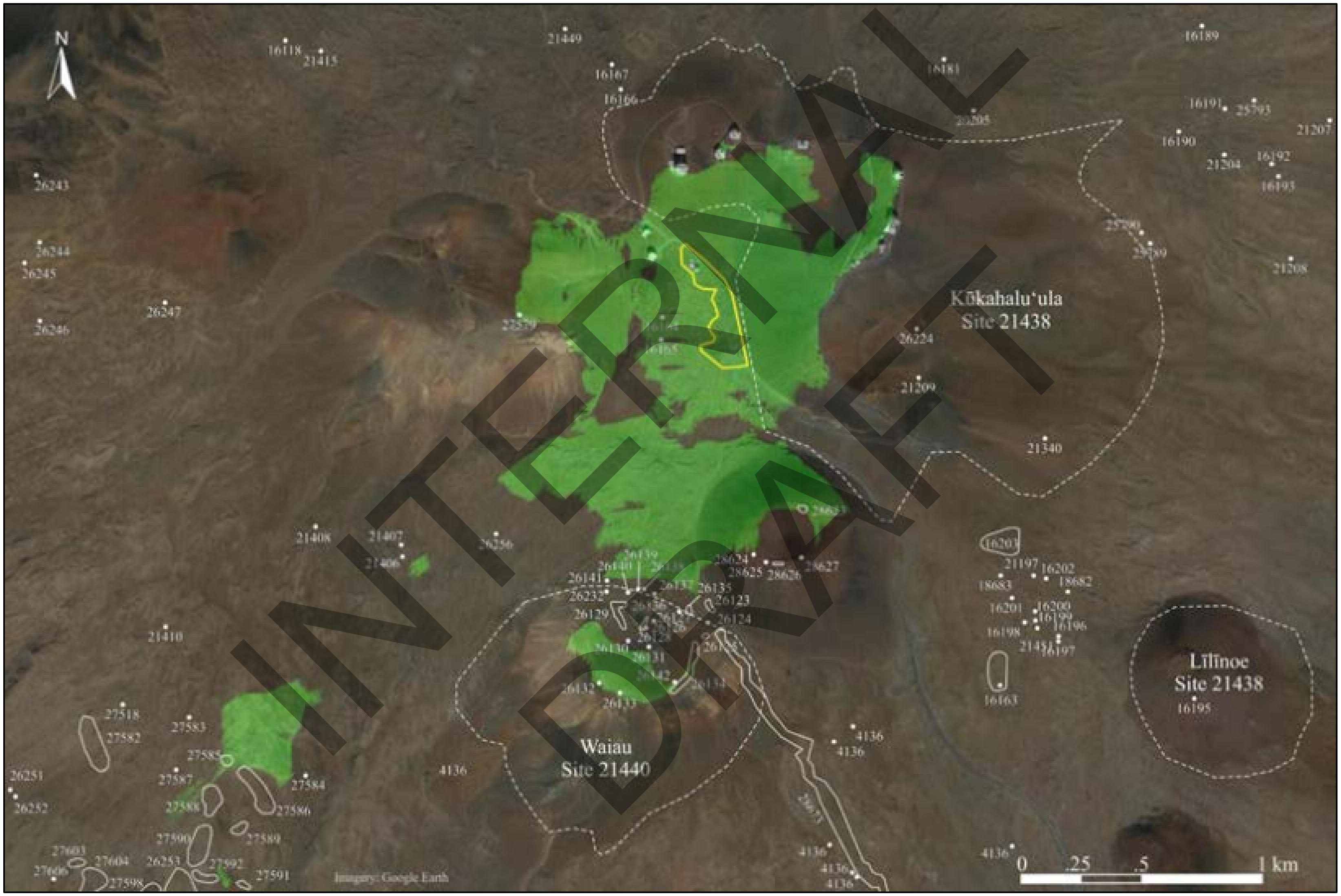
- The decommissioning of CSO will "result in an enhancement of the integrity of setting, feeling, and association" of the historic properties and district. Thus, in accordance with applicable rules and regulations, the determination of effect for the proposed decommissioning would be "no historic properties affected."
- Native Hawaiians are not monolithic in their views, and there may be a multitude of opinions regarding the sanctity of Maunakea. This was illustrated by members of Kahu Kū Mauna stressing that based on their experience it is important to acknowledge that "there is a diversity of perspectives regarding the sacredness of Maunakea and some Native Hawaiians do not view Maunakea as sacred."
- Maunakea's upper slopes continue to be sacred – i.e., provide a cultural landscape – to contemporary cultural practitioners, whether their practices are "traditional and customary" or contemporary. Cultural practitioners place value on this cultural landscape, and their practices reinforce that value for them.
- The CIA, and the quotes from it included in the sections below, focus on those that participated in the CIA and hold the region to be sacred. That cohort of Native Hawaiians believes that it would be improper and culturally offensive if the CSO decommissioning effort does not *intend* to remove all facilities and infrastructure and fully restore the CSO Site.

The reports did not identify:

- Any specific ongoing traditional, customary, or contemporary cultural practices occurring within or associated with the CSO Site or direct effect study area.
- Any specific cultural practices that would be directly affected (adversely or beneficially) by the decommissioning of CSO.
- Any resources used for traditional and customary cultural practices that are present on the CSO Site.
- That the CSO Site or direct effect study area is used to access locations where traditional and customary cultural practices are conducted or cultural resources are gathered.

Consequently, Caltech has concluded that there will be no direct effect on any specific archaeological, historical, or cultural resources as a result of the CSO Decommissioning Project and that any resulting indirect effects will be entirely positive. Nevertheless, Caltech will implement the mitigation measure suggested by those that participated in the CIA: having a cultural monitor present during decommissioning as mentioned in Section 5.1.1.

Figure 6-5: Direct Effect and Visual Study Areas for the Archaeological Assessment



Google Earth™ satellite image showing the visual effects study area (green) and the direct effects study area (outlined in yellow). Historic sites in the vicinity are indicated.
Source: ASM Affiliates, Archaeological Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Maunakea (2018)

Figure 6-6: Direct Effect Study Area for the Archaeological Assessment

Google Earth™ satellite image showing the direct effects study area (outlined in yellow). It includes the CSO Site, the Batch Plant, the area in between, and land to the northwest of the CSO Site.
Source: ASM Affiliates, *Archaeological Assessment for the Caltech Submillimeter Observatory Decommissioning Project on Maunakea* (2018).

Figure 6-7: CSO Site from SIHP Site 50-10-23-16164

Note: CSO is in center left midground, site 50-10-23-16164 is in the foreground, view to the northeast.
Source: ASM Affiliates, *Cultural Impact Assessment for the Caltech Submillimeter Observation Decommissioning Project on Mauna Kea* (2020).

6.4.1 Site Restoration Impacts to the Cultural Landscape

6.4.1.1 <u>The Cultural Landscape</u>

The CIA provides a substantial body of literature identifying Maunakea as a *wahi pana*, or storied place, and describes its cultural significance from a variety of perspectives. In its review of the literature regarding the cultural significance of Maunakea, it states (ASM Affiliates, 2020):

> *"An extensive body of literature describing the significance of Mauna Kea and the summit region has been developed over the past three decades (Kanahele and Kanahele 1997; Lang and Byrne 2013; Langlas 1999; Langlas et al. 1999, Maly 1998, 1999; Maly and Maly 2005, 2006; McCoy et al. 2009; McEldowney 1982; PHRI 1999; Simonson and Hammatt 2010). Through archival research and a compilation of native traditions, historical accounts, and oral-historical interviews, a detailed culture-history of Mauna Kea has been presented that documents a wide range of cultural knowledge and practice associated with the mountain, and more specifically with the summit region and [its] association with Hawaiian deities.*

> *These studies have also recognized Mauna Kea as a landscape that continues to be sacred to contemporary cultural practitioners."*

Its concluding analysis states:

> *"The culture-historical background information that has been generated for Mauna Kea as a result of the numerous detailed studies clearly demonstrates the sanctity of Mauna Kea and its summit region. The compiled oral-historical information provides further specific details about the cultural importance of the summit's viewplanes, the traditional significance of individual pu'u, and the importance of proper cultural protocol. It is also clear from the oral-historical information that current-day Hawaiian cultural activities on Mauna Kea are perceived by the practitioners of those activities to be an exercise in, and extension of traditional and customary practices."*

While some of this text references specific cultural resources, these references augment its overarching position about the sanctity and significance of Maunakea's upper slopes to current-day cultural practitioners. This SDP terms this sanctity and significance as the "cultural landscape." The cultural landscape is not merely a sum of specific, identifiable resources, it represents the combined works of nature and cultural practitioners and the values attributed to the landscape by Native Hawaiians.

6.4.1.2 Impacts of CSO Decommissioning on the Cultural Landscape

The CIA begins its analysis of impacts of site decommissioning as follows (ASM Affiliates, 2020):

> *"…there is no disputing that the decommissioning of an observatory facility within the Astronomy Precinct on Mauna Kea would have a positive cultural impact. What is up for review and discussion in this analysis is the identification of those aspects of the decommissioning that could diminish or reverse the positive impact, and the measures that can be taken to avoid or mitigate any potential negative effects."*

The following subsection identifies the measures that will be incorporated into cultural, archaeological, and biological resources monitoring plans (see Section 5.1.1) and observed during the process of site restoration to avoid diminishing the positive cultural impacts of the decommissioning on the cultural landscape. The second subsection outlines the potential positive and negative impacts on the cultural landscape as a result of site decommissioning and site restoration.

6.4.1.2.1 Site Restoration Process Impacts

The CIA offers guidance on measures to take during the process of site restoration to prevent the lessening of the positive impact on the cultural landscape (ASM Affiliates, 2020):

> *"Also, consistent with recommendations contained in the NASA (2005) study, it is recommended that a cultural monitor be present when ground-altering activities are being conducted for the CSO decommissioning. The role of the onsite cultural monitor will be to provide an appropriate cultural orientation to individuals conducting onsite work, and to provide guidance on following cultural protocols during the decommissioning process. In that vein, and as specified in the CMP*

> *(Ho‘akea 2009:7-7) and its decommissioning sub-plan (Sustainable Resources Group Int’l, Inc. 2010:ii) as “Management Action CR-1,” it is also recommended that a set of cultural protocols be developed in consultation with Kahu Kū Mauna, families with lineal and historical connections to Mauna Kea, as well as cultural practitioners to address all aspects of the demolition and restoration work to be completed as part of the decommissioning process.”*

As described in Section 5.1.1, the cultural monitor will be present and provide services consistent with the recommendations in the CIA. The procedures and protocols, directed by a cultural monitor, should help to avoid and minimize the potential for adverse impacts throughout the decommissioning effort.

6.4.1.2.2 Impacts Associated with Removal Option and Restoration Level

The CIA analyzes the impact of CSO decommissioning associated with its goals and intents on the cultural landscape as follows (ASM Affiliates, 2020):

> *“What has been expressed by several cultural practitioners in prior and current interviews is that the goal of decommissioning from their perspective would be to ultimately clear the summit of Mauna Kea of “Western” intrusions and return the landscape as best as possible to its pre-development condition. While this ideal is not necessarily achievable given the existing roadways and associated infrastructure, it is the assessment of the current study that any decommissioning proposal that leaves behind physical remnants of a facility, whether above or below the current ground surface, would result in a negative cultural impact with respect to the proposed action [with the proposed action being removal and restoration to the fullest extent possible].”*

From this point of view, the presence of the current CSO facilities, including any invisible underground infrastructure, has a negative impact on the cultural landscape, and the greater the degree of removal and restoration, the proportionately greater the potential positive impact on that resource would be. However, while the above discussion suggests simply that greater levels of removal and restoration have greater benefit, the CIA (ASM Affiliates, 2020) follows immediately with a statement regarding targets and desires created by the DP (2010) and how the restoration outcome may or may not align with them:

> *“As stated in the Decommissioning Sub-Plan, “Ideally, the target for all sites is restoration to the site’s historical condition prior to construction of the facility.” (Sustainable Resources Group Int’l, Inc. 2010:23). If this is DLNR and the University’s position, adopted through approval of the CMP (and its sub-plans), then as stated in the CMP, the “[d]esired outcome to the extent possible, [is to] reduce the area disturbed by physical structures … by upgrading and reusing buildings and equipment at existing locations, removing obsolete facilities, and restoring impacted sites to pre-disturbed condition” (Ho‘akea 2009:7-53; emphasis [added]). Both the CMP and the Decommissioning Sub-Plan indicate that the decommissioning starting point is for the observatories to do their utmost to completely remove all structures and fully restore the site, and based on what was said during consultation, doing less than that could be perceived as improper and culturally offensive.”*

Thus, a negative impact to the cultural landscape may arise if the removal option and restoration level employed at the CSO Site is less extensive than the DP's "starting point" (e.g., complete removal and full restoration) when the greater extent was technically feasible. The CIA provides the following statements and recommendations related to decommissioning:

> *With the understanding that some negative impacts may result from decommissioning, these impacts would not completely erase the overall positive impact. However, a perception exists that anything short of an attempt at complete facility removal and full environmental restoration would result in a disingenuous decommissioning effort, as well as be an affront to cultural sensibilities. Therefore, it is recommended that the complete facility (above and below ground) be removed and the affected environment be restored to the fullest extent possible. Following this, and the other above-offered recommendations, will help to ensure that the proposed decommissioning will not result in impacts to any traditionally valued cultural or historical resources nor any traditional cultural practices or beliefs.*

These two passages indicate, in the view of the authors of the CIA and based upon the sentiments expressed during the consultation process, that removal and restoration of the CSO Site to the greatest extent possible would result in a qualitatively better outcome for the cultural landscape than other options. By extension, these two quotes also suggest that anything less than an attempt at total removal and full site restoration could have a negative impact, compounding the ongoing adverse impact caused by the presence of the CSO.

Consequently, remaining committed to Caltech's intent, first outlined in the NOI (Chapter 2, Appendix A), to completely remove the CSO infrastructure and fully restore the site will maximize the beneficial effects, and prevent negative impacts, of decommissioning on the cultural landscape. This benefit is based on repeated statements, both in the DP (2010) and by Caltech, regarding total removal and full restoration being the starting point and the desired goal of the decommissioning process (see Section 4.1 and Chapter 5). ALT-2, ALT-3, and ALT-4 all reflect Caltech's intent, but under ALT-3 and ALT-4 that intent would not be fully realized, despite being attempted, due to unanticipated factors beyond Caltech's control. Thus, ALT-2 would provide the largest beneficial effect and ALT-3 and ALT-4 would provide a quantitatively lesser, but qualitatively comparable, benefit if complete removal and full restoration could not be achieved.

6.4.2 Site Restoration Impacts to Specific Cultural Resources

6.4.2.1 Specific Cultural Resources

The AA summarizes the absence of previously known archaeological or historic resources in the direct effects study areas and lists the known resources in the visual effects study area in its Executive Summary (ASM Affiliates, 2018):

> *"The direct effects study area was included in three prior archaeological surveys (McCoy 1982a; McCoy and Nees 2010; McCoy et al. 2010). The visual effects study area was included in these three studies, and also two other archaeological inventory surveys (McCoy and Nees 2009, 2013). No archaeological sites were previously reported within the direct effects study area. The two closest previously recorded sites are two shrines (Sites 50-10-23-16164 and 16165) located 188 meters and 250 meters, respectively, to the south-southwest of the CSO project*

> *area. The Mauna Kea Summit Region Historic District (SIHP Site 50-10-23-26869), which encompasses the extent of the glacial moraines and crest of the relatively pronounced change in slope that create the impression of a summit plateau (Log No.: 23155; Doc No.:9903PM07), includes the CSO facility site, although no contributing elements of the district are located within the direct effects study area. Eleven of the historic properties that contribute to the historic district lie within the visual effects study area."*

It goes on to report the results of the direct effect study areas pedestrian survey (ASM Affiliates, 2018):

> *"As a result of the fieldwork, no archaeological resources of any kind were identified within the direct effects study area."*

Based on prior studies and the results of the AA and CIA (ASM Affiliates, 2018; 2020), Caltech is unaware of any traditional or customary native Hawaiian practices, such as spiritual practices, religious practices, or subsistence gathering occurring on the CSO Site, nor is there access to any traditional trails via the CSO Site. However, while no archaeological or historical properties have been identified, either during previous archaeological surveys or detected during the AA's pedestrian survey of the direct effect study area, there are archaeological-historic sites within the CSO viewshed. Section 6.4.2.2 discusses the implications of site restoration on the archaeological and historic resources in the visual effects study area.

6.4.2.2 <u>Impacts of Site Restoration on Specific Cultural Resources</u>

Based on the preceding discussion and the findings of the AA and CIA, Caltech has concluded that, provided site decommissioning operations include the presence of appropriate archaeological and cultural monitoring, the process of site restoration will have no negative impacts on any specific cultural resources. With regard to the outcome of decommissioning and site restoration, Caltech has also concluded that the greater the extent of removal and restoration of the CSO Site, the greater the positive impact will be on the two relevant specific cultural resources: (*i*) cultural viewplanes, and (*ii*) sense of place. The following subsections provide additional detail related to the potential for impacts both during and after site restoration operations.

6.4.2.2.1 Site Restoration Process Impacts

The AA concluded that site restoration will have no impact on archaeological and historical resources because there are none present on the CSO Site (ASM Affiliates, 2018):

> *"Given the negative findings of the current study with respect to archaeological resources, it is concluded that the Caltech Submillimeter Observatory Decommissioning Project on Maunakea will have no direct effect on any historic property within the project area."*

The above is relevant to both the process and the outcome of restoration. Nevertheless, with respect to process, it makes the following recommendation (ASM Affiliates, 2018):

> *"Archaeological monitoring is recommended as a precautionary measure to ensure protection of Site 21438 (Kūkahauʻula), which is adjacent to the Mauna Kea Summit Access Road and the lower portion of the CSO project area, and as a contingency for the discovery of unanticipated archaeological resources. An*

> *archaeological monitoring plan in accordance with HAR 13 §13-279 will be prepared for acceptance by DLNR-SHPD prior to project implementation."*

Since the SDRP already calls for the presence of an onsite archaeological and cultural monitors during deconstruction and removal activities (see Section 4.2.2), their continued presence during the site restoration activities described in this SRP would satisfy this recommendation.

6.4.2.2.2 Restoration Outcome Impacts

In addition to the AA's conclusion that site restoration will have no direct effect on any historic property within the decommissioning project area, it also gives due consideration to cultural viewplanes and sense of place. To do so, it used the following methodology (ASM Affiliates, 2018):

> *"…an assessment of the potential visual impacts of the removal of the CSO dome and facilities was made by photographing the CSO facility site from the nearest historic property within the visual effects study area…. Removal of the CSO facility was simulated by digitally erasing the telescope superstructure from the photographs…."*

Using this methodology, the AA concluded that with regard to cultural viewplanes and sense of place, as well as the entire Mauna Kea Summit Region Historic District (ASM Affiliates, 2018):

> *…will experience overall beneficial effects from the removal of the CSO facilities. For those sites, the removal of the above-ground facilities will partially restore the appearance of the summit as it was prior to the construction of the CSO. This will result in an enhancement of the integrity of setting, feeling, and association of the six sites as well as the historic district.*

Based on the findings in the AA and CIA (ASM Affiliates, 2018; 2020), Caltech has concluded that all alternatives will have positive impacts on the specific cultural resources (i.e., cultural viewplanes and sense of place). While neither the AA nor the CIA specifically address the partial infrastructure removal and/or less than full restoration considered in ALT-3 and ALT-4, it is reasonable to conclude that the positive impacts would be tempered to a degree commensurate with the extent of removal and restoration.

6.5 SITE RESTORATION METHODOLOGY

As noted in Section 6.1, site restoration consists of two elements: (*i*) topographic restoration; and (*ii*) biological habitat restoration. All site restoration operations will adopt the recommendations regarding geophysical and habitat restoration contained in the BSA (see Section 6.3.3). Caltech will also require all decommissioning operations to observe the provisions of the BMPs, including site monitoring (see Section 5.1.1), augmented with informal input from local experts. The following subsections summarize the consistency of the topographic restoration methodology discussed in Section 6.2 vis-à-vis the BSA and BMPs. It will also evaluate how moderate restoration (e.g., ALT-3 and ALT-4) would necessarily modify that methodology.

6.5.1 Topography Restoration Methodology

Guidance on topography restoration from the BSA is as follows (SRGII, 2019):

> *"[Topography] restoration includes removal of all manmade features, backfilling holes and trenches, and placing and removing fill to restore the topography and surficial material of the site. Under full restoration, restored topography and surface materials would mimic site conditions just prior to the CSO construction to the extent possible. A topographic map dated January 21, 1983 represents the site prior to construction. A second topographic map dated November 24, 2015 depicts existing site conditions. The 2015 map, along with other documents, indicates that some earthen material moved during construction activities at the summit in this area (i.e. CSO, James Clerk Maxwell Telescope and potentially road work) was pushed into elongated piles. [The previous sentence refers to earthmoving at the time of CSO and JCMT construction in the 1980s.] All fill material used for backfilling and finishing would come from the piles around parts of the site's perimeter. Geological analysis has confirmed that this fill is consistent with other material at the summit. The only non-native species present in the fill would be those that are already part of the existing environment. Estimates of the volume of earthen material needed to backfill and finish the site indicate more material is available than needed. This phase of the restoration process aims to create the topographic conditions that provide sufficient conditions for passive restoration of the biological community."*

Consistent with this guidance, and to the extent practicable depending on the alternative being implemented, the grade at the CSO Site will be completed as outlined in Section 5.1.14 so that it matches the pre-construction topography to the maximum extent possible. As stated in that section, because the CSO Site is located on a lava flow, it will not be possible to fully reconstruct the preexisting flow in excavated areas. Rather, restoration will use rocks and fill, compacting as necessary for long-term stability, to return those areas to a natural condition visually consistent with the surrounding topography.

Section 5.1.1 presented BMPs for minimizing habitat disturbance, avoiding the introduction of non-native species and monitoring for them, and for onsite storage and disposal of materials. Because of the intensity of topography restoration activities, it will be critical to apply these BMPs throughout the restoration process. In addition, Sections 6.3.3.1, 6.4.1.2.1, and 6.4.2.2.1 document that doing so will result in no significant adverse physical, biological, or cultural impacts as a result of site restoration operations.

6.5.2 Habitat Restoration Methodology

6.5.2.1 Full Restoration

The BSA indicates that habitat restoration will occur passively once restoration of the physical environment is complete (SRGII, 2019):

> *"Passive [habitat] restoration through natural recruitment of lichens, mosses, and vascular plants as well as the arthropod community is expected once the site has been topographically restored. No out-planting of native species is recommended as few plants were present prior to construction of the CSO, and sparse plant populations are typical of lava flow habitat in the alpine stone desert. No transfer of arthropods, other than those already present in fill, is recommended."*

Caltech has augmented the BSA's guidance with input from a local expert, Jessica Kirkpatrick, CMS' Natural Resource Specialist staff:

> *As far as habitat…, observations suggest that the Hawaiian wolf spiders prefer rocky habitats while endemic Agrotis caterpillars are usually found in spaces between rocks, in an ash layer that holds moisture. Various rock sizes with interstitial spaces provide habitat for lichens, mosses, spiders, caterpillars and other taxa on the CSO site.* (Jessica Kirkpatrick, personal communication, November 6, 2020)

Based on her advice, prior to long-term, passive restoration, active habitat restoration will be performed. It will consist of scattering fine ash material and small rocks stockpiled during fill removal using medium to small equipment (e.g., a mini loader) and hand tools. It is Caltech's intent that this effort will provide the variety of niche habitats Ms. Kirkpatrick mentions. Section 5.1.1 presented BMPs for minimizing habitat disturbance, avoiding the introduction of non-native species and monitoring for them, and for onsite storage and disposal of materials. Because of the intensity of topography restoration activities, it will be critical to apply these BMPs throughout the restoration process. Sections 6.3.3.1, 6.4.1.2.1, and 6.4.2.2.1 document that doing so will result in no significant adverse physical, biological, or cultural impacts as a result of site restoration operations. Further, the biological monitoring called for throughout the site deconstruction and removal process will continue during the site restoration phase of the effort.

6.5.2.2 __Moderate Restoration__

Moderate restoration differs from full restoration in that it does not include full topographical restoration; moderate restoration is similar to full restoration in that it includes active habitat restoration where the ground surface is disturbed and no longer provides good habitat. ALT-3 and ALT-4 would result in at least a portion of the CSO Site being moderately restored due to circumstances discovered during decommissioning. Where subsurface infrastructure could not be removed or other obstacles prevented full restoration, the ground would be graded to leave a safe condition (i.e., no cavities or large depressions) followed by restoration of surficial material to provide suitable habitat. Over portions of the site where there was no such work, the existing surface may already be suitable. This restoration (or retention) of surficial material corresponds to the last steps of topography restoration (see Section 6.5.1) and the entirety of active habitat restoration (see Section 6.5.2.1). Successful execution of these active components of site restoration will promote passive habitat restoration even in the moderate restoration scenario called for under ALT-3 and ALT-4 (see Table 1-1).

6.5.3 Restoration Monitoring

Finally, to assess the success of habitat restoration there will be monitoring after completion of restoration activities. The specific protocol will be that suggested in the BSA (SRGII, 2019):

> *"It is recommended that two points within the sub-lease footprint be selected for monitoring during the OMKM [now CMS] annual native/non-natives species monitoring program to evaluate if restoration goals are being achieved."*

Three years of monitoring will take place, satisfying the guidance from the DP (2010). Assessment will consist of comparison of native and non-native species diversity and abundance to pre-decommissioning survey efforts and surrounding areas.

6.6 FUTURE LAND USE

Upon completion of the decommissioning process outlined in this SDP, except for the restoration monitoring, Caltech intends to terminate its sublease for the CSO Site. Caltech has no plans for any future land use at the CSO Site. Future land use on the site will be guided by the applicable Master Plan and CMP and is beyond the scope of Caltech's planning and decommissioning process.

CHAPTER 7: COST-BENEFIT ANALYSIS

7.1 CONTEXT

7.1.1 Cost-Benefit Analysis Guidance

In addition to the requirement for the NOI, EDD, SDRP, and SRP addressed in prior chapters of this SDP, the CMP (2009) and its DP (2010) both stipulate that observatories present a Cost-Benefit Analysis (CBA). The CBA must address, for each alternative identified in the SDP, the potential costs and benefits associated with implementation of all activities described in the SDRP and SRP. The CMP states (UH, 2009)

> *"Each observatory will need to identify what course of action they will pursue when the life expectancy of their technology is reached and it becomes obsolete, or when the lease expires. While OMKM shall be responsible for overseeing compliance of these activities with the CMP, the process needs to be a collaborative effort between OMKM, DLNR, the University, and the observatories.*
>
> *…Appropriate strategies shall be developed to address restoring the land to its original condition, as required by the lease. In particular, any plan to restore habitat needs to be analyzed at the landscape level, rather than as only the footprint of a single observatory. A cost-benefit analysis will need to be conducted by the observatories to determine what level of restoration is appropriate for their site."*

The CMP reiterates this requirement in Table 7-13, SR-2 (CMP, 2009):

> *"Require observatories to develop a restoration plan in association with decommissioning, to include an environmental cost-benefit analysis and a cultural assessment."*

With these statements, the CMP makes clear that the CBA is intended to consider and contrast the costs and benefits of varying levels of observatory removal and site restoration called for under the various alternatives considered in the SDRP and SRP and is an adjunct to those documents. The purpose of the CBA is further developed in the DP:

> *"Ideally, the target for all sites is restoration to the site's historical condition prior to construction of the facility. However, the SRP must also consider cultural sensitivities, the extent of infrastructure removal and deconstruction, the size of the site restoration effort, the use of backfill cinder with respect to its source and size. The level of restoration attempted and the potential benefits and impacts of the restoration activities on natural and cultural resources during and post-activity must be carefully evaluated. A cost-benefit analysis shall also be conducted."*

The purpose of this CBA is to fulfill the CMP and DP requirement by providing an analysis of the potential costs and benefits of the varying levels of observatory removal and site restoration called for in each of the alternatives described in Table 1-1 and developed in further detail in Chapter 4. Caltech interprets the CMP and DP as requiring a financial CBA, which is provided in this chapter; Caltech's decision making is informed by other factors as well, as discussed in Section 7.4.

7.1.2 Consideration of Impacts

Caltech acknowledges that decommissioning decision-making must consider factors beyond the "costs" considered in the CBA. Consequently, the potential natural and cultural impacts associated with the various alternatives, which cannot be assessed quantitatively in the CBA, are addressed first, in the SRP (see Section 6.2, 6.3, and 6.4) and remain critically important when evaluating the alternatives and selecting the best course of action.

7.1.3 Content of the CBA

In general, a CBA is a systematic method for estimating the strengths and weaknesses of alternative courses of action. A CBA can be a useful method for identifying which of a range of options provides the most benefit while preserving the greatest degree of savings. Because a CBA is a comparative exercise, it requires that costs and benefits be expressed with the same unit so that the positive(s) and negative(s) associated with a potential alternative can be effectively and consistently weighed in the balance. Here, Caltech is the one conducting the CBA, therefore, the costs and benefits are considered from their perspective. The alternative courses of action being considered are the project alternatives in Table 1.1. The common unit of comparison is estimated costs (dollars) and estimated decommissioning process duration (days). These two "costs" are used in this CBA; however, Caltech believes that any measure of "cost" could be examined and arrive at the same outcome. In terms of process, this CBA will:

- Define the CSO deconstruction and restoration steps that need to be taken under each alternative;
- Assign estimated costs associated with each of those steps;
- Assign estimated value for the benefits associated with taking each of those steps; and
- Compare the relative costs and benefits of each alternative to determine which offers the most benefit while providing the most savings.

As noted above, the range of alternatives being evaluated are the alternatives identified for detailed consideration in this SDP (see Table 1-1 and Chapter 4). Collectively, these alternatives include varying combinations of the two site deconstruction and removal options and the three levels of site restoration, and are representative of the full range of reasonable alternatives. Table 7-1 below summarizes the alternatives for quick reference.

Table 7-1: Removal Option and Level of Site Restoration by Alternative

Alternative	*Deconstruction and Removal Option*	*Level of Restoration*
ALT-1	n/a	n/a
ALT-2	Complete facility and infrastructure removal	Full restoration
ALT-3	Complete facility and infrastructure removal	Moderate restoration
ALT-4	Complete facility removal and infrastructure capping	Moderate restoration
Source: Compiled by Planning Solutions, Inc. (2020)		

Each possibility—both the extent of site deconstruction and removal and level of site restoration—comes with an attached cost in dollars, defined as the sum total of an alternative's cost factors. By contrasting the comparative costs and benefits of each alternative against the others, Caltech will be able to illustrate how, and to what extent, cost factors bear on the decision-making process.

As a final note, it is important to acknowledge that not all the alternatives considered in the SDP, and by extension this CBA, would fulfill all of Caltech's obligations regarding disposition of the CSO Site. The *Sublease Agreement Among the California Institute of Technology, the University of Hawaii, and the State of Hawaii, Department of Land and Natural Resources, Sublease H09176* (henceforth, "the sublease") offers four options for termination or extirpation of its sublease: (*i*) sale to UH; (*ii*) surrender with concurrence of UH; (*iii*) sale to a third party acceptable to UH; and (*iv*) removal of the property and restoration of the site to even grade at the expense of Caltech. At minimum, ALT-1 (the No Action alternative), does not comport with this requirement. However, it remains a valuable alternative for reasons described in Section 1.3.2, including as a baseline for comparison with the action alternatives.

7.2 ASSESSING COST

For the purposes of this CBA, cost factors are those project elements (e.g., materials, labor, services, time, etc.) that will incur cost per unit during the decommissioning process. This section considers the costs that will be incurred during the deconstruction and restoration of the CSO Site, and how they differ between the various action alternatives, based on their unique scopes of work.

The general deconstruction activities which are applicable to all the action alternatives considered in this SDP are provided in Table 7-2, which divides the activities into two groups for cost estimating purposes. Group 1 deconstruction activities can be considered equal in all quantifiable measures, including duration and cost, across all decommissioning action alternatives; Group 2 activities may have decommissioning costs that vary by action alternative. The No Action alternative (i.e., ALT-1) has no associated deconstruction activities or costs and is therefore excluded from the discussion below.

Table 7-2: General Deconstruction, Removal, and Site Restoration Activities

Description	***Activity***
Group 1 – Decommissioning activities with equal costs in all action alternatives	*Mobilization* – Preparing the Site for deconstruction activity including securing the Site and establishing staging areas (Sections 5.1.1 and 5.1.2).
	Demolition Preparation – Isolating the observatory from shared summit utility systems (Section 5.1.2) and removing the telescope, if it remains (Section 5.1.3).
	MEP Demolition – Removing internal mechanical, electrical, and plumbing systems that operate the observatory (Section 5.1.4).
	Partition Demolition – Removing interior walls and ceilings to complete the interior gutting of the observatory leaving only the building shell (Section 5.1.5).
	Skin Removal – Removing the exterior aluminum panels from the main structure (Section 5.1.6).
	Structure Demolition – Dismantling of the observatory structural steel frame (Section 5.1.7).
	Surface Paving Demolition – Removing asphaltic surface treatments (Section 5.1.8).
	Cesspool Removal – Removing the full extent of the underground cesspool (Section 5.1.10).
	Outbuilding and Secondary Above-Ground Instructure Removal – Removing the outbuilding, generator, pump house, transformer, and other above ground improvements that remain (Section 5.1.12)
	Demobilization – Removing all fencing, staging facilities, and equipment from the Site (Section 5.1.15).
Group 2 – Decommissioning activities with costs that may vary by action alternative	*Foundation and Grounding Grid Removal* – Removing the telescope and dome foundation plus the ground grid nearby and under the foundation (Section 5.1.9)
	Remaining Underground Removal – Removing remaining concrete slabs, tanks, grounding grid, and underground utility lines (Section 5.1.13).
	Backfill and Finish Grading – Filling in of trenches created during the activities above and grading the Site to the level of site restoration identified in each decommissioning alternative (Section 5.1.14).
	Habitat Restoration – Restoring habitat for the native arthropod community (Chapter 6).

Source: Compiled by Planning Solutions, Inc. (2020)

Unlike Group 1, Group 2 deconstruction and removal activities will vary in duration and cost by alternative. The following discussion describes the applicable differences between the alternatives for the Group 2 activities:

- *Foundation and Ground Grid Removal*. A small scope and cost difference exists between the action alternatives, specifically, ALT-2 and ALT-3 in comparison to ALT-4. ALT-2 and ALT-3 both involve the complete removal of the underground infrastructure, including foundations and ground grid. ALT-4 involves not removing at least a portion of the underground infrastructure due to unanticipated circumstances that only become evident after removal begins; thus, the extent of infrastructure that would be capped and not removed under ALT-4 is unknown. For the purpose of this analysis, the extreme-case scenario is assumed where the entire grounding grid is left in place (Figure 4-6). Although it is assumed that the foundations can be removed under all action alternatives, ALT-4 as illustrated in Figure 4-6 may not result in the removal of the grounding grid near and under the foundation. Because efforts will be made to remove all the infrastructure under ALT-4, limited cost or schedule savings would be realized. Any cost savings would primarily be related to not removing the fill material covering the infrastructure left in place.

- *Remaining Underground Removal*. A small scope and cost difference exists between the action alternatives, specifically, ALT-2 and ALT-3 in comparison to ALT-4. ALT-2 and ALT-3 both involve the complete removal of the underground infrastructure. ALT-4 involves not removing at least a small portion of the remaining underground infrastructure due to unanticipated circumstances that only become evident after removal begins; thus, the extent of infrastructure that would be capped and not removed under ALT-4 is unknown. For the purpose of this analysis, the extreme-case scenario is assumed where all underground utilities are capped and left in place (Figure 4-5 and Figure 4-6). Because efforts will be made to remove all the infrastructure under ALT-4, limited cost or schedule savings would be realized. The cost savings would primarily be related to not removing the fill material covering the infrastructure left in place.

- *Backfill and Finish Grading* and *Habitat Restoration*. In the case of the CSO Site, these activities involve removal of remaining fill brought to the site during construction in 1980s. True backfilling is only necessary where excavation into the lava flow occurred during CSO construction (e.g., the cesspool and some utility trenches). Relative to ALT-2, ALT-3 and ALT-4 have limited differences, the extent of which would not be known until after deconstruction commences. The quantity of fill removed from the CSO Site and the number of vehicle trips necessary to move it to the Batch Plant has a direct relationship to the duration and cost associated with it.[10]

Total deconstruction duration and the number of vehicle trips associated with disposing of removed infrastructure off-site and moving the fill material to the Batch Plant is summarized in Table 7-3. The table also includes the estimated deconstruction cost for each alternative, illustrating the relationship of duration and trips to the cost. There is no more than a 10 percent difference in duration and not more than a 5 percent different in cost between the three action alternatives.

Table 7-3: Summary of Deconstruction Activity Duration, Vehicle Trips, and Total Deconstruction Costs for each Alternative

Alternative	*Duration (days)*	*Total Number of Large Vehicle Trips*	*Total Number of Small Vehicle Trips*	*Estimated Deconstruction Cost*
ALT-1	0	0	0	$0
ALT-2	141	70	776	$4,034,040
ALT-3	129	70	729	$3,947,430
ALT-4	125	63	684	$3,834,120

Note: Deconstruction costs are in Q4 2019 US dollars.
Source: M3

[10] Although attempts will be made to remove all of the infrastructure under ALT-4 and attempts will be made to conduct full restoration over the entire CSO Site under ALT-3 and ALT-4, the cost estimates, durations, and vehicle trips presented in the tables (e.g., Table 5-3, Table 5-4, Table 7-3, Table 7-6, and Table 7-7) assume the extreme case that would result in the least work in the shortest possible time. The extreme case being that none of the ground grid and utility infrastructure can be removed (ALT-4, Figure 4-5) and none of the site can be fully restored (ALT-3 and ALT-4; Figure 4-4 and Figure 4-6, respectively). This assumption results in the maximum difference in cost, duration, and trip numbers between the alternatives.

The estimated deconstruction costs in Table 7-3 are derived from detailed estimates provided in Table 5-2, Table 5-3, and Table 5-4 and dollar cost estimates below. Table 7-4 provides a summary spreadsheet breaking down deconstruction activity cost factors. It identifies a cost per unit and any applicable contingency factor for it, demonstrating how costs were computed for each action alternative. This cost estimate is based on a conceptual understanding of the project conditions, plus or minus 30 percent. Based on the calculation in Table 7-4, detailed cost projections for ALT-2, ALT-3, and ALT-4 are provided in Table 7-5, Table 7-6, and Table 7-7, respectively. All costs in these tables are shown in Q4 2019 dollars.

Table 7-5, Table 7-6, and Table 7-7 also include rows for (*i*) site habitat restoration and three years of monitoring, and (*ii*) decommissioning of shared infrastructure, the cost for which is based on estimates prepared by UH. As discussed in Section 1.3.2 and Section 4.3, the action alternative cost estimates include costs for the future removal of shared infrastructure; Caltech has committed to provide those funds to UH so that the shared infrastructure can be removed at a later date.

Table 7-4: Summary of Deconstruction, Removal, and Site Restoration Cost Factors

DES	DES	DES	DES	DES	DES	DES / PM	PM		CE	CE		DES / CE	PM			CE	CE / PM		CE		CE	PM				CE / PM	CE / PM	CE / PM	CE / PM	PM		CE / PM			PM		
MASTERSPEC				QUANTITY					MATERIAL							INSTALLATION										CONTRACTOR COSTS											
																Labor																					
Section	Division	Origin	Design % Complete	Base Quantity	Unit	Quantity Multiplier	* Quantity Contingency (Risk) Factor	TOTAL QUANTITY	Base Unit Cost	Unit Cost Multiplier	TOTAL UNIT COST	SHIPPING	* Material Contingency (Risk) Factor	Material Contingency (Risk) Cost	TOTAL MATERIAL COST	Base Unit Manhours	* Site Difficulty Factor	Total Base Manhours	* Average Rate	Total Labor Costs	Other Direct Costs	* Installation Contingency (Risk) Factor	Installation Contingency (Risk) Cost	TOTAL INSTALL COST	TOTAL MATERIAL & INSTALL COST	* Division 1 (General Conditions)	* Overhead	* Profit	* Bond	* Contractor Cost Contingency	CONTRACTOR GENERAL COND/OH&P	* Room & Board	LINE SUBTOTAL	Total Design Contingency	* Construction Contingency Percentage (%)	Construction Contingency Cost ($)	TOTAL
DIVISION 02 - EXISTING CONDITIONS																																					
	Paving & ABC Demolition (asphalt)			540	sy	1.00	1.00	540	$ -	1.10	$ -	$ -	1.00	$ -	$ -	0.12	1.00	0.12	$ 78.57	$ 5,091	$ 3,996	1.00	$ -	$ 9,087	$ 9,087	$ 1,363.10	$ 1,567.56	$ 1,202	$ 396.59	$ 226.45	$ 4,756	$ -	$ 13,843	$ -	30.0%	$ 4,153	$ 17,996
	Loading & Hauling			1	ea	1.00	1.00	1	$ -	1.10	$ -	$ -	1.00	$ -	$ -	60.0	1.00	60	$ 75.00	$ 4,500	$ 3,500	1.00	$ -	$ 8,000	$ 8,000	$ 1,200.00	$ 1,380.00	$ 1,058	$ 349.14	$ 199.36	$ 4,186	$ -	$ 12,186	$ -	30.0%	$ 3,656	$ 15,842
	Subtotal														$ -					$ 9,591	$ 7,496			$ 17,087	$ 17,087						$ 8,942	$ -	$ 26,029			$ 7,809	$ 33,838
DIVISION 03 - CONCRETE																																					
	Concrete Demolition			250	cy	1.00	1.00	250	$ -	1.00	$ -	$ -	1.00	$ -	$ -	2.20	1.00	2.20	$ 100.85	$ 55,469	$ 43,750	1.00	$ -	$ 99,219	$ 99,219	$ 14,883	$ 17,115	$ 13,122	$ 4,330	$ 2,472.49	$ 51,922	$ -	$ 151,141	$ -	30.0%	$ 45,342	$ 196,483
	Loading & Hauling			1	ea	1.00	1.00	1	$ -	1.00	$ -	$ -	1.00	$ -	$ -	200	1.00	200.00	$ 75.00	$ 15,000	$ 12,500	1.00	$ -	$ 27,500	$ 27,500	$ 4,125	$ 4,744	$ 3,637	$ 1,200	$ 685.29	$ 14,391	$ -	$ 41,891	$ -	30.0%	$ 12,567	$ 54,458
	Subtotal														$ -					$ 70,469	$ 56,250			$ 126,719	$ 126,719						$ 66,313	$ -	$ 193,032			$ 57,910	$ 250,941
DIVISION 04 - MASONRY																																					
					sf	1.00	1.00	0	$ -	1.00	$ -	$ -	1.00	$ -	$ -	0.00	1.00	0.00	$ 92.94	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal														$ -					$ -	$ -			$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 05 - METALS																																					
	Skin Removal for Recycling (Alum)			11000	sf	1.00	1.00	11,000	$ -	1.00	$ -	$ -	1.00	$ -	$ -	0.11	1.00	0.11	$ 103.29	$ 124,984	$ 93,500	1.00	$ -	$ 218,484	$ 218,484	$ 32,773	$ 37,688	$ 28,894	$ 9,535	$ 5,444.53	$ 114,335	$ -	$ 332,819	$ -	30.0%	$ 99,846	$ 432,664
	Loading & Hauling			1	ea	1.00	1.00	1	$ -	1.00	$ -	$ -	1.00	$ -	$ -	600	1.00	600.00	$ 75.00	$ 45,000	$ 40,000	1.00	$ -	$ 85,000	$ 85,000	$ 12,750	$ 14,663	$ 11,241	$ 3,710	$ 2,118.17	$ 44,482	$ -	$ 129,482	$ -	30.0%	$ 38,844	$ 168,326
	Structure Demolition (Steel)			155	ton	1.00	1.00	155	$ -	1.00	$ -	$ -	1.00	$ -	$ -	32.20	1.00	32.20	$ 103.29	$ 515,531	$ 209,250	1.00	$ -	$ 724,781	$ 724,781	$ 108,717	$ 125,025	$ 95,852	$ 31,631	$ 18,061.28	$ 379,287	$ -	$ 1,104,068	$ -	30.0%	$ 331,220	$ 1,435,289
	Loading & Hauling			1	ea	1.00	1.00	1	$ -	1.00	$ -	$ -	1.00	$ -	$ -	3050	1.00	3050.00	$ 75.00	$ 228,750	$ 125,000	1.00	$ -	$ 353,750	$ 353,750	$ 53,063	$ 61,022	$ 46,783	$ 15,439	$ 8,815.32	$ 185,122	$ -	$ 538,872	$ -	30.0%	$ 161,661	$ 700,533
	Subtotal														$ -					$ 914,265	$ 467,750			$ 1,382,015	$ 1,382,015						$ 723,225	$ -	$ 2,105,240			$ 631,572	$ 2,736,812
DIVISION 06 - WOOD, PLASTICS, AND COMPOSITES																																					
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 103.39	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 75.00	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal														$ -					$ -	$ -			$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 07 - THERMAL AND MOISTURE PROTECTION																																					
	Subtotal														$ -					$ -	$ -			$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 08 - OPENINGS																																					
	Subtotal														$ -					$ -	$ -			$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 09 - FINISHES																																					
	Partition Wall Demolition			150	sf	1.00	1.00	150	$ -	1.00	$ -	$ -	1.00	$ -	$ -	0.62	1.00	0.62	$ 99.56	$ 9,259	$ 7,860	1.00	$ -	$ 17,120	$ 17,120	$ 2,568	$ 2,953	$ 2,264	$ 747	$ 426.62	$ 8,959	$ -	$ 26,079	$ -	30.0%	$ 7,824	$ 33,903
	Loading & Hauling			1	ea	1.00	1.00	1	$ -	1.00	$ -	$ -	1.00	$ -	$ -	30	1.00	30.00	$ 75.00	$ 2,250	$ 1,500	1.00	$ -	$ 3,750	$ 3,750	$ 563	$ 647	$ 496	$ 164	$ 93.45	$ 1,962	$ -	$ 5,712	$ -	30.0%	$ 1,714	$ 7,426
	Subtotal														$ -					$ 11,509	$ 9,360			$ 20,870	$ 20,870						$ 10,922	$ -	$ 31,792			$ 9,537	$ 41,329
DIVISION 10 - SPECIALTIES																																					
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 103.39	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal														$ -					$ -	$ -			$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 11 - EQUIPMENT																																					
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 103.79	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal														$ -					$ -	$ -			$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 12 - FURNISHINGS																																					
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 99.56	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal														$ -					$ -	$ -			$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 13 - SPECIAL CONSTRUCTION																																					
						1.10	1.00	0		1.10	$ -	$ -	1.00	$ -	$ -		1.00	0		$ -	-	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
						1.10	1.00	0		1.10	$ -	$ -	1.00	$ -	$ -		1.00	0		$ -	-	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal														$ -									$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 14 - CONVEYING EQUIPMENT																																					
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 103.79	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 103.79	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal														$ -					$ -	$ -			$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 21 - FIRE SUPRESSION																																					
	Subtotal														$ -					#REF!	#REF!			$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 22 - PLUMBING																																					
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 103.80	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 103.80	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal														$ -					$ -	$ -			$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 23 - HEATING VENTILATION AND AIR COND. (HVAC)																																					
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 103.80	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 103.80	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal														$ -					$ -	$ -			$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 26 - ELECTRICAL																																					
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 113.34	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 113.34	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -		1.00	0.00	$ 113.34	$ -	$ -	1.00	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal														$ -					$ -	$ -			$ -	$ -						$ -	$ -	$ -			$ -	$ -
DIVISION 27 - COMMUNICATIONS																																					

Section	Division	Origin	Design % Complete	QUANTITY: Base Quantity	Unit	Quantity Multiplier	* Quantity Contingency (Risk) Factor	TOTAL QUANTITY	MATERIAL: Base Unit Cost	Unit Cost Multiplier	TOTAL UNIT COST	SHIPPING	* Material Contingency (Risk) Factor	Material Contingency (Risk) Cost	TOTAL MATERIAL COST
						1.10	1.00	0		1.10	$ -	$ -	1.00	$ -	$ -
						1.10	1.00	0		1.10	$ -	$ -	1.00	$ -	$ -
						1.10	1.00	0		1.10	$ -	$ -	1.00	$ -	$ -
	Subtotal														$ -
DIVISION 28 - ELECTRICAL SAFETY AND SECURITY															
						1.10	1.00	0		1.10	$ -	$ -	1.00	$ -	$ -
						1.10	1.00	0		1.10	$ -	$ -	1.00	$ -	$ -
						1.10	1.00	0		1.10	$ -	$ -	1.00	$ -	$ -
	Subtotal														$ -
DIVISION 31 - EARTHWORK															
312000	Site Excavation			2800	cy	1.00	1.00	2,800	$ -	1.00	$ -	$ -	1.00	$ -	$ -
312000	Site Backfill			765	cy	1.00	1.00	765	$ -	1.00	$ -	$ -	1.00	$ -	$ -
312000	Area for final grading			25000	sf	1.00	1.00	25,000	$ -	1.00	$ -	$ -	1.00	$ -	$ -
	Loading & Hauling			1	ea	1.00	1.00	1	$ -	1.00	$ -	$ -	1.00	$ -	$ -
	Subtotal														$ -
DIVISION 32 - EXTERIOR IMPROVEMENTS															
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -
	Subtotal														$ -
DIVISION 33 - UTILITIES															
	MIIEP Demolition			60	cy	1.00	1.00	60		1.00	$ -	$ -	1.00	$ -	$ -
	Loading & Hauling			1	ea	1.00	1.00	1	$ -	1.00	$ -	$ -	1.00	$ -	$ -
						1.00	1.00	0		1.00	$ -	$ -	1.00	$ -	$ -
	Subtotal														$ -
	TOTAL														$ -

Section	Division	INSTALLATION – Labor: Base Unit Manhours	* Site Difficulty Factor	Total Base Manhours	* Average Rate	Total Labor Costs	Other Direct Costs	* Installation Contingency (Risk) Factor	Installation Contingency (Risk) Cost	TOTAL INSTALL COST	TOTAL MATERIAL & INSTALL COST
			1.00	0		$ -		1.00	$ -	$ -	$ -
			1.00	0		$ -		1.00	$ -	$ -	$ -
			1.00	0		$ -		1.00	$ -	$ -	$ -
	Subtotal									$ -	$ -
DIVISION 28 - ELECTRICAL SAFETY AND SECURITY											
			1.00	0		$ -		1.00	$ -	$ -	$ -
			1.00	0		$ -		1.00	$ -	$ -	$ -
			1.00	0		$ -		1.00	$ -	$ -	$ -
	Subtotal									$ -	$ -
DIVISION 31 - EARTHWORK											
312000	Site Excavation	0.09	1.00	0.09	$ 78.57	$ 20,625	$ 18,200	1.00	$ -	$ 38,825	$ 38,825
312000	Site Backfill	0.08	1.00	0.08	$ 78.57	$ 4,808	$ 3,017	1.00	$ -	$ 7,825	$ 7,825
312000	Area for final grading	0.001	1.00	0.00	$ 78.57	$ 1,964	$ 1,875	1.00	$ -	$ 3,839	$ 3,839
	Loading & Hauling	75	1.00	75.00	$ 75.00	$ 5,625	$ 3,500	1.00	$ -	$ 9,125	$ 9,125
	Subtotal					$ 27,397	$ 30,292			$ 66,814	$ 66,814
DIVISION 32 - EXTERIOR IMPROVEMENTS											
			1.00	0.00	$ 78.57	$ -	$ -	1.00	$ -	$ -	$ -
			1.00	0.00	$ 78.57	$ -	$ -	1.00	$ -	$ -	$ -
			1.00	0.00	$ 78.57	$ -	$ -	1.00	$ -	$ -	$ -
	Subtotal					$ -	$ -			$ -	$ -
DIVISION 33 - UTILITIES											
	MIIEP Demolition	18.60	1.00	18.60	$ 78.57	$ 87,684	$ 41,100	1.00	$ -	$ 128,784	$ 128,784
	Loading & Hauling	180	1.00	180.00	$ 75.00	$ 13,500	$ 10,500	1.00	$ -	$ 24,000	$ 24,000
			1.00	0.00	$ 78.57	$ -	$ -	1.00	$ -	$ -	$ -
	Subtotal					$ 101,184	$ 51,600			$ 152,784	$ 152,784
	TOTAL									$ 1,766,289	$ 1,766,289

Section	Division	CONTRACTOR COSTS: * Division 1 (General Conditions)	* Overhead	* Profit	* Bond	* Contractor Cost Contingency	CONTRACTOR GENERAL COND/OH&P	* Room & Board	LINE SUBTOTAL	Total Design Contingency	* Construction Contingency Percentage (%)	Construction Contingency Cost ($)	TOTAL
		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal						$ -	$ -	$ -			$ -	$ -
DIVISION 28 - ELECTRICAL SAFETY AND SECURITY													
		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal						$ -	$ -	$ -			$ -	$ -
DIVISION 31 - EARTHWORK													
312000	Site Excavation	$ 5,824	$ 6,697	$ 5,135	$ 1,694	$ 967.49	$ 20,317	$ -	$ 59,142	$ -	30.0%	$ 17,743	$ 76,884
312000	Site Backfill	$ 1,174	$ 1,350	$ 1,035	$ 342	$ 195.01	$ 4,095	$ -	$ 11,920	$ -	30.0%	$ 3,576	$ 15,497
312000	Area for final grading	$ 576	$ 662	$ 508	$ 168	$ 95.67	$ 2,009	$ -	$ 5,848	$ -	30.0%	$ 1,755	$ 7,603
	Loading & Hauling	$ 1,369	$ 1,574	$ 1,207	$ 398	$ 227.39	$ 4,775	$ -	$ 13,900	$ -	30.0%	$ 4,170	$ 18,070
	Subtotal						$ 34,965	$ -	$ 101,779			$ 30,534	$ 132,312
DIVISION 32 - EXTERIOR IMPROVEMENTS													
		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal						$ -	$ -	$ -			$ -	$ -
DIVISION 33 - UTILITIES													
	MIIEP Demolition	$ 19,318	$ 22,215	$ 17,032	$ 5,620	$ 3,209.24	$ 67,394	$ -	$ 196,178	$ -	30.0%	$ 58,853	$ 255,031
	Loading & Hauling	$ 3,600	$ 4,140	$ 3,174	$ 1,047	$ 598.07	$ 12,559	$ -	$ 36,559	$ -	30.0%	$ 10,968	$ 47,527
		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	30.0%	$ -	$ -
	Subtotal						$ 79,954	$ -	$ 232,737			$ 69,821	$ 302,559
	TOTAL						$ 924,320	$ -	$ 2,690,609			$ 807,183	$ 3,497,792

Note: Table is for construction costs only and does not include habitat restoration and costs related to shared infrastructure. Values in this table are representative of ALT-2, the preferred alternative.
Source: M3 Engineering and Technology (2020)

Table 7-5: ALT-2 Cost Estimate

Summit Facilities Decommissioning		*Total Labor*	*Other Directs*	*Contractor Costs*	*Contin-gency*	*Line Total*
Division 02	Existing cond.	$9,600	$7,500	$8,940	$7,810	$33,850
Division 03	Concrete	$70,470	$56,250	$66,310	$57,910	$250,940
Division 05	Metals	$914,260	$467,750	$723,230	$631,570	$2,736,810
Division 09	Finishes	$11,510	$9,360	$10,920	$9,540	$41,330
Division 31	Earthwork	$27,400	$30,290	$34,960	$30,530	$123,180
Division 33	Utilities	$101,180	$51,600	$79,950	$69,820	$302,550
Habitat restoration & monitoring		-	-	-	-	$20,000
Off-site shared infrastructure		-	-	-	-	$525,380
Totals		**$1,134,420**	**$622,750**	**$924,310**	**$807,180**	**$4,034,040**

Note Contractor general condition costs (Division 01 in Table 7-4) are included in each of the construction building components. Only those divisions shown in in Table 7-4 that have costs associated with them are included in this table.
Source: M3.

Table 7-6: ALT-3 Cost Estimate

Summit Facilities Decommissioning		*Total Labor*	*Other Directs*	*Contractor Costs*	*Contin-gency*	*Line Total*
Division 02	Existing cond.	$9,600	$7,500	$8,940	$7,810	$33,850
Division 03	Concrete	$70,470	$56,250	$66,310	$57,910	$250,940
Division 05	Metals	$914,260	$467,750	$723,230	$631,570	$2,736,810
Division 09	Finishes	$11,510	$9,360	$10,920	$9,540	$41,330
Division 31	Earthwork	$16,200	$7,830	$4,100	$8,450	$36,570
Division 33	Utilities	$101,180	$51,600	$79,950	$69,820	$302,550
Habitat restoration & monitoring		-	-	-	-	$20,000
Off-site shared infrastructure		-	-	-	-	$525,380
Totals		**$1,123,220**	**$600,290**	**$893,450**	**$784,600**	**$3,947,430**

Note Contractor general condition costs (Division 01 in Table 7-4) are included in each of the construction building components. Only those divisions shown in in Table 7-4 that have costs associated with them are included in this table.
Source: M3.

Table 7-7: ALT-4 Cost Estimate

Summit Facilities Decommissioning		*Total Labor*	*Other Directs*	*Contractor Costs*	*Contin-gency*	*Line Total*
Division 02	Existing cond.	$9,600	$7,500	$8,940	$7,810	$33,850
Division 03	Concrete	$70,470	$56,250	$66,310	$57,910	$250,940
Division 05	Metals	$914,260	$467,750	$723,230	$631,570	$2,736,810
Division 09	Finishes	$11,510	$9,360	$10,920	$9,540	$41,330
Division 31	Earthwork	$9,800	$5,220	$2,750	$5,330	$23,100
Division 33	Utilities	$67,790	$34,570	$53,570	$46,780	$202,710
Habitat restoration & monitoring		-	-	-	-	$20,000
Off-site shared infrastructure		-	-	-	-	$525,380
Totals		**$1,083,430**	**$580,650**	**$865,720**	**$758,940**	**$3,884,120**

Note Contractor general condition costs (Division 01 in Table 7-4) are included in each of the construction building components. Only those divisions shown in in Table 7-4 that have costs associated with them are included in this table.
Source: M3.

7.3 ASSESSING BENEFIT

As evidenced in the discussion of natural, biological, historic, and cultural impacts in the SRP (see Chapter 6), total removal of all structures and infrastructure, together with full restoration to pre-construction condition, would provide the maximum achievable environmental benefit. It also offers other significant advantages, including fulfilling the terms of Caltech's sublease and eliminating liability posed by remnant facilities.

As shown in Table 7-3, the cost of total removal and full site restoration called for under the preferred alternative (i.e., ALT-2) is approximately 141 days and $4.0 million. It follows then that, in alternatives that involve less than complete removal and restoration, that maximum financial/duration benefit relative to ALT-2 is 141 days and $4.0 million. The consideration of benefits derived from other alternatives must be in contrast and comparison to this amount.

However, a challenge arises in attaching a specific value to the variation in benefits realized by the different degrees of removal and restoration under ALT-3 and ALT-4. These alternatives diverge from the maximum achievable benefit of total removal and full site restoration in some way, and the difficulty lies in assessing the value of that difference. As noted in Section 7.1, the typical approach to a CBA estimates total equivalent values for the costs and benefits of a set of alternatives, so that they can be weighed comparatively, and the best course of action identified. Here, however, some of the factors deserving of analysis—visual, biological, and cultural impacts—are impossible to place cost values on and doing so effectively devalues them.

Ultimately, if it is accepted that the best possible outcome of total removal and full restoration (i.e., ALT-2) has a value of 141 construction days and $4.0 million, it is not critically necessary to precisely quantify or rank the more modest benefits that would be accrued under the other action alternatives. To illustrate this, consider ALT-4, where some subsurface infrastructure would remain, and a portion of the site would not be fully restored. To the extent that a portion of the infrastructure is not removed or that a portion of the site is not fully restored, the net benefit is diminished because the existing impact to the landform caused by the past CSO development would persist. The cost difference between ALT-2 and ALT-4 is roughly $200,000; and while it is not possible to assign a value to the diminished benefit, Caltech believes that if its intent was to proceed with ALT-4 as its preferred alternative the diminishment in benefit value would exceed the reduced cost value based on the input it has received.

The CIA prepared by ASM Affiliates (2020) states:

> "*Both the CMP and the Decommissioning Sub-Plan indicate that the decommissioning starting point is for the observatories to do their utmost to completely remove all structures and fully restore the site, and based on what was said during consultation, doing less than that could be perceived as improper and culturally offensive. …*"

> "*…a perception exists that anything short of an attempt at complete facility removal and full environmental restoration would result in a disingenuous decommissioning effort, as well as be an affront to cultural sensibilities. Therefore, it is recommended that the complete facility (above and below ground) be removed and the affected environment be restored to the fullest extent possible. Following this, and the other above-offered recommendations, will help to ensure that the*

> *proposed decommissioning will not result in impacts to any traditionally valued cultural or historical resources nor any traditional cultural practices or beliefs."*

From the above quote it may be reasonably concluded that:

- If Caltech's intent varied between the alternatives and included something less than an attempt at complete removal and full restoration, the benefit would vary substantially for those with strong cultural ties to Maunakea.
- If Caltech's intent is always complete removal and full restoration (ALT-2), the benefit resulting for different outcomes dictated by unanticipated findings would be nearly identical.

As outlined in this document, all the alternatives start with the intent to completely remove the facility and infrastructure and fully restore the site. With that intent as a foundation, ALT-3 and ALT-4 would only come to pass if conditions are encountered during decommissioning that the work needed to achieve complete removal and/or full restoration would create a new, unanticipated, adverse cultural or physical effect sufficiently great to outweigh the physical and cultural benefit of complete removal and full restoration.[11] Thus, although ALT-3 and ALT-4 would not achieve complete removal and full site restoration despite the intent, it is logical to conclude that they would result in a benefit greater than ALT-2 would achieve in a situation where such an unanticipated condition is encountered.

ALT-1, which does not achieve either facility removal or site restoration, provides less benefit than any of the action alternatives. While these varying degrees of benefit are not quantifiable, in terms of cost values, for reasons noted above they represent the most precise appraisal of comparative benefit possible under the circumstances.

7.4 CONCLUSIONS

In Section 7.2, Table 7-3 provide the projected schedule and dollar cost values of each of the action alternatives considered in this SDP. It is believed that other potential "cost" variables would have similar distributions/differences between the alternatives. As can be seen from a side-by-side comparison of these action alternatives, the difference in cost values is inconsequential. Thus, from the point of view of cost, all action alternatives are functionally the same; the No Action alternative (i.e., ALT-1) is the only alternative that would provide a meaningful cost savings.

Section 7.3, the assessment of relative benefit of the various action alternatives, establishes that the value of the greatest financial and duration benefit is equal to the cost values of ALT-2. That section also demonstrates that the other action alternatives do not provide the same level of benefit as ALT-2, even though they incur similar costs. While acknowledging that it may not be possible to attach a value to the ALT-2 vs. ALT-3 or ALT-4 benefit differential, there is ample support for attributing value to the protection of natural and cultural resources in State of Hawaiʻi law. With respect to the natural resources, Article XI, Section 1 of the *Constitution of the State of Hawaiʻi* states that:

[11] Should an unanticipated situation arise that increases the cost of achieving ALT-2 but does not create a new adverse cultural effect, Caltech would provide the funds to cover the additional ALT-2 costs.

> *"For the benefit of present and future generations, the State and its political subdivisions shall conserve and protect Hawai'i's natural beauty and all natural resources, including land, water, air, minerals and energy sources, and shall promote the development and utilization of these resources in a manner consistent with their conservation and in furtherance of the self-sufficiency of the State."*

And, in text added as part of the 1978 Constitutional Convention, the *Constitution of the State of Hawai'i* (Article XI, Section 1) establishes that:

> *"All public natural resources are held in trust by the State for the benefit of the people."*

Thus, it is both logical and reasonable to conclude that while none of the action alternatives offers consequential savings in terms of cost, ALT-2 provides significant additional benefit related to the positive environmental, biological, and cultural impacts of total removal and full site restoration. While these benefits and impacts may not be assessed in terms of cost values, there is strong support in Hawai'i State Law for protection of these as valuable public trust resources. In the absence of a clear cost difference differences in the action alternatives assessed in this SDP, these benefits and impacts are the most relevant factors identifying ALT-2 as the alternative possessing the best balance of cost and benefit.

CHAPTER 8: DECOMMISSIONING FUNDING PLAN

When Caltech and UH representatives signed the sublease dated December 20, 1983, they agreed that, upon termination or expiration of the sublease, Caltech would follow one of four options (Section 4.1). All the action alternatives involve the fourth option: removal of the property at the expense of the Caltech. Thus, funding for all the decommissioning activities described in this SDP must be provided by Caltech.

8.1 FINANCIAL COST OF DECOMMISSIONING

As detailed in Section 7.2, the estimated cost to decommission CSO is approximately $4,000,000.

8.2 FINANCIAL ASSURANCE AND MEANS OF FUNDING

Per the DP, there are several potential financial assurance "methods." The method of financial assurance that Caltech is employing is the "surety, insurance, or guarantee" where the sublessee self-guarantees the funding of decommissioning activities.

In the Notice of Intent to Decommission (NOI), Caltech stated that "Caltech intends to remove the CSO from Mauna Kea and to restore the Site in accordance with provision V.4 of its sublease" and "Caltech intends no further use of the Site. Upon completion of the decommissioning process, Caltech will surrender its sublease." That statement was made by Edward Stolper; Provost, William E. Leonhard Professor of Geology, and Carl and Shirley Larson Provostial Chair at Caltech. In addition, in a letter dated August 21, 2008, to UH's Institute for Astronomy (IfA) Caltech stated, "We confirm that we are aware of the technical and financial implications of the removal/restoration option in the event of termination or expiration of the sublease. Consistent with Caltech's legal obligations set forth in the sublease and the operating agreement, if the removal/restoration option becomes necessary, we are able to guarantee its implementation. Caltech will be the source of funding for the removal of the facilities and restoration of the property." Caltech, and its general funds, are backed by its endowment, which the National Center for Education Statistics estimates as the 35th biggest in the country, worth roughly $2.879 billion in 2019. Thus, Caltech has adequate financial strength to self-guarantee CSO's decommissioning and has done so via the NOI, 2008 letter, and this SDP.

CHAPTER 9: REFERENCES

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Appendix A. Notice of Intent

CALIFORNIA INSTITUTE OF TECHNOLOGY
Pasadena, California 91125 USA

Parsons-Gates
Mail Code 206-31

ems@caltech.edu

Tel: (626) 395-6336
Fax: (626) 795-1898

November 18, 2015

Office of Mauna Kea Management
Attn: Stephanie Nagata, Director
640 N. A'ohōkū Place, Room 203
Hilo, Hawai'i 96720

Re: Notice of Intent to Decommission
Caltech Submillimeter Observatory

Dear Ms. Nagata:

The California Institute of Technology hereby submits the enclosed Notice of Intent to Decommission its Caltech Submillimeter Observatory located on Maunakea.

In accordance with the process outlined in the *Decommissioning Plan for the Mauna Kea Observatories*, a sub-plan of the *Mauna Kea Comprehensive Management Plan*, Caltech will proceed to conduct an environmental due diligence review and to prepare the Site Deconstruction and Removal Plan and the Site Restoration Plan. As stipulated by the *Decommissioning Plan*, these documents will be submitted to OMKM.

Sincerely,

Edward Stolper

Edward Stolper
Provost
William E. Leonhard Professor of Geology
Carl and Shirley Larson Provostial Chair

CALIFORNIA INSTITUTE OF TECHNOLOGY

CSO Decommissioning
Notice of Intent

2015 November 18

Introduction

Since 1986, the California Institute of Technology has operated the Caltech Submillimeter Observatory (CSO) on Maunakea. The CSO site is subleased to Caltech by the University of Hawaii (UH) and the State of Hawaii, Department of Land and Natural Resources (DLNR) (Sublease H09176; Attachment A). Operation of the CSO is subject both to a Conservation District Use Permit issued by the DLNR (Attachment C) and to an Operating Agreement between Caltech and the UH (Attachment B).

In 2009 and again in 2015, Caltech publicly announced the closure of the CSO on Maunakea. This document is Caltech's formal Notice of Intent (NoI) for decommissioning the CSO.

Intent to Remove

Caltech intends to remove the CSO from Maunakea and to restore the site in accordance with provision V.4 of its sublease (H09176; Attachment A). Caltech intends no further use of the site. Upon completion of the decommissioning process, Caltech will surrender its sublease.

Caltech intends to follow the process outlined in the *Decommissioning Plan for the Mauna Kea Observatories*, a sub-plan of the *Mauna Kea Comprehensive Management Plan*. Submittal of this NoI is the first step in that process. Caltech intends to carry out the activities stipulated in the *Decommissioning Plan*, including, but not limited to, preparation and submittal for review of:

- An Environmental Due Diligence Review,
- A Site Deconstruction and Removal Plan (SDRP), and
- A Site Restoration Plan (SRP).

Caltech intends that deconstruction and removal will entail:

- Removal of the telescope and dome (enclosure);
- Removal of all other above ground structures, furnishings, and other improvements, including but not limited to the outbuilding, transformer, generator, and pump shed;
- Removal of all concrete slabs, aprons, and walkways that are 6 in or less thick;
- Removal of the asphalt parking lot;
- Removal of all underground plumbing connected to the cesspool and water tank;
- Removal of all underground electrical and communications conduits back to their branch connection point at the summit service lines;
- Removal of the underground water tank and backfilling of the cavity with native material; and

- Condemnation of the cesspool, removal of the manhole, and backfilling of the cavity with native material.

Caltech intends that site restoration will entail:
- Backfilling with native material of all cavities remaining after structures and furnishings are removed; and
- Grading the site to the approximate pre-construction topography to leave a visual appearance consistent with the original condition.

The *Decommissioning Plan* stipulates, “the level of restoration attempted and the potential benefits and impacts of the restoration activities on natural and cultural resources during and post-activity must be carefully evaluated. A cost-benefit analysis shall also be conducted.” For the telescope and dome foundations and for other deep underground structures, therefore, Caltech intends to carry out a benefit study. This study will compare the environmental, cultural, and cost benefits and impacts of two options:
1. Removal of the top of the underground structures and burial of the reminder.
2. Complete removal of the underground structures.

The study will assess, for example, the impact of any additional excavation necessary to completely remove the underground structures and the impact of relocating or importing material to backfill any cavities. This benefit study will be incorporated into the Site Restoration Plan (SRP).

Caltech fully intends to complete all phases of the decommissioning process, including deconstruction and site restoration, as expeditiously as practical. Caltech recognizes, however, the uncertainty concerning the appropriate level of site restoration. Caltech anticipates the additional studies and evaluation necessary to resolve this uncertainty may delay the completion of the SRP. Caltech intends, therefore, to proceed initially with removal of the telescope, the dome, and other above ground structures. Removal of below ground structures and site restoration will follow once the SRP is approved.

Site Description

The CSO is located on a 0.75 acre site at 13,350 ft altitude near the summit of Maunakea. The site is located within the Astronomy Precinct of the Mauna Kea Science Reserve (TMK: (3) 4-4-15:09) managed by the University of Hawaii. Caltech subleases the CSO site from the University of Hawaii. Placement of the CSO on Maunakea is governed by:
- Sublease H09176 among Caltech, the UH, and the state of Hawaii, DLNR (Attachment A);
- General Lease S4191 between the State of Hawaii and the University of Hawaii (Attachment A, Exhibit A);
- Operating and Site Development Agreement between the California Institute of Technology and the University of Hawaii Concerning the Construction and Operation of the Caltech Submillimeter Telescope Facility on Mauna Kea (Attachment B);
- Conservation District Use Permit HA-1492 issued by the state of Hawaii, DLNR (Attachment C).

The CSO (Figure 1) was constructed in 1983–6 and consists of the following structures and improvements:

1. The telescope itself, enclosed in a corotating dome.
   1.1. The 10.4 m (34 ft) diameter radio telescope has a reflector constructed of aluminum panels supported by a tubular steel truss. The weight of the reflector is about 10,500 lb. The reflector is attached to a two axis steel mount structure that allows pointing to any location on the sky. The approximate total weight of the telescope is 86,000 lb.
   1.2. The corotating dome is a steel structure clad with aluminum sheets. It is approximately hemispherical, about 60 ft in diameter and 52 ft high. It has a two part shutter door that opens to allow the telescope to observe the sky. To follow the telescope motion, the entire dome structure rotates on a rail. Inside the dome, there are several labs and other rooms on three levels with various furnishings and equipment. The approximate weight of the dome is 300,000 lb.
   1.3. The telescope and dome rest on concrete foundations surrounded by a sidewalk with an overall diameter of about 80 ft diameter (Figure 7).
2. A utility outbuilding. This is a single story building with metal framing on a concrete slab with an adjoining concrete sidewalk.
   2.1. The original outbuilding houses the main electrical switchgear for the CSO. It was also used as an occasional workshop and for storage.
   2.2. The outbuilding was extended in 1990. At present, the OMKM rangers store emergency equipment in the extension.
3. An electrical transformer on a concrete pad.
4. A backup electrical generator on a concrete pad, installed in 1990. This is fueled with propane from portable tanks stored in the outbuilding. Fuel lines are underground.
5. An underground water tank. Atop the tank, a pump is housed in a shed on a concrete pad.
6. An underground cesspool (Figure 8). There is a manhole for access.
7. A small concrete pad adjacent to the dome has plumbing fixtures for the water tank and cesspool.
   7.1. An underground ¾ in copper line connects to the water tank.
   7.2. An underground 4 in sewer line connects to the cesspool.
8. Underground electrical lines between the Helco service point, the transformer, the outbuilding, the generator, and the dome.
9. Underground conduits for communications cables between connection boxes near the access road, the outbuilding, and the dome.
10. Underground copper grid for electrical grounding.
11. The parking area between the dome and outbuilding is paved with asphalt. The parking area connects to a branch of the Maunakea access road.
12. Four ½ in diameter survey markers at the four corners of the CSO site and a fifth Bench Mark near the center of the site.

Site Plan

The locations of the CSO structures and improvements are shown on the attached site plan:

- Figure 2: Site Layout and Grading Plan, dated 1983-02-07, approved by the Chief Engineer, County of Hawaii on 1983-03-22, and field checked as graded on 1983-10-07.

Because this original drawing predates construction of the CSO structures, Caltech has contracted a surveyor to prepare an up to date, as built site plan. This updated site plan will be submitted as an addendum to this NoI.

Pre-Construction Condition

Prior to the construction of the CSO, which began in 1983, there was no development at the site, which was a flat region covered with native material typical of the summit. The following documents illustrate the pre-construction site condition:

- Figure 3. Pre-construction Topographic Survey, dated 1983-01-21.
- Figure 4: Photo of pre-construction site from nearby ridge.
- Figure 5: Photos of site before and after grading/construction of foundation.
- Figure 6: Photo of Prof. Robert Leighton installing a survey marker.

Historical Usage

Since 1983, the site has been used exclusively for the construction and scientific operation of the CSO. Other than the extension of the outbuilding in 1990, all the structures and improvements have been in place since the initial construction.

Attachments

A. Sublease agreement among the California Institute of Technology, the University of Hawaii, and the State of Hawaii, Department of Land and Natural Resources, H09176, 1983-12-20. Includes Exhibits:
   A. General lease by and between the State of Hawaii and the University of Hawaii, S-4191, 1968-06-20.
   B. Caltech Telescope Site
   C. Description of the Construction of the Caltech Telescope.
B. Operating and Site Development Agreement between the California Institute of Technology and the University of Hawaii Concerning the Construction and Operation of the Caltech Submillimeter Telescope Facility on Mauna Kea, Hawaii, 1983-12-20.
C. Conservation District Use Permit, HA-1492, approved 1982-12-17.

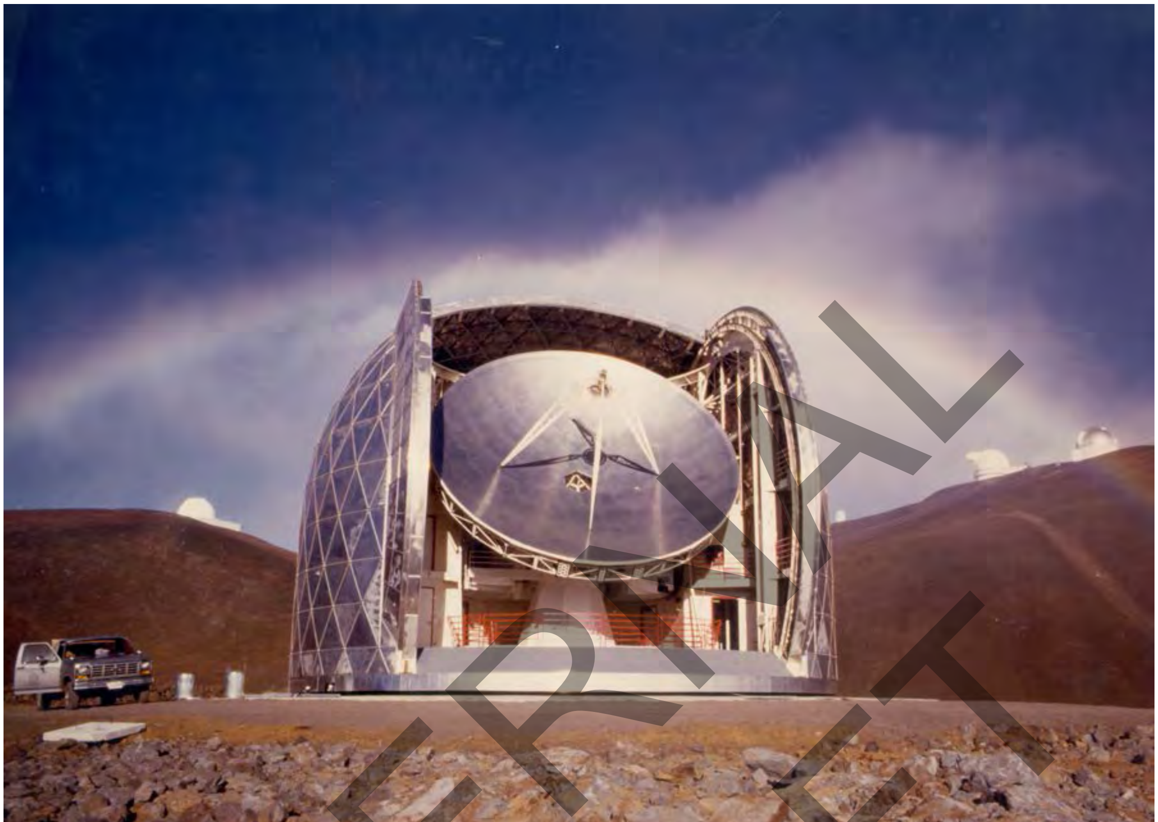


Figure 1. The Caltech Submillimeter Observatory (CSO) near the summit of Maunakea, Hawaii.

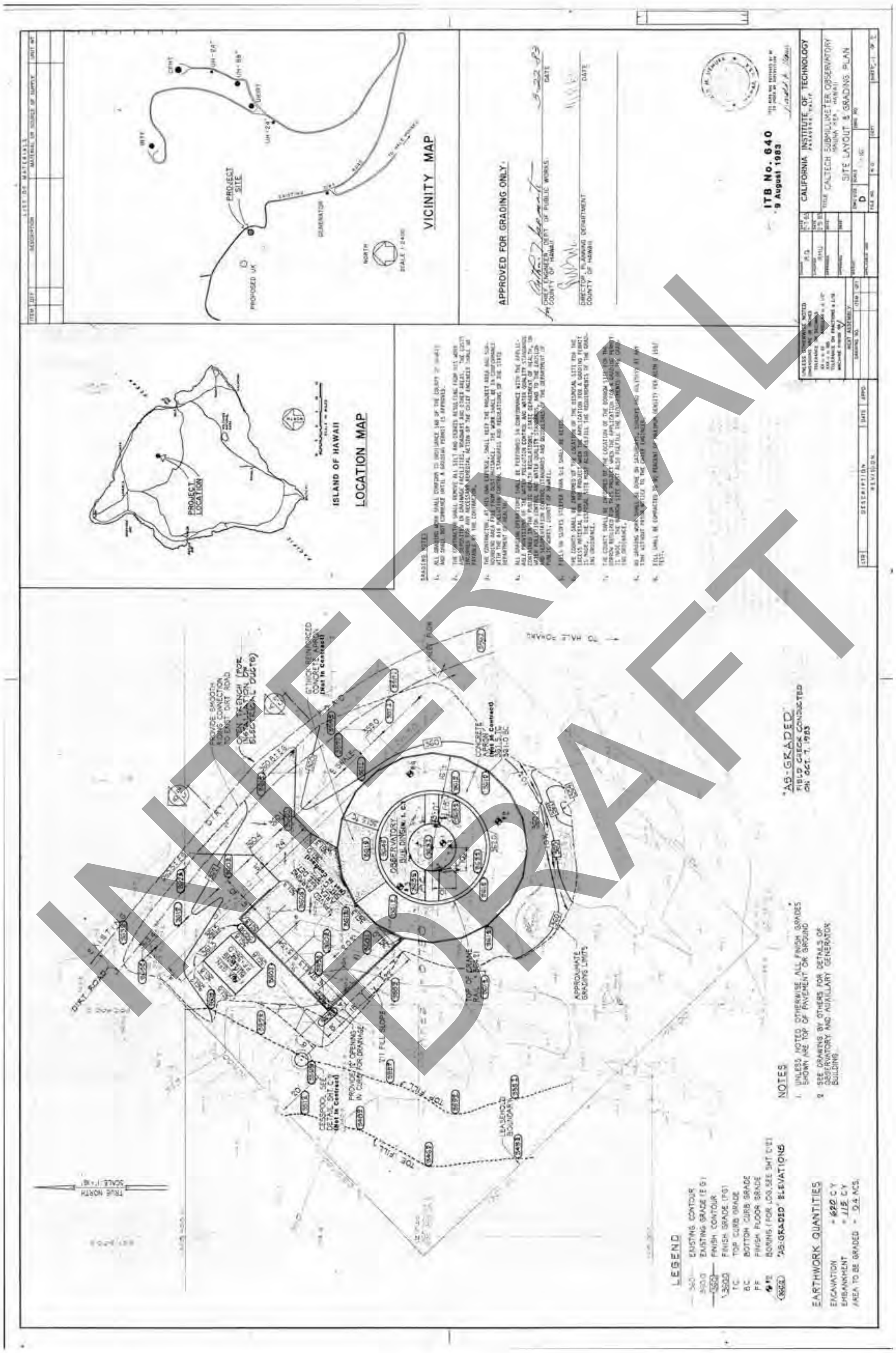


Figure 2: Site Layout and Grading Plan, 1983-02-07.

Figure 3: Pre-construction Topographic Survey, 1983-01-21.

Figure 4: Pre-construction photograph of CSO site.

Figure 5: Panoramic photographs of CSO site before (left) and after (right) grading and construction of foundations for the dome and telescope.

Figure 6: Prof. Robert Leighton hammering in the Bench Mark noted in Figure 3.

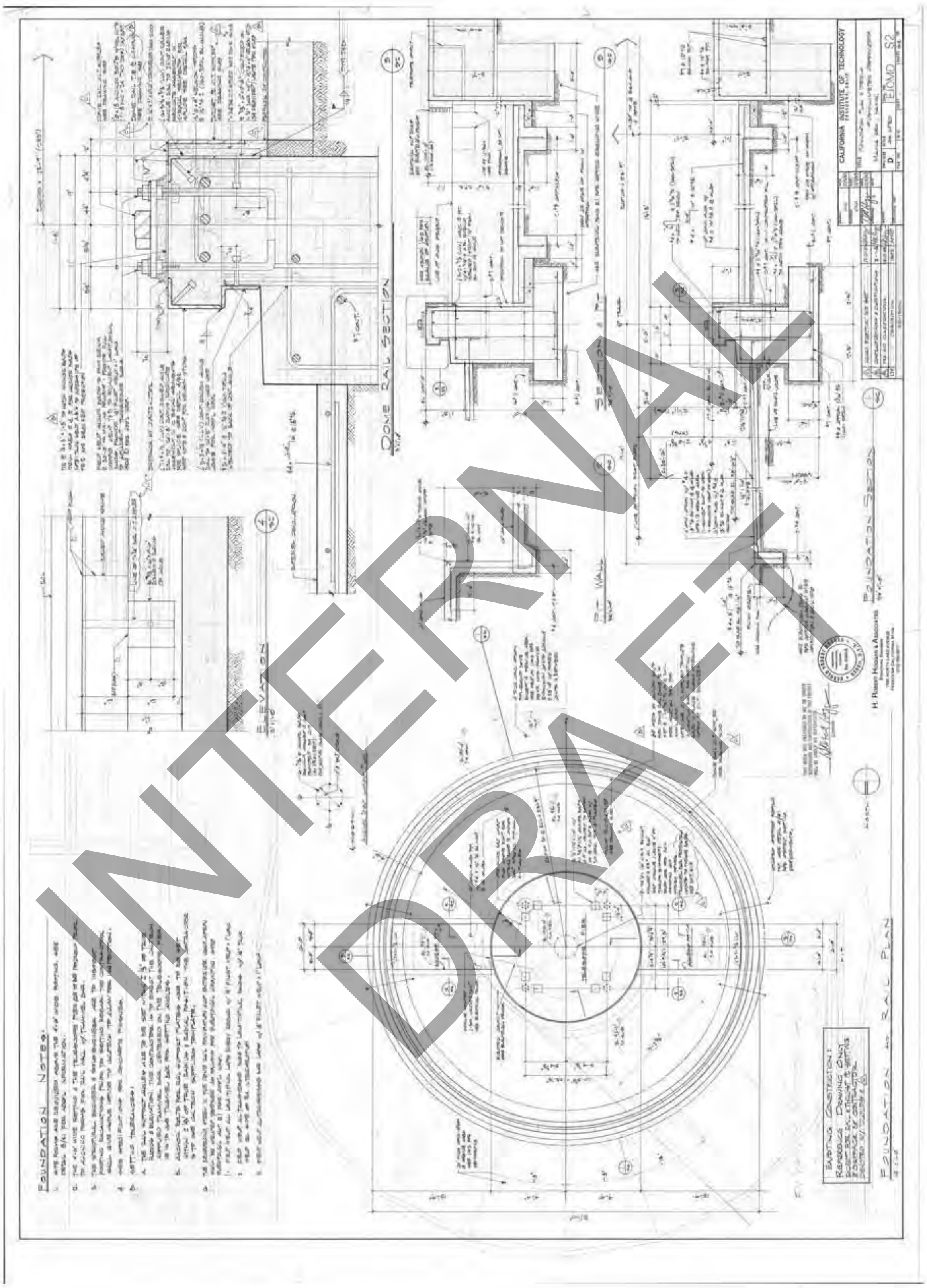


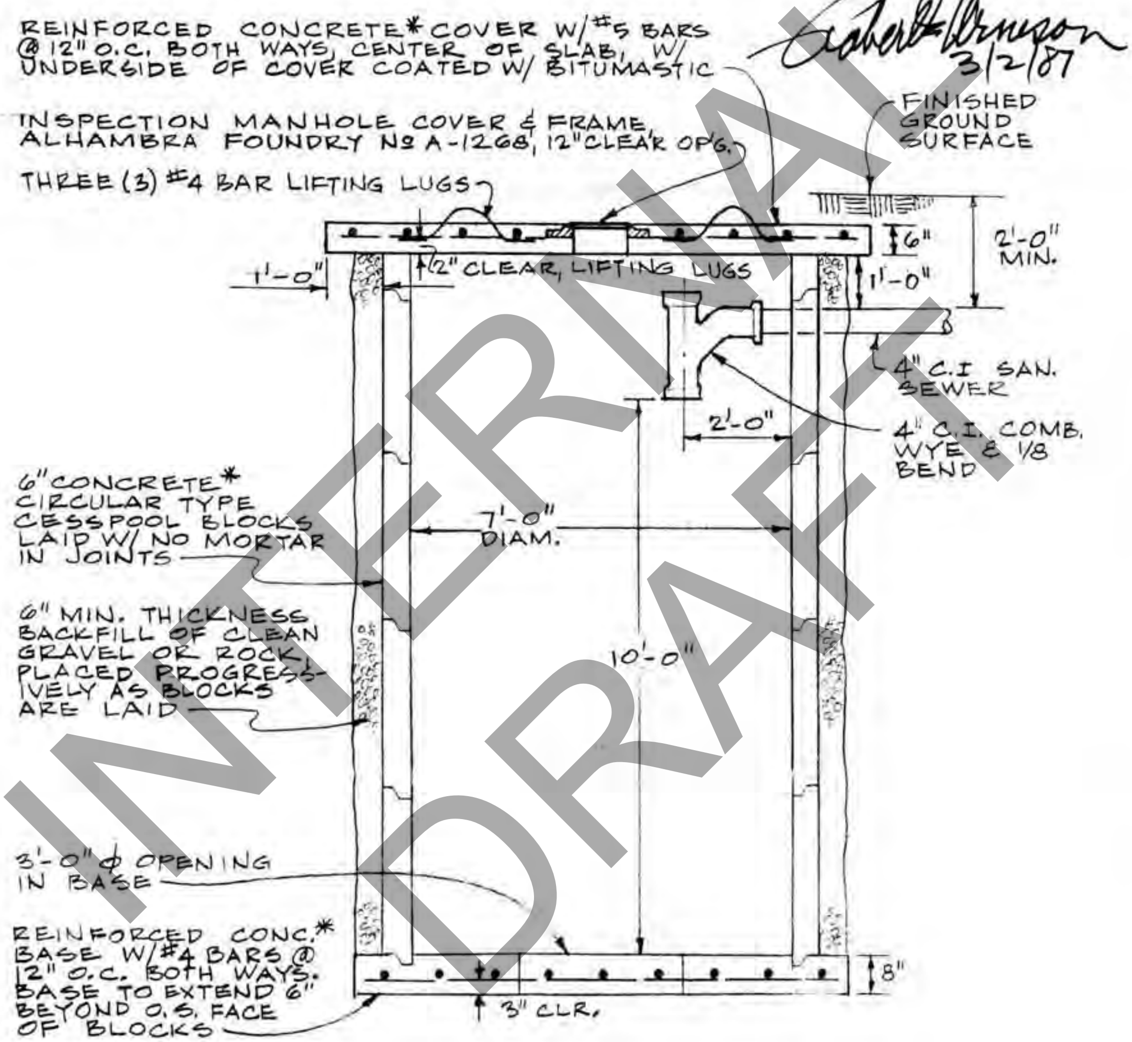
Figure 7. Foundation Plan, 1984-12-20.

REPORT ON INDIVIDUAL WASTEWATER SYSTEM   Page 2 of 2

PROPERTY OWNER: California Institute of Technology
Address: Mauna Kea, Hawaii
Lot Size: 198.00' X 165.00'
CONTRACTOR: Constructors Hawaii Inc.
OWNER'S AGENT: Robert E. Arneson, P.E.
Mailing Address: 1116 Donna Beth Avenue
West Covina, CA 91791
Telephone: (818) 9193304
(213) 8252853

ROBERT E. ARNESON REGISTERED PROFESSIONAL ENGINEER No. 5592 MECHANICAL HAWAII, U.S.A.

Robert E. Arneson 3/2/87



*NOTE:
ALL REINFORCED CONCRETE & CESSPOOL BLOCKS SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF TWENTY-FIVE HUNDRED (2500) POUNDS PER SQ. INCH.

CESSPOOL - CROSS SECTION
NOT TO SCALE

Figure 8: Cesspool report, 1987-03-02.

Attachment A

Sublease agreement among the

California Institute of Technology

the University of Hawaii

and the

State of Hawaii, Department of Land and Natural Resources

H09176

1983-12-20

ATTACHMENT A

SUBLEASE AGREEMENT AMONG THE
CALIFORNIA INSTITUTE OF TECHNOLOGY
THE UNIVERSITY OF HAWAII
AND THE
STATE OF HAWAII, DEPARTMENT OF LAND AND NATURAL RESOURCES

RECORDATION REQUESTED BY:

AFTER RECORDATION, RETURN TO:

When completed: Mail ( )
Pick up ( ) Phone:

H09176

SUBLEASE AGREEMENT

THIS SUBLEASE is made this 20 day of December, 1983, by and between the University of Hawaii, hereinafter called "SUBLESSOR," and the California Institute of Technology, Pasadena, California 91125, hereinafter called "SUBLESSEE." This Sublease is approved pursuant to General Lease S-4191, dated June 21, 1968, between Sublessor and the State of Hawaii, Board of Land and Natural Resources, hereinafter called "LESSOR." A copy of General Lease S-4191 is attached hereto as Exhibit A and incorporated herein by reference.

W I T N E S S E T H   T H A T

Sublessor, in consideration of the rent hereinafter reserved and upon the conditions, covenants and agreements hereinafter express, does hereby demise and let to Sublessee the parcels of land described in Exhibit B, hereto attached and by reference made a part hereof, and Sublessee does hereby Sublease from Sublessor for the purposes of erecting a tele-

I. GENERAL

A. Location/Area

The location/area comprises a portion of that certain land area described in General Lease S-4191, Exhibit A, and more specifically identified in Exhibit B, hereto attached and by reference made a part hereof, together with the right reserved to Sublessor to establish an access road, and power and communication lines to the above portion of land, and the right reserved to Sublessee of access to said premises over and across the common entrances and rights of way, together with others entitled thereto under such rules and regulations as may be established by and amended from time to time by Sublessor.

B. Term of Sublease

To have and to hold the demised premises unto Sublessee in strict compliance with the terms, conditions, and restraints contained in General Lease S-4191, until the 31st day of December 2033, or such earlier date as provided for in Article IV.I.

C. Rental Charge

Sublessee hereby covenants and agrees to pay rental for the demised premises at ONE DOLLAR ($1.00) per year in legal tender of the United States of America for the duration of the Sublease. Said fee shall be paid to the Business Office, Bachman Hall, University of Hawaii, 2444 Dole Street, Honolulu, Hawaii 96822.

D. Fire or Destruction of Facilities

If all three of the following events occur: (1) the facilities are destroyed by fire or other causes rendering the same unsuitable for purposes of millimeter-and submillimeter-wave astronomy, (2) Sublessee elects not to restore the faci

If the facilities or a portion thereof are restored, such restoration shall be subject to approval by the Sublessor, and in keeping with Article III.I. below.

E. Controlling Lease

In the event that any term or condition contained herein is inconsistent with or contrary to General Lease S-4191, the General Lease shall be controlling.

F. Operation of Facilities

Neither Sublessee nor its successor or assigns shall operate or permit to be operated the aforementioned Telescope for purposes of research without a signed Operating and Site Development Agreement between Sublessor and Sublessee. The Telescope may be operated in the absence of an Operating and Site Development Agreement by Sublessee when necessary to ensure the safety of personnel or of the facilities.

G. Indemnity

Sublessee will indemnify, defend and hold harmless the Lessor and Sublessor, their officers, agents, employees or any person acting on their behalf from and against any claim or demand for loss, liability or damages (including, but not limited to, claims for property damage, personal injury or death, based upon any accident, fire, or other incident on the demised premises and roadways adjacent thereto) which arises from any act or omission of Sublessee, its officers, agents, employees, or invitees, or occasioned by any failure on the part of Sublessee to maintain the premises in a safe condition or to observe or perform any of the terms and conditions herein or any regulations, ordinances and laws of the Federal, State, Municipal or County Governments.

Additionally, Sublessee shall, during the period of this Sublease, at its own cost and expense, maintain liability

II. SUBLESSOR HEREBY COVENANTS WITH SUBLESSEE AS FOLLOWS:

A. Peaceful Enjoyment

Upon provision by Sublessee of the use rights in lieu of rent in the aforesaid Operating and Site Development Agreement and upon observance and performance of all the terms, covenants and conditions herein contained and on the part of Sublessee to be observed and performed, Sublessee shall peaceably hold and enjoy the demised premises during the term hereof without hindrance or interruption.

B. Covenant Against Contingent Fees

Sublessee warrants that no person or selling agency has been employed or retained to solicit or secure this Sublease upon an agreement or understanding for a commission, percentage, brokerage, or contingent fee, excepting bona fide employees or bona fide established commercial or selling agencies maintained by Sublessee for the purpose of securing business. For breach or violation of this warranty, Sublessor shall have the right to annul this Sublease without liability or in its discretion to deduct from the Sublease price or consideration, or otherwise recover, the full amount of such commission, percentage, brokerage, or contingent fee.

C. Renewal

At lease SIX (6) months prior to the expiration of General Lease S-4191 on the 31st day of December 2033, Sublessor shall seek to negotiate a renewal of the General Lease with the Board of Land and Natural Resources or its successor and, in the event of renewal, Sublessor shall renew or extend this Sublease, or shall negotiate in good faith a new Sublease with Sublessee, if so desired by Sublessee, and under such terms and conditions as may then be mutually acceptable.

III. SUBLESSEE HEREBY COVENANTS WITH SUBLESSOR AS FOLLOWS:

C. Repairs and Maintenance

At all times during the term of this Sublease, Sublessee shall, at Sublesse's own cost and expense, keep and maintain the demised premises and the buildings and improvements erected upon the demised premises, in good order and repair and in a clean condition. This obligation shall include, but not be limited to, the obligation of painting the improvements and any part thereof, when necessary, and making any modification, improvement, or alteration approved by Sublessor and made by Sublessee.

D. Utilities and Other Charges

Except as may be agreed in the Operating and Site Development Agreement, Sublessee shall pay or shall cause to be paid when due all charges associated with the Telescope and, all charges, duties and rates of every description, including electricity, water, communications, sewer, gas, refuse collection or any other similar charges, as to which said demised premises, or any part thereof, or any improvements thereon, or to which Sublessor or Sublessee in respect thereof, are now or may be assessed or become liable by authority of law during the term of this Sublease.

E. Taxes and Assessments

Sublessee shall pay or cause to be paid when due, the amount of all taxes, rates, assessments, and other outgoings of every description as to which said premises or any part thereof, or any improvements thereon, or Sublessor or Sublessee in respect thereof, are now or may be assessed or become liable by authority of law during the term of this Sublease.

F. Assignment and Subleasing

Neither Sublessee nor its successor or assigns shall, without the prior written consent of Sublessor, assign or mortgage this Sublease or any interest therein, or sublet the "reasonable wear and tear" shall include without limitation such grading, excavation and filling of the land demised as may be reasonably required for the construction, modification or removal of the improvements contemplated by this Sublease, and such grading, excavation and filling shall not be deemed to constitute strip or waste. Sublessee shall make every reasonable effort to minimize grading, excavation and filling.

H. Liability

All goods, wares, merchandise, equipment or other property of Sublessee shall be kept on the demised premises at the sole risk of Sublessee.

I. Improvements and Alterations

Prior to the commencement of any construction, alteration, or repair of any building or other improvement which expands or changes the external structure or appearance of facilities located on the demised premises, the final location map, plans, and specifications shall be submitted to Sublessor and to the Chairman, Department of Land and Natural Resources, or to their authorized representatives, for approval, which approval shall not be arbitrarily or capriciously withheld or delayed. Sublessor and Lessor shall process any application for such alterations and additions as expeditiously as possible and subject to regulations of the Department of Land and Natural Resources.

All construction shall be in full compliance with all laws, rules, regulations of the Federal, State and County Governments applicable thereto, and also in accordance with plans and specifications submitted by Sublessee to and approved by Sublessor prior to commencement of construction.

IV. AND THE PARTIES MUTUALLY COVENANT AS FOLLOWS:

A. Service of Process

B. Governing Law; Severability

The validity, construction and performances of this Sublease, and the legal relations among the parties to this Sublease shall be governed by and construed in accordance with the laws of the State of Hawaii, excluding that body of law applicable to choice of law. In the event any provision of this Sublease shall be held by a court of competent jurisdiction to be contrary to law, the remaining provisions of this Sublease shall remain in full force and effect.

C. Binding on Successors

This Sublease shall be binding on and inure to the benefit of the successors of the parties hereto.

D. Partial Invalidity

Should any provision of this Sublease be held by a court of competent jurisdiction to be either invalid, void, or unenforceable, the remaining provisions of this Sublease shall remain in full force and effect.

E. Final Agreement

This instrument constitutes the final agreement between Sublessor and Sublessee regarding the Sublease of the demised premises to Sublessee for purposes of Sublessee's construction of the telescope herein described. All prior discussions and/or agreements between the parties concerning the subject matter addressed in this Sublease shall have no force and effect.

F. Notices

All notices required or permitted to be given hereunder by Sublessor to Sublessee or Sublessee to Sublessor shall be in writing and sent to the following people or offices at the following addresses:

Sublessor and Sublessee may change the address of the recipient of notices by sending a written notice of each such change to the last designated address of the addressee.

G. Termination

This Sublease may be terminated by the Sublessor upon the occurrence of any of the following events:

1. If a substantial part of the planned construction as described in Exhibit C does not exist on the site by the 31st day of December 1986, unless otherwise agreed in writing between Sublessor and Sublessee.

2. Termination of the "Operating and Site Development Agreement Between the California Institute of Technology and the University of Hawaii Concerning the design, Construction and Operation of the 10.4-m Millimeter-Wave Telescope of the California Institute of Technology on Mauna Kea, Hawaii."

3. The expiration of General Lease S-4191 on December 31, 2033. If said General Lease is renewed, extended or renegotiated, this Sublease may be renewed, extended, or renegotiated at that time.

4. If Sublessee fails to observe or comply with any of the terms and conditions herein within THIRTY (30) days after being notified in writing by Sublessor of such failure. In the event that more than THIRTY (30) days are reasonably required to observe or perform, Sublessee shall in good faith, and within said THIRTY (30) days, initiate action and provide a plan for observance or performance, and shall diligently prosecute the same to completion.

5. Destruction of the improvements by fire or other causes rendering the same unsuitable for purposes of millimeter and submillimeter astronomy, unless Sublessee notifies Sublessor within SIX (6) months of the date of casualty of its

V. TITLE TO FACILITIES, ALTERATIONS, ADDITIONS, IMPROVEMENTS, AND EQUIPMENT, AND DISPOSITION IN EVENT OF TERMINATION

Title to all facilities, additions, improvements, alterations, and equipment (collectively referred to herein as "property") on, affixed or installed in, or placed on the premises by Sublessee shall, at all times, remain in the name of the California Institute of Technology.

However, upon the termination or expiration of this Sublease for any cause, Sublessee must select one of the following options:

1. Negotiate with Sublessor for sale of the property to Sublessor.

2. With concurrence of Sublessor, peaceably surrender the demised premises and all or part of the property in place and good repair, order, and clean condition, reasonable wear and tear excepted. In the event that part of the property is removed, Sublessee shall restore the demised premises, or any portion affected thereby, to even grade to the extent that improvements are removed, and shall repair any damage done to the improvements in the event that equipment is removed.

3. Sell the assets to a third party acceptable to Sublessor, which acceptance shall not be arbitrarily or capriciously withheld. Such sale shall be contingent upon the execution of a new Sublease and Operating and Site Development Agreement between the third party and Sublessor.

4. Remove the property at the expense of Sublessee provided such removal is completed within EIGHTEEN (18) months after termination or expiration of Sublease, unless otherwise agreed to in writing between Sublessor and Sublessee. In the event of such removal, Sublessee shall restore the property, or any portion affected thereby, to even grade to the extent

IN WITNESS WHEREOF, the parties hereto have executed these presents on the day and year first above written.

FOR THE UNIVERSITY OF HAWAII

By ________________________ OCT 24 1983
Fujio Matsuda   Date
President

By ________________________ OCT 24 1983
                             Date

APPROVED AS TO FORM:

By ________________________ 8/3/83
Its Deputy Attorney   Date
General

FOR THE CALIFORNIA INSTITUTE OF TECHNOLOGY

By ________________________
Marvin L. Goldberger   Date
President

FOR THE DEPARTMENT OF LAND AND NATURAL RESOURCES

By ____________ / 12.20.83
Susumu Ono Date
Chairman

APPROVED AS TO FORM:

By ____________ / September 27, 1983
Its Deputy Date
Attorney General

By ____________ / 12/16/83
Member Date

APPROVED BY THE BOARD OF
LAND AND NATURAL RESOURCES
AT ITS MEETING HELD ON

AUGUST 26, 1983

STATE OF CALIFORNIA)
) S.S.
CITY AND COUNTY OF LOS ANGELES)

On this 15th day of November, 1983, before me appeared Marvin L. Goldberger, to me personally known who, being by me duly sworn, did say that he is President of the CALIFORNIA INSTITUTE OF TECHNOLOGY, a California corporation; that the seal affixed to the foregoing instrument is the corporate seal of said corporation; that said instrument was signed and sealed in behalf of said corporation by the authority of its Board of Trustees; and said Marvin L. Goldberger acknowledged the instrument to be the free act and deed of said corporation.

OFFICIAL SEAL
SUSAN RUTH MARTIN
NOTARY PUBLIC - CALIFORNIA
LOS ANGELES COUNTY
My comm. expires SEP 22, 1986

Susan Ruth Martin
Notary Public, State of California
My commission expires: 9/22/86

STATE OF CALIFORNIA)
) S.S.
CITY AND COUNTY OF LOS ANGELES)

On this 15th day of November, 1983, before me appeared David W. Morrisroe, to me personally known who, being by me duly sworn, did say that he is Vice-President for Business + Finance of the CALIFORNIA INSTITUTE OF TECHNOLOGY, a California corporation; that the seal affixed to the foregoing instrument is the corporate seal of said corporation; that said instrument was signed and sealed in behalf of said corporation by the authority of its Board of Trustees; and said David W. Morrisroe acknowledged the instrument to be the free act and deed of said corporation.

OFFICIAL SEAL
SUSAN RUTH MARTIN
NOTARY PUBLIC - CALIFORNIA
LOS ANGELES COUNTY
My comm. expires SEP 22, 1986

Susan Ruth Martin
Notary Public, State of California
My commission expires: 9/22/86

STATE OF HAWAII)
) ss.
CITY AND COUNTY OF HONOLULU)

On this 24th day of October, 1983, before me appeared Fujio Matsuda and Harold S. Masumoto, to me personally known, who, being by me duly sworn, did say that they are President and Vice President for Administration respectively, of the University of Hawaii, a Hawaii corporation; that the seal affixed to the foregoing instrument is the corporate seal of said corporation; that said instrument was signed and sealed in behalf of said corporation by the authority of its Board of Regents; and said Fujio Matsuda and Harold S. Masumoto acknowledged the instrument to be the free act and deed of said corporation.

Ruth M. Chang
Notary Public, First Circuit

Attachment A, Exhibit A

General lease S-4191

by and between

the State of Hawaii and the University of Hawaii

1968-06-20

EXHIBIT A

GENERAL LEASE S-4191

GENERAL LEASE NO. S-4191

THIS INDENTURE OF LEASE, made this 21st day of June, 1968, by and between the STATE OF HAWAII, by its Board of Land and Natural Resources, pursuant to the provisions of Section 103A-90(b), Revised Laws of Hawaii 1955, as amended, hereinafter referred to as the "LESSOR", and the UNIVERSITY OF HAWAII, a body corporate, whose post office address is 2444 Dole Street, Honolulu, City and County of Honolulu, State of Hawaii, hereinafter referred to as the "LESSEE",

WITNESSETH THAT:

FOR and in consideration of the mutual promises and agreements contained herein, the Lessor does hereby demise and lease unto the said Lessee and the said Lessee does hereby rent and lease from the Lessor, all of that certain parcel of land situate at Kaohe, Hamakua, County and Island of Hawaii, State of Hawaii, and more particularly described in Exhibit "A", hereto attached and made a part hereof.

TO HAVE AND TO HOLD, all and singular the said premises, herein mentioned and described, unto the said Lessee, for and during the term of sixty-five (65) years, to commence from the 1st day of January, 1968, and to terminate on the 31st day of December, 2033.

RESERVING UNTO THE LESSOR THE FOLLOWING:

1. Water Rights. All surface and ground waters appurtenant to the demised premises, together with the right to enter and to capture, divert or impound water; provided, that the Lessor shall exercise such rights in such manner as not to interfere unreasonably with the Lessee's use of the demised premises; provided, further, that the Lessee shall have the right to use the waters of Lake Waiau for any purpose necessary or incidental to the use permitted by this lease on the following conditions:

a. No drilling or disturbance of Lake Waiau's bottom, banks or areas adjacent thereto shall be permitted;

b. No activity shall be permitted which will result in the pollution of the waters of Lake Waiau;

c. Lessee shall not take or divert any of the waters arising from springs which furnish the water supply for Pohakuloa, and no alterations to said springs shall be made by Lessee.

2. Access. All rights to cross the demised premises for inspection or for any government purposes.

3. Hunting and Recreation Rights. All hunting and recreation rights on the demised lands, to be implemented pursuant to rules and regulations issued by said Board in dis-

4. Right to use Demised Lands. The right for itsel and its successors, lessees, grantees and permittees, to use a portion of the lands demised and the right to grant to others rights and privileges affecting said land; provided, however, that, except as otherwise provided herein, no such use shall be permitted or rights and privileges granted affecting said lands, except upon mutual determination by the parties hereto that such use or grant will not unreasonably interfere with th Lessee's use of the demised premises; provided, further, that such agreement shall not be arbitrarily or capriciously withheld.

THE LESSEE, IN CONSIDERATION OF THE PREMISES, COVENANTS WITH THE LESSOR AS FOLLOWS:

1. Surrender. The Lessee shall, at the expiration or sooner termination of this lease, peaceably and quietly sur render and deliver possession of the demised premises to the Lessor in good order and condition, reasonable wear and tear excepted.

2. Maintenance of the Premises. The Lessee shall keep the demised premises and improvements in a clean, sanitar and orderly condition.

3. Waste. The Lessee shall not make, permit or suf fer, any waste, strip, spoil, nuisance or unlawful, improper c

RWH
PS

~~during hours of darkness~~ and certain types of electric or electronic installation on the demised lands, but shall not necessarily be limited to the foregoing.

5. Assignments. The Lessee shall not sublease, sub-rent, assign or transfer this lease or any rights thereunder without the prior written approval of the Board of Land and Natural Resources.

6. Improvements. The Lessee shall have the right during the existence of this lease to construct and erect buildings, structures and other improvements upon the demised premises; provided, that plans for construction and plot plans of improvements shall be submitted to the Chairman of the Board of Land and Natural Resources for review and approval prior to commencement of construction. The improvements shall be and remain the property of the Lessee, and shall be removed or disposed of by the Lessee at the expiration or sooner termination of this lease; provided, that with the approval of the Chairman such improvements may be abandoned in place. The Lessee shall, during the term of this lease, properly maintain, repair and keep all improvements in good condition.

7. Termination by the Lessee. The Lessee may terminate this lease at any time by giving thirty (30) days' notice in writing to the Lessor.

8. Termination by the Lessor. In the event that (1) the Lessee fails to comply with any of the terms and conditions of this lease, or (2) the lessee abandons or fails to use the demised lands for the use specified under paragraph 4 of these covenants for a period of two years, the Lessor may terminate this lease by giving six months' notice in writing to the Lesse

9. Non-Discrimination. The Lessee covenants that th use and enjoyment of the premises shall not be in support of ar

policy which discriminates against anyone based upon race, creed, color or national origin.

10. General Liability. The Lessee shall at all time with respect to the demised premises, use due care for safety, and the Lessee shall be liable for any loss, liability, claim or demand for property damage, personal injury or death arisin out of any injury, death or damage on the demised premises caused by or resulting from any negligent activities, operati or omissions of the Lessee on or in connection with the demise premises, subject to the laws of the State of Hawaii governinc such liability.

11. Laws, Rules and Regulations, etc. The Lessee shall observe and comply with Regulation 4 of the Department of Land and Natural Resources and with all other laws, ordinances, rules and regulations of the federal, state, municipal or county governments affecting the demised lands or improvements.

12. Objects of Antiquity. The Lessee shall not appropriate, damage, remove, excavate, disfigure, deface or destroy any object of antiquity, prehistoric ruin or monument of historical value.

13. Undesirable Plants. In order to prevent the introduction of undesirable plant species in the area, the Lessee shall not plant any trees, shrubs, flowers or other

day of ________________, 1968, and the UNIVERSITY OF HAWAII, by its ________________ and ________________, has caused these presents to be duly executed this ______ day of ________________, 1968, effective as of the day and year first above written.

STATE OF HAWAII

By: ________________________
ACTING Chairman and Member
Board of Land and
Natural Resources

And By: ________________________
Member
Board of Land and
Natural Resources

UNIVERSITY OF HAWAII

By: ________________________
Its ACTING President

And By: ________________________
Its

APPROVED AS TO FORM:

____
Deputy Attorney General
Dated: ________________

mm
Proofed by:

EXHIBIT "A"

MAUNA KEA SCIENCE RESERVE

Kaohe, Hamakua, Island of Hawaii, Hawaii

Being a portion of the Government Land of Kaohe

Beginning at a point on the south boundary of this parcel of land, the coordinates of said point of beginning referred to Government Survey Triangulation Station "SUMMIT 1955" being 12,325.95 feet South and 471.84 feet West, as shown on Government Survey Registered Map 2789, thence running by azimuths measured clockwise from True South:-

1. Along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and dist being: 135° 00' 18,667. feet;

2. Thence along Mauna Kea Forest Reserve, Governor's Procla dated June 5, 1909, still a curve to the right with radius of 13,200.00 feet, chord azimuth and distance being: 225° 00' 18,667. feet;

3. Thence along Mauna Kea Forest Reserve, Governor's Proclama dated June 5, 1909, still a curve to the right with radius of 13,200.00 feet, chord azimuth and distance

6. 27° 49' 06.5" 841.83 feet along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;

7. Thence along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 306° 59' 47.4" 1824.16 feet;

8. 227° 29' 00.9" 2805.06 feet along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;

9. Thence along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 1500.00 feet, the chord azimuth and distance being: 317° 29' 00.9" 3000.00 feet;

10. 47° 29' 00.9" 2805.06 feet along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;

11. Thence along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 13200.00 feet, the chord azimuth and distance being: 325° 3[illegible] 55.2" 701.87 feet;

12. 245° 46' 12.7" 2760.45 feet along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;

13. Thence along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 2000.00 feet, the chord azimuth and distance being: 335° 46' 12.7" 4000.00 feet;

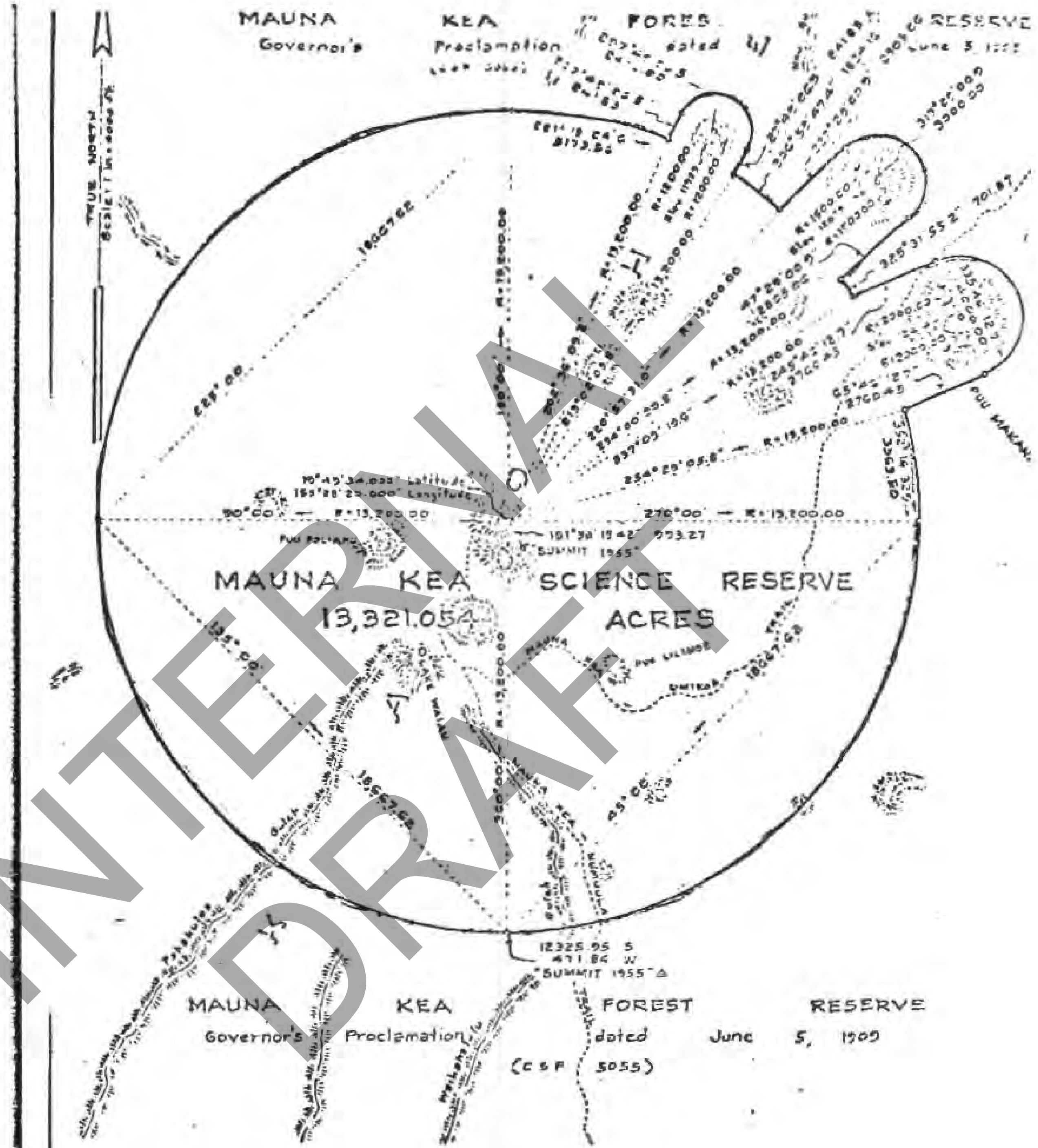
14. 65° 46' 12.7" 2760.45 feet along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;

15. Thence along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 352° 14' 33.9" 3563.50 feet;

16. Thence along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, still on a curve to the right with a radius of 13,200.00 feet, the chord azimuth and distance being: 45' 00' 18,667.62 feet to the point of beginning and containing an AREA OF 13,321.054 ACRES.

EXCEPTING and RESERVING to the State of Hawaii and to all others entitled thereto, the Mauna Kea-Humuula and Mauna Kea-Umikoa Trails, and all other existing trails within the above-described parcel of land, together with rights of access over and across said trails.

ALSO, EXCEPTING and RESERVING to the State of Hawaii, its successors and assigns, the waters and all riparian and other rights in and to all the streams within the above-described parcel of land.



MAUNA KEA SCIENCE RESERVE

Kaohe, Hamakua, Island of Hawaii, Hawaii

Scale 1 inch = 4000 feet

JOB 4-3878

TAX MAP 4-4-15

SURVEY DIVISION
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
STATE OF HAWAII

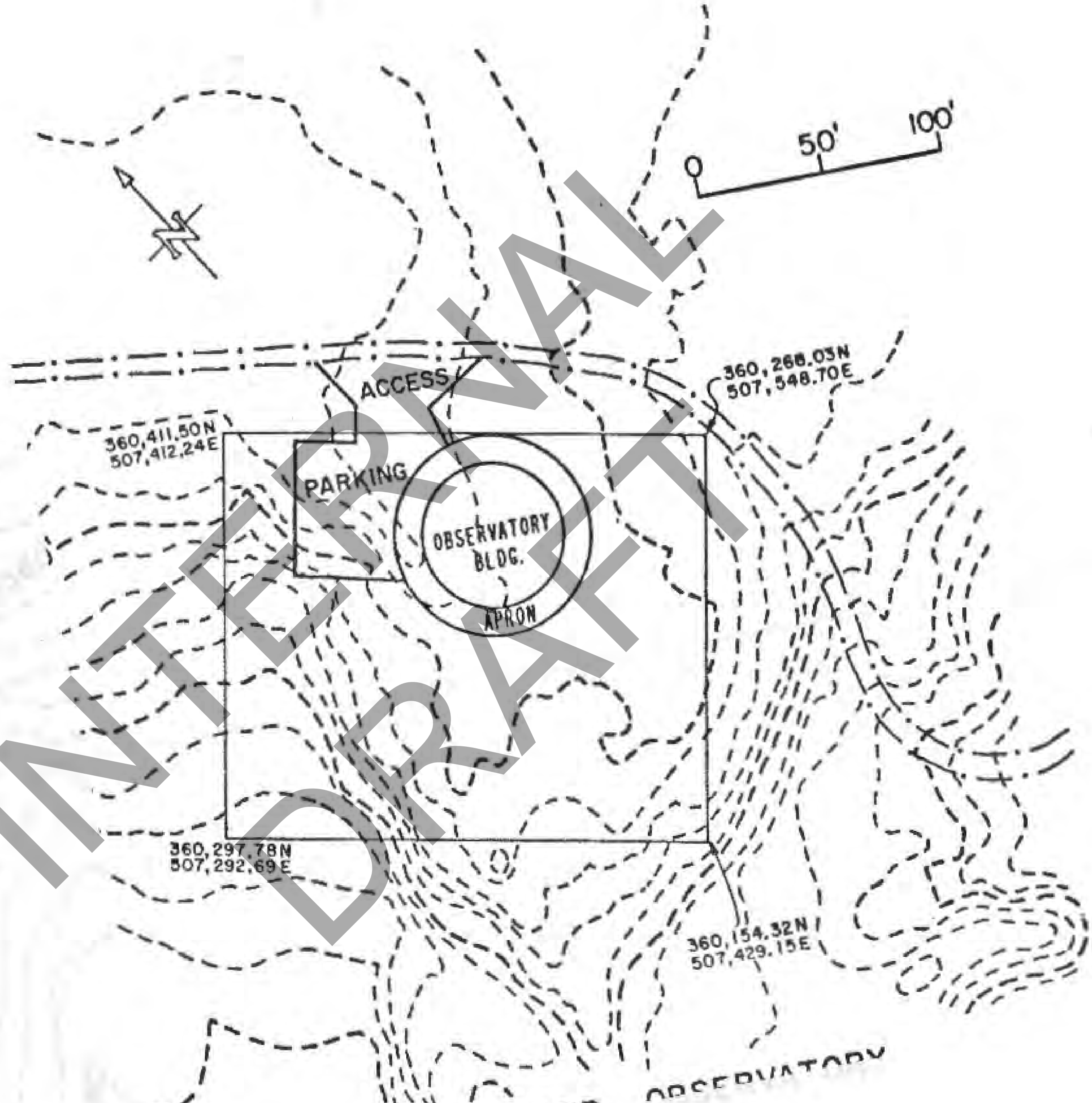
CALIFORNIA INSTITUTE OF TECHNOLOGY

Attachment A, Exhibit B

Caltech Telescope Site

EXHIBIT B

CALTECH TELESCOPE SITE



L TECH SUBMILLIMETER OBSERVATORY

CALIFORNIA INSTITUTE OF TECHNOLOGY

Attachment A, Exhibit C

Description of the Construction

of the Caltech Telescope

EXHIBIT C

DESCRIPTION OF THE CONSTRUCTION

OF THE CALTECH TELESCOPE

EXHIBIT C

Description of the Caltech
Submillimeter Telescope Facility

BACKGROUND

The California Institute of Technology plans to construct a submillimeter wave telescope for astronomical research, on a site at about 13,360 feet altitude in the Science Reserve on Mauna Kea. The telescope will be used by astronomers from Caltech and the University of Hawaii in accordance with the provisions of an operating and site development agreement.

The major components of the construction are a 10.4-meter diameter parabolic dish, supported by an azimuth-elevation mount on a concrete foundation. The telescope is protected by a 60-foot-diameter astronomical dome with shutter doors which open for observations. The dome, which rotates to follow the azimuth of the telescope, is supported by a concrete foundation.

SITE WORK

In the vicinity of the telescope and dome the site will be leveled at an alti-

TELESCOPE

The primary reflector is made from hexagonal sections of aluminum honeycomb material, surfaced with aluminum sheeting which is accurately polished. It is backed by a tubular steel structure which maintains it in a parabolic shape. The mount for the reflector is a steel structure with azimuth and elevation bearings which permit all sky coverage. A secondary reflector, supported by four feed legs, directs the submillimeter radiation from the primary to the detection system at the secondary focus.

DOME

The dome is a steel structure, of approximately hemispherical shape, 60 feet across and 52 feet high. It is surfaced with aluminum sheet. The aperture through which the telescope observes the sky is a slit in the top and front of the dome about 11 meters in width, covered by two rolling shutter doors. The whole dome structure rotates in azimuth on a rail, so that the slit can follow the pointing of the telescope. Internally the dome consists of an internal space, which is occupied by the telescope, and a personnel work space on the first and second floors in which the telescope control, data collection, instrument preparation, maintenance and personnel needs are accomodated.

CALIFORNIA INSTITUTE OF TECHNOLOGY

Attachment B

Operating and Site Development Agreement

between the California Institute of Technology

and the

University of Hawaii

Concerning the

Construction and Operation

of the

Caltech Submillimeter Telescope Facility

on

Mauna Kea, Hawaii

1983-12-20

T.G.P.

final version – signed

OPERATING AND SITE DEVELOPMENT AGREEMENT

BETWEEN THE

CALIFORNIA INSTITUTE OF TECHNOLOGY

AND THE

UNIVERSITY OF HAWAII

CONCERNING THE

CONSTRUCTION AND OPERATION

OF THE

CALTECH SUBMILLIMETER TELESCOPE FACILITY

ON

MAUNA KEA, HAWAII

THIS AGREEMENT, made this 20 day of December, 1983, by and between the California Institute of Technology, hereinafter Caltech, and the University of Hawaii, hereinafter UH;

WITNESSETH:

WHEREAS, the far-infrared and millimeter regions of the electromagnetic spectrum have shown great scientific potential for contributing to our understanding of the astronomical universe;

WHEREAS, the summit area of Mauna Kea is exceptionally well-endowed as a site for observations in these wavelengths;

WHEREAS, Caltech has correspondingly initiated a program to construct a 10.4-meter-aperture telescope dedicated to observations at these wavelengths and is desirous of locating the Telescope on Mauna Kea;

WHEREAS, Caltech and UH believe that the best interests of both parties are to be served through a program of close scientific cooperation centered around the Telescope; and

WHEREAS the academic program of UH will benefit significantly from the establishment in Hawaii of a major facility dedicated to far-infrared and millimeter-wave astronomy;

WHEREAS, Caltech and UH have executed a Memorandum of Understanding on October 29, 1981 to proceed with the arrangements necessary for Caltech to construct and operate the Telescope on land leased by UH on Mauna Kea;

NOW, THEREFORE, in consideration of the mutual accommodations and agreements herein contained, the parties hereto agree as follows:

I DEFINITIONS:

"Associated Installations" include all other facilities associated with the Telescope on the subleased property, such as electrical and telephone conductors, cableways and tunnels, driveways and parking lots, and access roads from the border of the subleased property.

"Mauna Kea Science Reserve" (Science Reserve) is that area on the summit of Mauna Kea consisting generally of the area higher than 12,000 feet above sea level and specifically of that area leased by UH from the State of Hawaii, Board of Land and Natural Resources, under General Lease S-4191.

II. LOCATION OF FACILITIES:

Sublease No. H09176, attached hereto as Attachment A and specifically incorporated herein by reference, specifies the proposed location on Mauna Kea of the Telescope.

III. PARTIES TO THE AGREEMENT:

A. Principal Parties:

1. California Institute of Technology

The California Institute of Technology (Caltech), incorporated in 1891 under the laws of the State of California, is a privately endowed nonprofit educational institution of university rank devoted to undergraduate and graduate instruction and research in science, engineering and the humanities and social sciences. The governing body of Caltech is a Board of Trustees, which has the ultimate responsibility for the conduct of Caltech's affairs.

2. University of Hawaii

The University of Hawaii (UH) is the public university of the State of Hawaii. The University system comprises the Manoa, for representing the interests of UH on UH-owned or UH-leased land on Haleakala and Mauna Kea.

2. Division of Physics, Math and Astronomy

The Division of Physics, Math and Astronomy (PMA) is the research organization within Caltech which has responsibility for the conduct of astronomy research programs.

C. Interaction Between Parties:

While this Agreement is between Caltech and UH, the functional interaction between these parties will usually be carried out for UH by the IFA and for Caltech by the PMA.

IV. RESPONSIBILITIES:

A. Caltech:

1. Design and Construction of Facilities

Caltech shall be solely responsible for the design, fabrication and installation of the Facilities on Mauna Kea. Caltech shall obtain such funds for design and construction and associated work connected with the Facilities as shall be needed. Caltech shall conform to uniform regulations established by UH, by the State of Hawaii, and by the United States of America for the preservation of the environmental quality and the scientific integrity of the summit area.

2. Operation and Maintenance of the Facilities

Funds for operating and maintaining the Facilities shall be obtained by Caltech.

3. Permanent Mid-Level Facilities

If Caltech elects to participate in the expansion of the permanent Mid-Level Facilities at Hale Pohaku, this participation will be governed by the terms of a separate Agreement to be negotiated between Caltech and UH. In order to facilitate the planning effort if Caltech makes such election, Caltech agrees to negotiate this separate agreement in conjunction with at least one other major astronomy-related future project on Mauna Kea at the first opportunity presented for such expansion (see also IV.B.3.).

4. Base Support Facilities

If Caltech elects to participate in construction of base support facilities in Hilo on the Big Island (Island of Hawaii), it will give first consideration to doing so on land provided by UH in Hilo, and in cooperation with users of other telescope facilities on Mauna Kea. If Caltech elects to rent base support accommodation in Hilo, it will give first consideration to any accommodation available on the UH Hilo campus (see also VI.C.2.).

5. Installation of Individually Metered Electrical Service Connection and Telephone Lines

Caltech will be responsible for the installation and maintenance of power and telephone lines from central terminals to the subleased property. Caltech may coordinate and fund this effort in conjunction with other users of those same lines.

6. Research Environment

Recognizing that Caltech is part of a community of research organizations using the Science Reserve, Caltech shall ensure that its activities are compatible with activities of other telescope facilities located there.

B. UH:

1. Sublease

Subject to the approval of the Board of Land and Natural Resources, UH shall execute a Sublease with Caltech to cover the land and necessary easements for the construction and operation of the Telescope.

2. Access

UH shall ensure right-of-access to Caltech to the

3. Permanent Mid-Level Facilities

Until such time as an opportunity to participate in the construction or permanent use of additional space at the permanent Mid-Level Facilities at Hale Pohaku is presented, UH will rent to Caltech space in the form of four bedrooms from its share of the Mid-Level Facilities. This provision will apply for no more than five (5) years from the execution of this Agreement, unless both parties elect to extend or renegotiate this provision. If Caltech elects to participate in the permanent Mid-Level Facilities, UH shall negotiate a separate Agreement with Caltech detailing the conditions of that participation.

4. Management

UH shall provide a forum to allow Caltech and other astronomy-related organizations using the Science Reserve to discuss, on an equal footing, aspects of the management of the Science Reserve. However, since UH is the primary lessee with the State of Hawaii, it is recognized that the final responsibility for management of the Science Reserve resides with UH.

5. Mauna Kea Support Services

a. UH shall provide services on a basis of no profit, no loss, to all the astronomical facilities in the Science Reserve through Mauna Kea Support Services (MKSS). Such services shall include, but shall not be limited to, food and lodging, transportation and library services, road maintenance, snow removal, utilities, access control and public information services, and general administration. Caltech shall reimburse UH for such services provided for its benefit; reimbursement is referred to here as a User's fee and shall be made on the basis of invoices distributed periodically by MKSS.

b. Annually UH shall provide Caltech with a statement setting forth UH's cost of the services described in the immedithe denominator of which is the number of subleases, including the Caltech Sublease, which have been executed for land within the Science Reserve for separately identified telescope facilities. If the number of such subleases in the Science Reserve changed during the year for which the statement is rendered, the allocation of costs shall be prorated appropriately. In the event that services are provided for the benefit of a subgroup of all such facilities, the terms of reimbursement will be negotiated prior to the initiation of this service.

c. Caltech shall be represented on the MKSS Oversight Committee which reviews existing activities and recommends changes to the activities of the MKSS.

6. Research Environment

Recognizing that Caltech is part of a community of research organizations using the Science Reserve, UH shall ensure that activities in the Science Reserve are compatible with the research or potential research related to the Telescope. UH shall determine which activities are compatible with such research in consultation with all astronomy-related organizations using the Science Reserve.

7. Electrical Power and Roads

UH plans to construct an electric power line in the Mauna Kea summit area and to grant to the Telescope access to this power to a peak capacity of 150 kW. The location of the handhole where connection may be made will be within approximately 2000 feet of the subleased property.

Pending the installation of permanent power, Caltech will be entitled to connect to an existing 850-kW generator and to draw a peak load of 60 kW, conditional on payment to UH of the sum of $19,907.12, this being its share of the capital cost of the generator. The costs of connection from the Telescope to the terminal, and of electric power, are to be paid by Caltech.

the summit to Hale Pohaku, but, in any case, including the spur road from the Telescope to the main access road. Both of these improvements (hereinafter Infrastructure Improvements) are subject to State and County permits and approvals, and to appropriate amendment of the 1977 DLNR Mauna Kea Plan, and to the UH's obtaining the agreements of the existing and future users to paying a negotiated share of the costs. The power line shall provide Caltech with at least 150 kW of electrical power at a handhole described in IV.B.7. Funds available to UH for Infrastructure Improvements shall be used in order of priority as follows: First, for the construction of said power line; and second, for the improving and paving, in whole or in part, of said road (including safety devices), including the spur road from the Telescope to the main access road, beginning at the boundary of the subleased properties of all facilities existing, under construction, or which are the subject of a completed Operating and Site Development Agreement.

C. Responsibilities Shared by Caltech and UH

1. Operating and Maintenance Costs:

a. Caltech shall be responsible for payment of an annual User's fee as prescribed in IV.B.5.

b. Caltech shall be responsible for operation and maintenance costs of the permanent power line from the handhole described in IV.B.7. to the Caltech Telescope, together with any other parties who may share the line.

2. Infrastructure Improvements:

a. In recognition of benefits to Caltech accruing from the Infrastructure Improvements referenced in IV.B.8, Caltech agrees to pay additions to its annual User's fee. Any such additions to the User's fee are to commence at the time that the contract for the improvement construction is let. The basis for determining the additions to the User's fee are set out below.

b. It is the intention of UH to spend a total of $7 million on Infrastructure Improvements. Approximately $5 million will be set aside for the power line, and any funds remaining will be given to improving the safety features of the road and to paving, beginning at the boundary of the subleased properties of all facilities existing, under construction, or which are the subject of a completed Operating and Site Development Agreement SIX (6) months before the contract for road improvement and paving is let. UH intends to fund the infrastructure improvements on behalf of existing and future non-UH Users with revenue bonds.

c. UH has developed a scheme for assessing the additional User fees which each telescope sponsor at Mauna Kea should pay for the availability and use of a permanent power line and an improved road. Consistent with this, Caltech will undertake to pay over a period of FIVE (5) years, an additional annual User's fee for use of the permanent power line and the road improvements. The added User's fee will be set at a sum sufficient to compensate UH for providing a fraction (0.06840) of the total cost that UH has assumed on behalf of Caltech. If the rate on the loan taken out by UH to finance the power line and road improvements exceeds 12% per annum, this User's fee will be subject to approval by Caltech. In return for payment of the additional annual User's fee discussed above, Caltech will be entitled to the use of the power line and road throughout the tenure of the Sublease.

d. If the capital amounts spent by UH on either the road or power line are less than stated in IV.C.1.b. above, the additional User's fees charged to Caltech shall be proportionately reduced. If it appears that UH will be unable to complete the Infrastructure Improvements for $7 million, UH shall so notify Caltech. Caltech shall thereupon consider in good faith its ability to pay additional User's fees to help defray the additional cost.

e. If UH receives funds from future users buying into the infrastructure, or from the power company for repayment of the construction advance, these amounts will be used to (1) retire the Revenue bond portion of the University's investment in the infrastructure which will have been made for the benefit of future users, and (2) defray the common costs of supporting astronomy-related activities on the mountaintop.

f. If for any reason this Agreement is terminated after Caltech has obtained the funds necessary to construct and install the Facilities, and before the additional User's fees have been paid for the number of years indicated in IV.C.1.c. above, then Caltech shall be obligated to continue to pay the addition-operation of the facilities in the Science Reserve, they shall negotiate in good faith to determine Caltech's fair share of the cost of such improvements.

VI. SCIENTIFIC COOPERATION:

In recognition of the potential for scientific interaction between Caltech and UH which the Telescope offers, and of the contribution of UH in making the site available to Caltech, Caltech and UH agree on the following matters with regard to the operational phase of the Telescope.

A. UH Access to the Telescope

Scientists sponsored by UH will compete on an equal footing with Caltech colleagues for observing time on the Telescope up to a maximum allocation of 10 percent of the total time scheduled for observing. UH anticipates that the growth in its new program in the area will result in observing proposals of sufficient merit to match this allocation. UH shall receive technical support whilst at the Telescope and access to the Telescope and its instrumentation on the same basis as Caltech scientists.

B. Participation in Caltech Committee Structure

In order to encourage productive interaction between UH and Caltech, UH shall be represented by one voting member on the Caltech Submillimeter Observatory Advisory Committee (CSOAC).

In order to facilitate UH/Caltech interaction during the design and construction phases at both the engineering and scientific levels, the UH member shall be represented on the CSOAC as soon as possible after the signing of this Agreement. The UH member shall be appointed by the Director of the IFA upon consultation with the Chairman of the CSOAC.

A Time Allocation Committee (TAC) shall be formed by the CSOAC and shall include a voting member of UH.

C. Interaction with UH Academic Program

It is the expressed policy of UH, and consistent with past practice, that new astronomical facilities in the Science Reserve should provide some specific benefit to the academic program of UH. UH wishes to implement this policy in such a manner as to bring a parallel benefit to the sponsoring institutions. To this end, UH is seeking specific interaction with Caltech staff, both at its UH Manoa headquarters and at its Hilo campus. Details of this interaction are set out below.

1. Joint Scientific Programs

Caltech and UH intend to encourage interaction among their staff members and graduate students, in submillimeter astronomy. This would be expected to include some joint scientific investigations, development of some communal instrumentation and visits of UH staff to Pasadena and vice versa. To further such collaboration and to insure the full advantage to UH of the presence of the Telescope in Hawaii, UH expects to appoint a faculty member in the field of submillimeter-wave astronomy. That person would be eligible for a Caltech visiting appointment, subject to the usual Caltech regulations.

Collaborative proposals between Caltech and UH faculty would be encouraged. Such proposals from Caltech to funding agencies could contain requests for salary funds for the UH faculty member.

2. UH Hilo

Caltech expects to place its base support facility in Hilo, on UH property (see IV.A.4.) and under conditions which will be negotiated at the time that Caltech wishes to proceed. It is specifically envisaged that Caltech staff members based in Hilo, or visiting for an extended period, will interact academically and professionally with UH Hilo staff and students.

VII. GENERAL LIABILITY

Caltech will indemnify, defend and hold harmless UH, its officers, agents, employees or any person acting on its behalf from and against any claim or demand for loss, liability or damages (including, but not limited to, claims for property damage, personal injury or death, based upon any accident, fire, or other incident on the demised premises and roadways adjacent thereto) which arises from any act or omission of Caltech, its officers, agents, employees, or invitees, or occasioned by any failure on the part of Caltech to

VIII. TERMINATION

This Agreement shall be dissolved upon any of the following events:

1. Termination of Sublease No. H09176 between Caltech and UH. One or both of the parties may wish to extend, renew, or renegotiate the Sublease prior to its termination and, if so, the parties will give consideration to a simultaneous extension, renewal, or renegotiation of this Agreement.

2. Failure of Caltech to obtain, by December 31, 1985, the funds necessary to construct and install the Facilities.

3. Failure of Caltech to observe or comply with any of the terms and conditions herein within THIRTY (30) days after being notified in writing by UH of such failure. In the event that more than THIRTY (30) days are reasonably required to observe or perform, Caltech shall in good faith, and within said THIRTY (30) days, initiate action and provide a plan for observance or performance, and shall diligently prosecute the same to completion.

4. Expiration of General Lease No. S-4191 on 31 December 2033, unless said Lease is renewed, extended, or renegotiated.

5. Mutual agreement in writing between Caltech and UH.

Disposition of property and improvements shall be conducted under the provisions of Sublease No. H09176 referenced above.

IN WITNESS WHEREOF, the parties hereto have executed these presents on the day and year first above written.

FOR THE UNIVERSITY OF HAWAII:

by Fujio Matsuda OCT 24 1983
Fujio Matsuda — Date
President

by Harold S. Masumoto OCT 24 1983
Its — Date

APPROVED AS TO FORM:

Edward Y. 8/8/83
Its Deputy Attorney General — Date

FOR THE CALIFORNIA INSTITUTE OF TECHNOLOGY:

by Marvin L. Goldberger 8/15/83
Marvin L. Goldberger — Date
President

by 8/15/83
Vice-President for — Date
Business and Finance

Attachment C

Conservation District Use Permit

HA-1492

approved 1982-12-17

Caltech CSO Permit 6524

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

RECEIVED JAN 12 Vice Pre... Admin...

RECEIVED JAN 13 1983 DIRECTOR INSTITUTE FOR ASTRONOMY

SUSUMU ONO, CHAIRMAN
BOARD OF LAND & NATURAL RESOURCES

EDGAR A. HAMASU
DEPUTY TO THE CHAIRMAN

DIVISIONS:
AQUACULTURE DEVELOPMENT PROGRAM
AQUATIC RESOURCES
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FORESTRY AND WILDLIFE
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

JAN 11 1983

REF. NO.: CPO-1096
FILE NO.: HA-7/22/82-1492
180-DAY EXP. DATE: 1/20/83

Mr. Harold S. Masumoto
Vice-President for Administration
University of Hawaii
2444 Dole Street, Room 202
Honolulu, Hawaii 96822

1/12/83 - Xcs to J. Jefferies / G. Pilcher, Mae Nishioka

Dear Mr. Masumoto:

We are pleased to inform you that your Conservation District Use Application for construction of the California Institute of Technology 10-meter telescope for millimeter and submillimeter astronomy at Mauna Kea, with right-of-entry, at Hamakua, Hawaii, was approved on December 17, 1982. Subject to the following recommendations and conditions:

A. Approval of the application subject to the following conditions:

1. That the applicant comply with all applicable statutes, ordinances, rules and regulations of the Federal, State and City and County governments, and applicable parts of Section 13-2-21 of Title 13, Chapter 2, Administrative Rules, as amended;

2. Other terms and conditions as prescribed by the Chairman;

3. In that this approval is for use of conservation lands only, the applicant shall obtain appropriate authorization through the Division of Land Management, State Department of Land and Natural Resources for the occupancy of State lands;

4. In the event any unanticipated sites or remains such as shell, bone or charcoal deposits, human burials, rock or coral alignments, pavings, or walls are encountered during construction, the applicant shall stop work and contact the Historic Preservation Office at 548-7460 or 548-6408;

5. That the applicant comply with all applicable Public Health Regulations;

6. A fire contingency plan, acceptable to the Division of Forestry and Wildlife shall be implemented during and after the construction of the structure.

B. That this approval is not to be considered as precedence for any future action the Board may desire to exercise through their discretionary conditional land use action.

C. That no further commitment of land use involving major improvements within the Mauna Kea Science Reserve be considered until such time as the University's Mauna Kea Science Reserve Development Plan is completed.

Should you have any questions on any of these conditions, please feel free to contact Mr. Roger C. Evans of our Planning Office at 548-7837.

Very truly yours,

SUSUMU ONO, Chairman
Board of Land and Natural Resources

cc: Hawaii Board Member
Hawaii Land Agent
Hawaii Planning Dept.
DOH/OEQC/EQC/OHA/DPED

Jefferies / Plasch

UNIVERSITY OF HAWAII

Vice-President for Administration

June 10, 1982

RECEIVED
JUN 16 1982
DIRECTOR
INSTITUTE FOR ASTRONOMY

Mr. Susumu Ono, Chairman
Board of Land and Natural Resources
Department of Land and Natural Resources
State of Hawaii
State Office Building
Honolulu, Hawaii 96813

Dear Mr. Ono:

SUBJECT: CDUA for the Subdivision and Construction of California Institute of Technology 10-Meter Telescope for Millimeter and Submillimeter Astronomy at Mauna Kea
Hamakua District, County of Hawaii
Tax Map Key: 4-4-15:9 (Por.)

The University of Hawaii as lessee of the Mauna Kea Science Reserve, requests the approval by the Board of Land and Natural Resources of the attached Conservation District Use Application for a .75 acre site and construction and operation of a 10.4 meter telescope for millimeter and submillimeter astronomy by the California Institute of Technology. A right-of-entry permit is also requested for the inspection and survey of the site for the preparation of the metes and bounds description and map.

The enclosed CDUA submittal requires your signature, as representative of the landowner, for its completion. The California Institute of Technology would like to begin site preparation work by May 1983.

The draft EIS for this facility was filed on May 23, 1982. A copy of this document is attached to the CDUA.

A filing fee of fifty ($50.00) is enclosed. Copies of the construction plans will be submitted to your office for review and approval at a later date.

Please feel free to communicate with me if there are any questions. For more specific information on the project, please contact Mr. Walter Muraoka of the Facilities Planning Office at 948-8216.

Sincerely yours,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

Enclosures
cc Group 70
Dr. T. G. Phillips, CIT
Dr. John Jefferies/G. Plasch
Mrs. Mae Nishioka/W. Muraoka

LNR-PU
EV. 1981

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

CONSERVATION DISTRICT USE APPLICATION

FOR DLNR USE ONLY

Reviewed by ______
Date ______
Accepted by ______
Date ______
File No. ______
EIS Required ______
PH Required ______

Print or Type)

I. LANDOWNER (If State land, to be filled in by Gov't. Agency in control of property).

Name Dept. of Land and Natural Resources

Address P.O. Box 621
Honolulu, Hi 96809

Telephone No. 548-6550

SIGNATURE ______

I. APPLICANT (Omit if applicant is landowner).

Name University of Hawaii

Address 2444 Dole Street
Honolulu, Hi 96822

Telephone No. 948-7069

Interest in Property G.L.No. S-4191
(Indicate interest in property; submit written evidence of this interest).

SIGNATURE Harold S. Masumoto

. USE REQUESTED -- DESCRIPTION OF AREA

District Hamakua

Island Hawaii

County Hawaii

Tax Map Key 4-4-15:09(Por.)

Area of Parcel .75 acre
(Indicate in acres or sq. ft.).

Area of Proposed Use 8,850 sq. ft.
(Indicate in acres or sq. ft.).

Name & Distance of Nearest Town or Landmark Hilo 42 miles

Boundary Interpretation (If the area is within 40 feet of the boundary of the Conservation District, include map showing interpretation of the boundary by the the State Land Use Commission).

Conservation District District Subzone Resource

County General Plan Designation Conservation

IV. TYPE OF USE REQUESTED (Mark where appropriate).

1. Permitted Use (exception occasional use): DLNR Chapter 2, Section 13-2 ; Subzone 13 .
2. Accessory Use (accessory to a permitted use): DLNR Chapter 2, Section ____; Subzone ____.
3. Occasional Use: Subzone ____.
4. Temporary Variance: Subzone ____.
5. Conditional Use: Subzone ____.

V. FILING FEE

1. Enclose $50.00. All fees shall be in the form of cash, certified or cashiers check, and payable to the State of Hawaii.
2. If use is commercial, as defined, submit additional public hearing fee of $50.00.

NOTE: Use additional sheets, as necessary, to provide the requied information listed on pages 2 and 3.

INFORMATION REQUIRED FOR ALL USES

I. Description of Parcel

A. Existing structures/Use. (Attach description or map).

B. Existing utilities. (If available, indicate size and location on map. Include electricity, water, telephone, drainage, and sewerage).

C. Existing access. (Provide map showing roadways, trails, if any. Give street name. Indicate width, type of paving and ownership).

D. Vegetation. (Describe or provide map showi g location and types of vegetation. Indicate if rare native plants are present).

E. Topography; if ocean area, give depths. (Submit contour maps for ocean areas and areas where slopes are 40% or more. Contour maps will also be required for uses involving tall structures, gravity flow and other special cases).

F. If shoreline area, describe shoreline. (Indicate if shoreline is sandy, muddy, rocky, etc. Indicate cliffs, reefs, or other features such as access to shoreline).

G. Existing covenants, easements, restrictions. (If State lands, indicate present encumbrances).

H. Historic sites affected. (If applicable, attach map and descriptions).

II. Description: Describe the activity proposed, its purpose and all operations to be conducted.

I. Commencement Date: May 1983

Completion Date: May 1986

V. Environmental Requirements

Pursuant to Chapter 343, Hawaii Revised Statutes, and in accordance with Section 1:30b of the EIS Regulations for applicant actions, an Environmental Assessment of the proposed use must be attached. The Environmental Assessment shall include, but not be limited to the following:

A. Identification of application;

B. Description of proposed use and statement of objectives;

C. Description of affected environment, including appropriate maps and plans to show location, topography, site improvements, existing utilities and vegetation and archaeological/historical sites, if any. (See Page 3, Section I).

D. General description of the technical, economic, social and environmental characteristics of the proposed use.

E: The Environmental Assessment may be submitted in lieu of the information required above.

INFORMATION REQUIRED FOR CONDITIONAL USE ONLY

I. Plans: (All plans should include north arrow and graphic scale).

A. Area Plan: Area plan should include but not be limited to relationship of proposed uses to existing and future uses in abutting parcels; identification of major existing facilities; names and addresses of adjacent property owners.

B. Site Plan: Site plan (maps) should include, but not be limited to, dimensions and shape of lot; metes and bounds, including easements and their use; existing features, including vegetation, water area, roads, and utilities.

C. Construction Plan: Construction plans should include, but not be limited to, existing and proposed changes in contours; all buildings and structures with indicated use and critical dimensions (including floor plans); open space and recreation areas; landscaping, including buffers; roadways, including widths; offstreet parking area; existing and proposed drainage; proposed utilities and other improvements; revegetation plans; drainage plans including erosion sedimentation controls; and grading, trenching, filling, dredging or soil disposal plans.

D. Maintenance Plans: For all uses involving power transmission, fuel lines, drainage systems, unmanned communication facilities and roadways not maintained by a public agency, plans for maintenance shall be included.

E. Management Plans: For any appropriative use of animal, plant, or mineral resources, management plans are required.

F. Historic or Archaeological Site Plan: Where there exists historic or archaeological sites on the State or Federal Register, a plan must be submitted including a survey of the site(s); significant features; protection, salvage, or restoration plans.

II. Subzone Objective: Demonstrate that the intended use is consistent with the objective of the subject Conservation District subzone (as stated in Chapter 2).

I. Description of Parcel

A. Existing Structures/Use

Figure 1 illustrates the location of the proposed site at approximately the 13,360 foot elevation within the Mauna Kea Science Reserve. The .75 acre site, which is at the foot of Puu Poliahu, is empty and undeveloped.

The site is located in the Resource subzone. The objective of this subzone is to develop, with proper management, areas to ensure sustained use of the natural resources of those areas. The Mauna Kea Science Reserve, within which the proposed use will be located, was established as a "scientific complex, including without limitation thereof an observatory" in recognition of its outstanding astronomical attributes.

The proposed Caltech telescope will, in adding to the research capabilities of the Mauna Kea Observatory, fulfill the goals of the Resource subzone by utilizing the excellent astronomical resources that Mauna Kea possesses. These resources and their importance to submillimeter research are discussed on pages 18 through 21 and pages 28 and 29 in the attached draft EIS.

B. Existing Utilities

No utilities directly serve the site. The generator used for power needs at the summit is approximately 1300 ft. south of Caltech's proposed site. Two 12 KV underground power lines run from the generator to the summit cinder cone. The power is distributed through underground conduits to the existing facilities. The microwave antenna which provides telephone communication to the summit is located on the UH 88-inch telescope facility. Water must be trucked to the summit from Hilo. Each telescope has its own water storage tank. Each of the four large existing telescopes has its own septic tank. Solid waste is carried down to Hale Pohaku by telescope personnel. A more detailed description of the existing utilities can be found on page 51 of the attached draft EIS.

C. Existing Access

Access to the summit of Mauna Kea is from Saddle Road, Route 20, which connects Hilo to Mamalahoa Highway, Route 19. From Saddle Road at Puu Huluhulu, a paved road extends approximately six miles to Hale Pohaku. From there, an 8.5 mile unpaved one-lane road extends to the summit. Figure 1 shows the roads within the Science Reserve. Caltech's proposed site is adjacent to an unpaved road.

D. Vegetation

There are no officially designated endangered plant species on the summit. Photographs of the proposed site indicate that the area is a likely site for lichens and bryophytes, the principal components of flora at the summit. The project site is not suitable for higher plant life such as ferns or seed bearing plants. The attached draft EIS describes some potential impacts of locating a telescope on the site and prposes some measures to mitigate them.

E. Topography

The topography of the site is relatively flat. Figure 2.

F. If shoreline area - N/A

G. Existing covenants, easements, restriction

See attached Lease S-4191.

H. Historic sites affected

Dr. Patrick McCoy, Bishop Museum anthropologist, has been retained by Caltech to conduct a reconnaissance survey of the site.

Because of the snow pack, which to date still covers the site, he has been unable to complete his field research. A survey will be completed prior to approval of the CDUA. Dr. McCoy is fairly certain that there are no archaeological sites at Caltech's site. (Appendix E, attached draft EIS)

II. Description

Operations to be conducted:

Construction: Although the .75 acre site selected for this telescope is essentially level, some grading and excavating will be necessary to prepare the area for construction. A minimal foundation will be required, since the telescope and dome are relatively light (total building and telescope weight will be less than 250 tons).

Approximately 100 cubic yards will have to be excavated for concrete footing, foundations, an 850 gallon septic tank, housing for the 25 KW standby generator and 1,000 gallon fuel tank, and a 1,000 - 1,500 gallon water tank. Most of the excavated material will be used as fill or for balancing the site. Additional excavation will be done for installation of the telephone and power lines. The existing utility trench and 1,300 linear feet of a new trench from the generator to the Caltech site will have to be excavated for telephone and power lines.

One hundred fifty yards of concrete will be used in the construction of the facility. No concrete batch plant will be required. Dry mix concrete will be trucked to the summit in mixing trucks and water will be added at the site. Approximately thirty truck loads will be required.

Construction equipment, vehicles, and materials, a temporary construction field office and an auxiliary generator will be stored on-site during construction and will be removed upon completion of the construction phase. Outdoor sanitary facilities will be used during the construction phase. Power will be provided by the on-site auxiliary generator.

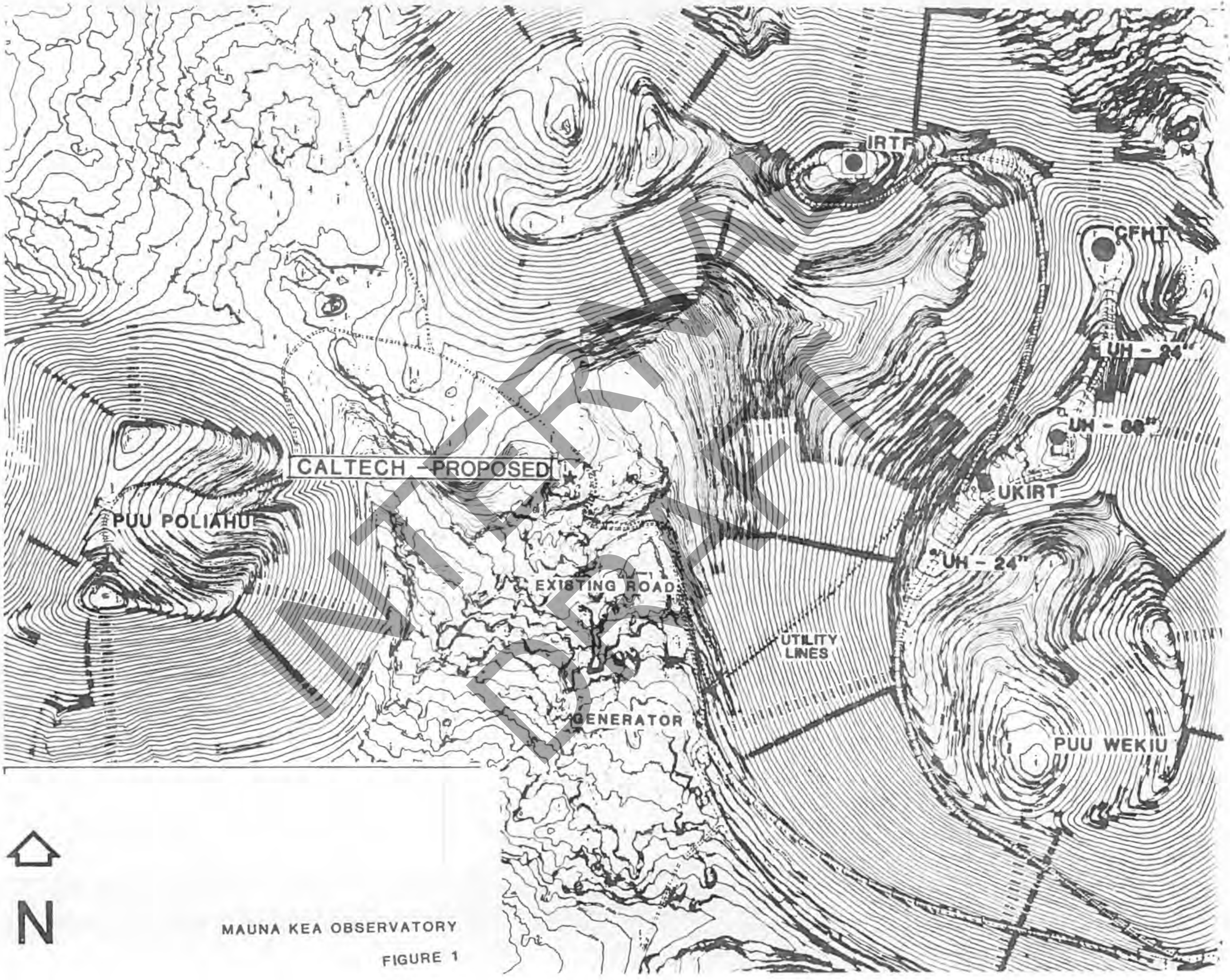
Operations: It is estimated that when the telescope becomes operational an average of five to seven persons will be present on the mountain at one time, operating in two shifts per day at the telescope site. The additional personnel are expected to generate an additional 1,100 - 1,500 gallons per month of liquid sewage, the consumption of 1,500 - 2,000 gallons per month of water for heating, cooling and domestic consumption, and the additional consumption of less than four gallons per hour of diesel fuel by the 850 KW generator.

The proposed telescope will be able to investigate the submillimeter portion of the electromagnetic spectrum. The development of an instrument capable of studying the submillimeter band has opened a whole new field of inquiry for astronomers. The telescope provides a new way to investigate the astronomical environment in regions inaccessible to optical methods. The attached draft EIS describes the scientific capabilities of the proposed telescope more fully.

III. Commencement Date: May 1983
     Completion Date: May 1986

IV. Environmental Requirements

EIS attached



MAUNA KEA OBSERVATORY

FIGURE 1

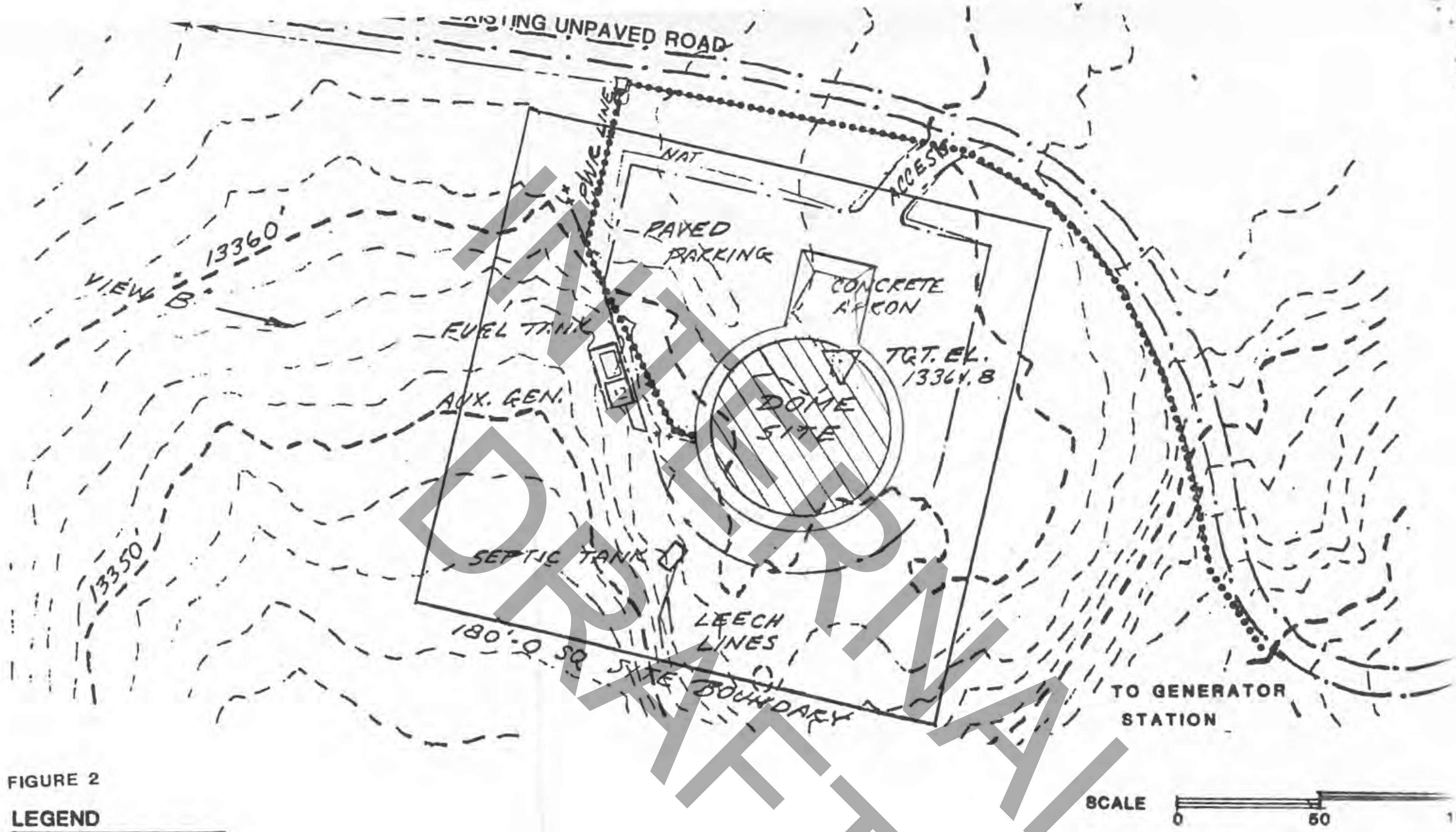
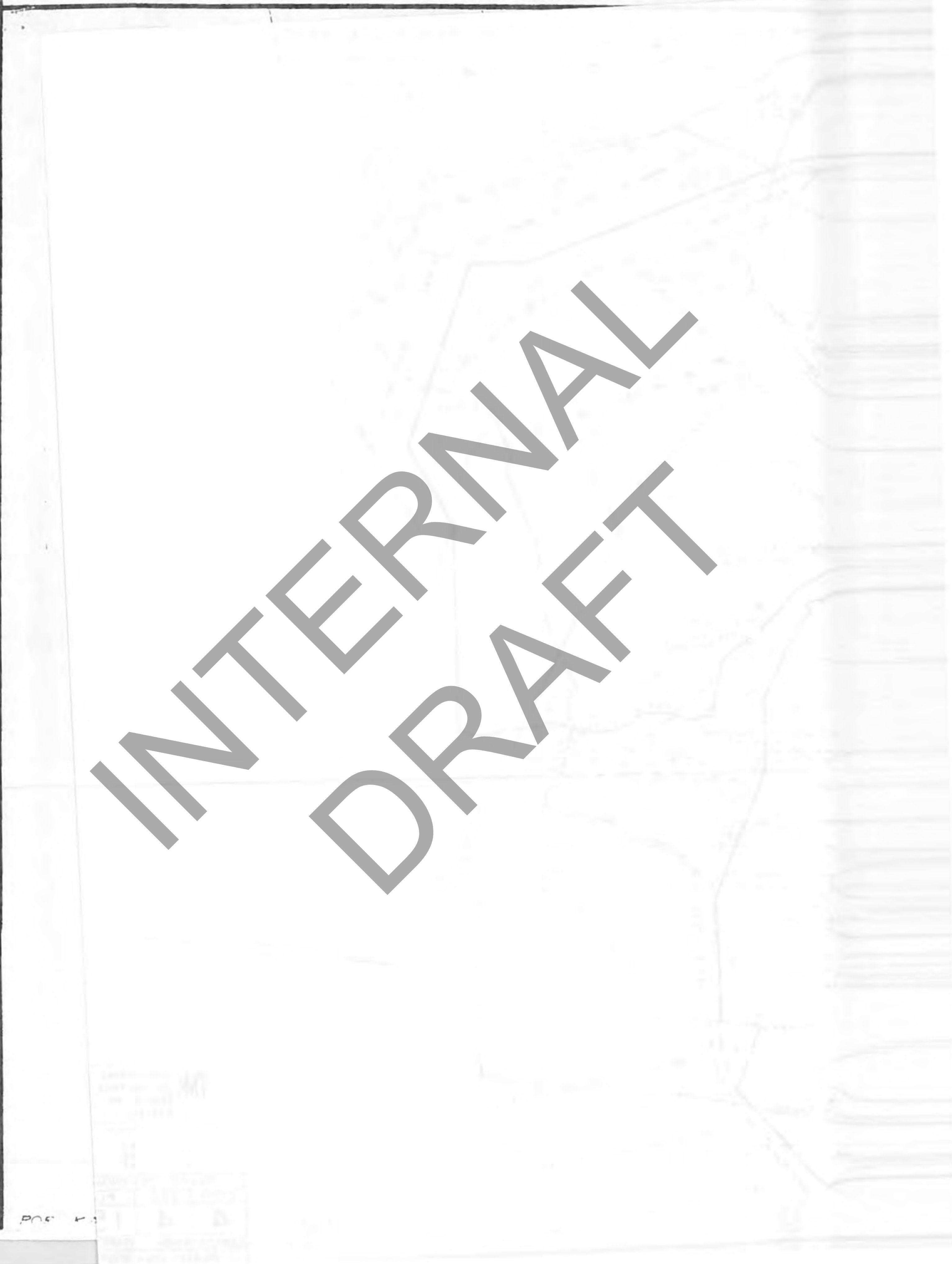


FIGURE 2

LEGEND

.... UTILITY LINES



Source: Survey Office & Tax Maps Bureau
By D.K. & F.P. May 1955

CALIFORNIA INSTITUTE OF TECHNOLOGY
DIVISION OF PHYSICS, MATHEMATICS, AND ASTRONOMY
MAIL CODE 367-17, 1200 E. CALIFORNIA BOULEVARD, PASADENA, CA 91125
EMAIL: GOLWALA@CALTECH.EDU; VOICE: 626-395-8003; FAX: 626-395-2366

March 22, 2016

Office of Mauna Kea Management
Attn: Stephanie Nagata, Director
640 N. Aʻohōkū Place, Room 203

Re: Notice of Intent to Decommission
Caltech Submillimeter Observatory
Site Survey

Dear Ms. Nagata,

On November 18, 2015, the Provost of the California Institute of Technology submitted to your office a Notice of Intent to Decommission the Caltech Submillimeter Observatory located on Maunakea, in accordance with the *Decommissioning Plan for the Mauna Kea Observatories*, a sub-plan of the *Mauna Kea Comprehensive Management Plan*.

We hereby submit, as an addendum to the above Notice of Intent, an updated site plan, as required by the *Decommissioning Plan*. The development of the site plan was undertaken on behalf of Caltech by dlb & Associates, Keaʻau, HI 96749, in cooperation with our staff. In addition to the survey data acquired by this firm, the site plan incorporates historical data provided by CSO. The updated site plan is included as an attachment to this letter. An electronic version (include a .DWG file of the site plan) will be transmitted electronically to your office.

Sincerely,

Sunil Golwala
Professor of Physics
California Institute of Technology
Director, Caltech Submillimeter Observatory

dlb & Associates
LAND SURVEYING • MAPPING • CONSULTING

Daniel L. Berg, PLS11245
Ph: 808-966-4206 Email: info@dlbandassoc.com
Fax: 808-982-6830 Web: www.dlbandassoc.com
P.O. Box 49-2281, Kea'au, HI 96749

Report

March 1, 2016

To: California Institute of Technology
Purchasing Services, Attn. Sheri Stoll
1200 E. California Blvd.
Mail Code 103-6
Pasadena, CA. 91125

Caltech Subm. Observatory
Attn.: Simon Radford
111 Nowelo St.
Hilo, HI., 96720

Re: **Caltech Submillimeter Observatory**
TMK (3) 4-4-015:009 (portion)
Mauna Kea Science Reserve,
Kaohe, Hamakua, Island & Co. of Hawaii, Hawaii

This report summarizes methods of topographic survey completed November 24 2015 at Caltech Submillimeter Observatory at Mauna Kea summit.

Methods

Office preparation consisted of delivery of historical construction plans (dated Feb., 1983) and a lease area diagram. The original lease boundary appears to be referenced to NAD27, Hawaii State Plane coordinates, which was superseded by NAD83 projection.

The current topographic survey used static GPS observations at a control point near the site (station 101) to establish coordinates. Observations to CORS stations yields coordinate value on NAD 83, Hawaii State Plane Zone 1 (PA11) 2010.00 Epoch. This is the reference frame. GPS vectors were processed using NGS OPUS service. CORS stations used are:

1. Mauna Kea CORS ARP (PID: DE6589)
2. Mauna Loa Observ CORS (PID: DG9765)
3. Honolulu WAAS1 CORS ARP (PID: DF8972)

Geographic coordinates and residuals ( ) at control station 101 are:
Lat. N 19°49'22.27469" (0.010 m); Lon. W 155°28'31.20801" (0.027 m); Elev. 4075.299m (0.064 M)

Finally, Lat./Lon. were converted to North/East grid plane coordinates in US Survey Feet units.

Topographic survey data was acquired using GPS RTK methods in an assumed Hawaii state plan projection. The data was translated to the CORS derived coordinates at Sta. 101 and expanded from grid (raw meas.) to ground. Therefore the only true state plane coord value is at Sta. 101.

Diligent search of lease boundary evidence yielded only 1 found monument. The lease area was inserted at this location, oriented to grid azimuth. Contouring/drafting was completed in CAD software. Electronic files delivered to Simon Radford at the Hilo office of CSO

dlb & Associates
LAND SURVEYING • MAPPING • CONSULTING

Daniel L. Berg, PLS11245
Ph: 808-966-4206 Email: info@dlbandassoc.com
Fax: 808-982-6830 Web: www.dlbandassoc.com
P.O. Box 49-2281, Kea'au, HI 96749

Archived Plans

As above, historical construction plans (dated Feb., 1983) were provided to this office. At request of CalTech, certain underground utilities were included as a revision February 2016.

Image files were inserted into cad, aligned to observatory footprint or lease boundary, and digitally traced. Following features were included:

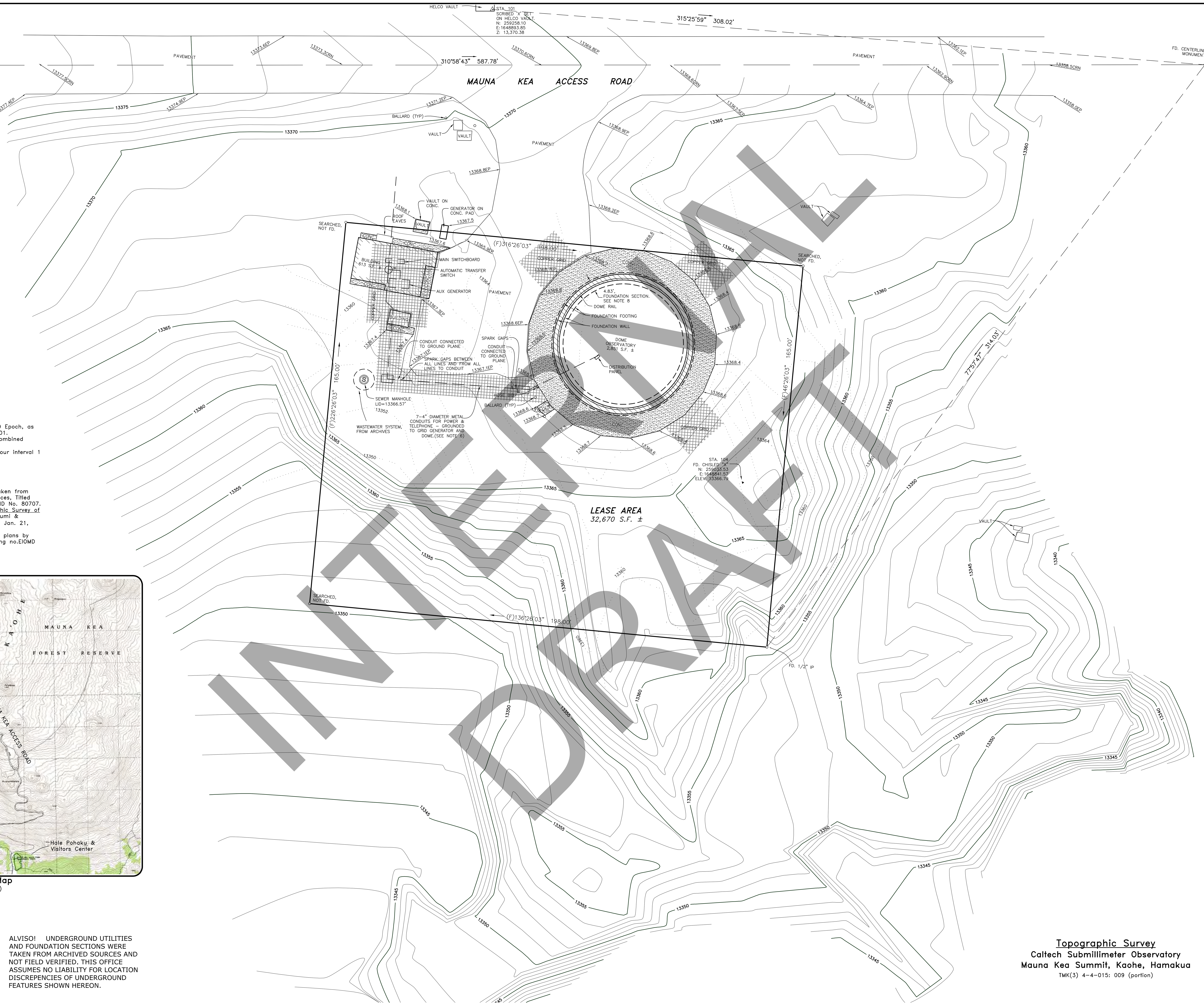
- Underground electrical conduit, power distribution panel, underground copper ground grid were taken from plans entitled Grounding and Power Distribution Diagram. Code id 80707 Being a diagram, exact location may not follow the alignment shown on the plans. No dimensions are specified for these features. (Note 6 on topo survey.)
- Preconstruction contors were taken from a topographic survey by Austin, Tsutsumi & Associates, dated Jan. 21, 1983 (Job No. 0-83-125-0-83-153.) The rastor pdf is of poor quality, but contours were traced as best possible. Contour interval varies. The Austin Tsutsumi plan includes breaklines and spot elevations. The correct method to produce the original surface is to digitize breaklines and spot elevations and create a 1983 era TIN model. Such a task is beyond the scope of this survey. (Note 7 on topo survey.)
- The observatory structural foundation and rail was taken from Foundation Plans and Detail, Submillimeter Observatory, drawing no. EIOMD S2 dated 12/5/83. The foundation wall was measured at exterior. Detail 1/S2 and 3/S2 per plans indicate a foundation thickness up to 4.83 ft. (4'10") and 5 ft. below grade. These values were not field verified. (Note 8 on topo survey.)

Underground features were taken from archived sources provided by others. Field verification by potholing or probing was not a part of the scope of work and not conducted. dlb and associates assumes no liability for variance of location, depth or material of underground features shown on the revised topographic survey dated February 29, 2016.

This report was prepared by
me or under my direction.

____

Daniel L. Berg
PLS 11245 (HI)



0' 20' 40'

SCALE IN FEET

LEGEND

PROPERTY MONUMENT AS DESCRIBED.

BUILDING FOOTPRINT

ROOF EAVES

CONCRETE SURFACE

AC PAVEMENT

UNDERGROUND COPPER GRID. (SEE NOTE 6.)

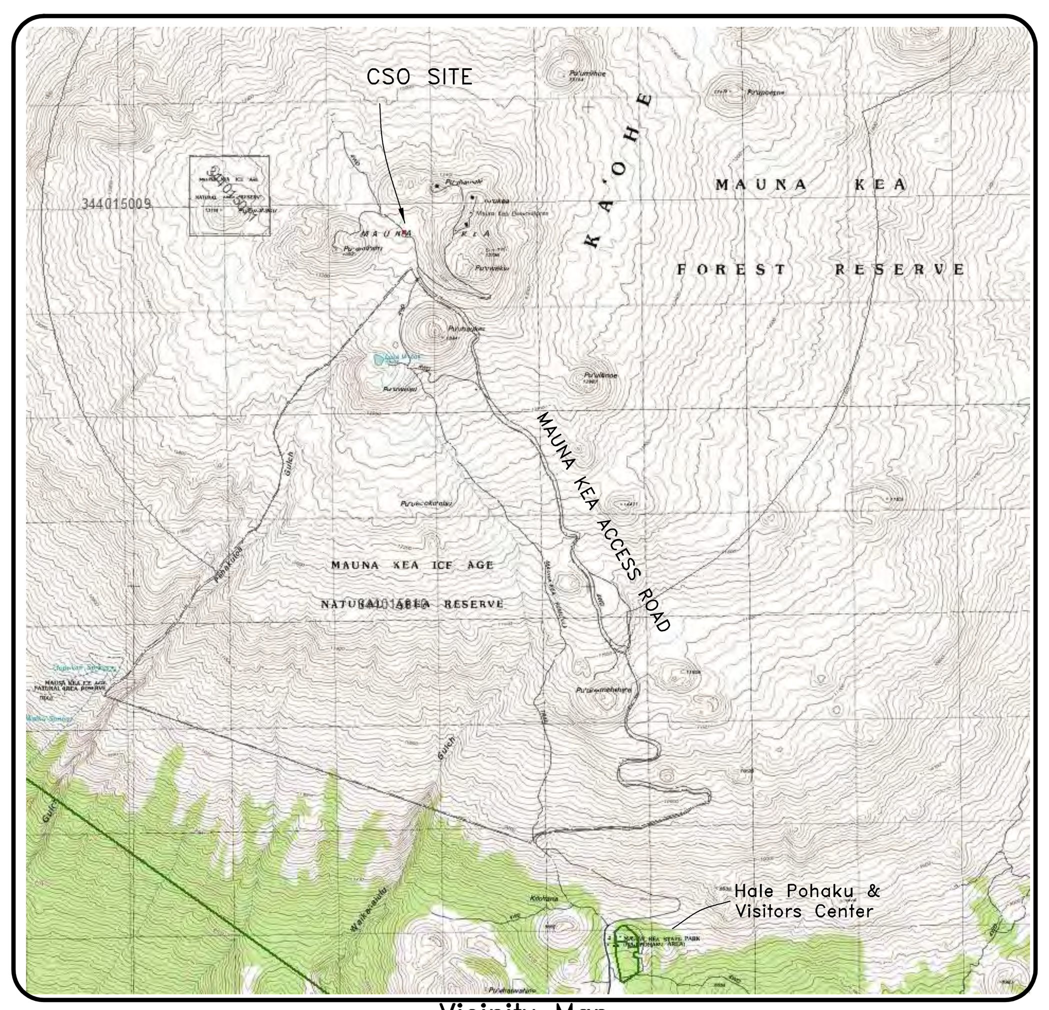
13345 EXISTING CONTOURS. (SEE NOTE 4.)

13360 PRE-CONSTRUCTION CONTOURS, DIGITIZED FROM ARCHIVED PLANS. (SEE NOTE 7.)

CRN CROWN OF ROAD
EP EDGE OF PAVEMENT
TYP TYPICAL

NOTES:

1. Field survey completed November 24, 2015.
2. Coordinates referenced to NAD83 (PA11) 2010.000 Epoch, as derived from static GPS observations at station 101.
3. Distances are ground. To reduce to grid use a combined factor (CF) of 0.99932244 (Grid=Grnd x CF)
4. Elevations referenced to Hawaii Tidal Datum. Contour interval 1 ft.
5. CORS control stations used:
   MKEA Mauna Kea Cors ARP (PID: DE6589)
   MLO1 Mauna Loa Observ Cors (PID: DG9765)
   ZHN1 Honolulu WAAS1 Cors ARP (PID: DF8972)
6. Underground conduit and electrical copper grid taken from design plans by CalTech Central Engineering Services, Titled Grounding and Power Distribution Diagram, Code ID No. 80707.
7. Preconstruction countours digitized from Topographic Survey of CalTech Submillimeter Observatory by Austin Tsutsumi & Associates,(Job No. 0-83-125-0-83-153) dated Jan. 21, 1983.
8. Observatory Foundation section taken from design plans by CalTech Foundation Plans and Detail, SMO drawing no.EIOMD S2, dated 12/5/83.



Vicinity Map
(No Scale)

REVISION NOTES

2/29/16	ADD PRE-CONST. CONTOUR MAPPING
2/29/16	ADD ELEC. GRND.& POWER FROM PLANS
2/29/16	ADD FOUNDATION SECTION PER PLANS

Date: December 01, 2015
Project: J2015-208

ALVISO! UNDERGROUND UTILITIES AND FOUNDATION SECTIONS WERE TAKEN FROM ARCHIVED SOURCES AND NOT FIELD VERIFIED. THIS OFFICE ASSUMES NO LIABILITY FOR LOCATION DISCREPENCIES OF UNDERGROUND FEATURES SHOWN HEREON.

Topographic Survey
Caltech Submillimeter Observatory
Mauna Kea Summit, Kaohe, Hamakua
TMK(3) 4-4-015: 009 (portion)

This work was prepared by me or under my direct supervision.

Daniel L. Berg
PLS 11245

dlb & Associates
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www.dlbandassoc.com

24X36L

DAVID Y. IGE
GOVERNOR OF HAWAII

SUZANNE D. CASE
CHAIRPERSON
BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

KEKOA KALUHIWA
FIRST DEPUTY

JEFFREY T. PEARSON
ACTING 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

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
OFFICE OF CONSERVATION AND COASTAL LANDS
POST OFFICE BOX 621
HONOLULU, HAWAII 96809

REF: OCCL: MC

Correspondence HA-16-118
FEB 19 2016

Stephanie Nagata
Director, Office of Mauna Kea Management
640 N. Aohoku Place
Hilo, HI 96720

SUBJECT: **NOTICE OF INTENT TO DECOMMISSION**
Caltech Submillimeter Observatory
University of Hawai'i at Hilo Hoku Kea Telescope
Mauna Kea Science Reserve, Ka`ohe Mauka, Hāmakua District, Hawai`i
TMK (3) 4-4-015:009

The Department of Land and Natural Resources (DLNR) Office of Conservation and Coastal Lands (OCCL) has reviewed the Notices of Intent to Decommission the Caltech Submillimeter Observatory and the University of Hawai'i at Hilo Hoku Kea Telescope, both in the Mauna Kea Science Reserve.

Pursuant to the Decommissioning Plan, a subplan of the Mauna Kea Comprehensive Management Plan, the decommissioning of an astronomy facility in the Science Reserve is a multi-step process involving 1) a Notice of Intent, 2) an environmental due diligence review, 3) a Site Deconstruction and Removal Plan, 4) a Site Restoration Plan, and, if necessary, 5) a Remedial Action Plan.

Both Notices of Intent appear to be in compliance with the requirements of the Decommissioning Plan. The next steps will be the preparation of an environmental assessment and a Conservation District Use Application (CDUA) for each of the proposals. The environmental assessment should discuss the preferred alternatives for the deconstruction and removal of the facilities, and the restoration plan for the sites.

The environmental assessment and the CDUA can be processed simultaneously by our office. At the end of the 180-day review process, dated from acceptance of the CDUA and draft EA for processing, our office will present our analysis and recommendations to the Board of Land and Natural Resources. The Board will have the final authority to approve, modify, or deny the permit.

If you have any questions please contact Michael Cain at (808) 587-0048.

Sincerely,

Samuel J. Lemmo, Administrator
Office of Conservation and Coastal Lands

copy: Chair; Hawai'i Board member; Hawai'i Land Division; Hawai'i County Planning Department

University of Hawai‘i at Hilo
640 N. A‘ohoku Place, Room 203, Hilo, Hawai‘i 96720
Telephone: (808) 933-0734 Fax: (808) 933-3208
Mailing Address: 200 W. Kawili Street, Hilo, Hawai‘i 96720

Minutes
Regular Meeting

Mauna Kea Management Board
Wednesday, May 11 2016

Kukahau‘ula, Room 131
640 N. A'ohoku Place
Hilo, Hawaii 96720

Attending MKMB:	Chair Gregory Mooers, 1st Vice Chair Hannah Kihalani Springer, 2nd Vice Chair/Secretary Gregory Chun, Roger Imoto, Herring Kalua and Douglas Simons
BOR:	Wayne Higaki and Barry Mizuno
Kahu Kū Mauna:	Shane Palacat-Nelsen
OMKM:	Wally Ishibashi, Fritz Klasner, Stephanie Nagata, Scotty Paiva, Dawn Pamarang, Lukela Ruddle, Amber Stillman, Sage Van Kralingen, Darcy Yogi and Joy Yoshina
Others:	Mark Chun, John Coney, Kathy Cooksey, Jesse Eiben, Sunil Golwala, N. Gonsalves, Saeko Hayashi, Clyde Higashi, Stewart Hunter, Patrick Kahawaiola‘a, Paula Kekahuna, David Lonborg, Wendy Light, R. Pierre Martin, Warren Matsumoto, John McBride, Shirley Pedro, John Roberts, Marianne Takamiya, Barry Taniguchi, Nicolette Thomas, Dwight Vicente, Keahi Warfield, Ross Wilson Jr., and Dwayne Yoshina

I. CALL TO ORDER
Chair Mooers called the meeting of the Mauna Kea Management Board (MKMB) to order at 10:00 a.m.

II. APPROVAL OF MINUTES
Upon motion by Kihalani Springer and seconded by Greg Chun the minutes of the March 9, 2016, meeting of the MKMB were unanimously approved.

III. DIRECTOR'S REPORT
A. Thirty-Meter Telescope (TMT) Contested Case
On May 6th the Board of Land and Natural Resources (BLNR) denied the petitioners' request to have Judge Riki May Amano disqualified as the hearing officer for the TMT contested case because of her family membership in the ‘Imiloa Astronomy Center. The BLNR found that “under applicable legal standards, a reasonable person knowing all the facts would not doubt the impartiality of Judge Amano.” Based on case law, a hearing officer is entitled to a “presumption of honesty and integrity,” and in the case of Judge Amano, that presumption remains in tack. The BLNR also denied the petitioner's objections to the selection process which they believed was improper. The BLNR provided a full discussion that the process they followed was legally sound.

A pre-hearing conference has been set for Monday, May 16 on Oahu. The purpose of this conference is to discuss: 1) the record; 2) the parties; 3) anticipated prehearing motions; 4) motions hearing(s) schedule; and 5) other procedural and logistical matters.

- Review and provide feedback on Site Deconstruction and Removal Plan and Site Restoration Plan
- Suggested Participants:
  - Decommissioning Facility
  - Landscape Architect
  - Engineer
  - Planner
  - Environmental Consultant
  - Kahu Kū Mauna
  - Environment Committee
  - Maunakea Management Board
  - Institute for Astronomy
  - OMKM

F. Caltech Submillimeter Observatory (CSO) Notice of Intent to Decommission

The Caltech Submillimeter Observatory is requesting approval of their Notice of Intent (NOI) to decommission their telescope. Pursuant to the 2009 Comprehensive Management Plan (CMP) and the 2010 Decommissioning Plan (DP), CSO submitted their NOI to decommission in November 2015. CSO began operating in 1986 and ceased operations in 2015. They first announced their intent to decommission back in 2009.

<u>Purpose</u>

The purpose of the NOI is to notify UH of an observatory's intention to: 1) propose whether their site will be removed; 2) continue use of the observatory by a third party, or 3) retrofit the facility for a different use. The NOI should contain the following:

1. Intentions for site restoration.
2. Site description summarizing of the overall condition and land use, including a description of all structures, equipment and other appurtenances.
3. Site plan(s) drawn to scale showing all existing structures, above and below grade.
4. Available historical information on the development, operation, and use of the site.
5. A description of the pre-construction condition of the site based on available information.
6. Site restoration will be based on pre-construction, topographic condition prior to construction of the observatory.

<u>Proposed Activities</u>

CSO's intent is to remove the observatory and restore the site (as opposed to transferring the site to a 3rd party or retrofit the facility for a different use). CSO intends to:

1. Remove all above ground structures, all surface infrastructure, all conduits and sewer lines, and the top six inches of concrete and asphalt.
2. Backfill the cesspool with native material.
3. Restore the ground by grading the site to approximate pre-construction topography and leave a visual appearance consistent with the original condition.

CSO's NOI contained a site description including a list of the structures and improvements, historical documents, a scaled site layout and grading plan and foundation drawing, and photographs depicting the site prior to construction. CSO recognizes their proposed actions may likely undergo modification to address concerns raised by Kahu Kū Mauna and others during the decommissioning review process.

The CSO started their environmental due diligence process and have all but completed Phase 1. They had a hydraulic oil spill that was identified in early 2000 which constitutes a potential recognized condition and they will need to go to Phase 2.

<u>Kahu Kū Mauna</u>

Kahu Kū Mauna Council was consulted on April 12, 2016. The Council requested that OMKM and CSO proceed with preparation of the Site Deconstruction Plan assuming a starting point of complete infrastructure removal and full restoration, reaffirming the stated DP expectation. OMKM and CSO concur and subsequent documents will be prepared accordingly while complying with the DP and Environmental Assessment requirements to identify alternatives that include infrastructure capping and minimal or moderate restoration levels. Decisions regarding removal and restoration options will be made after consultation with the Council and submittal to the Board.

The Council questioned when doing the cost benefit analysis if economics or money would trump culture. Kahu Kū Mauna also expressed their appreciation to CSO for providing a detailed proposal.

Maunakea Environment Committee
The Environment Committee chose to submit comments on an individual basis, rather than reviewing the NOI as a committee. The Committee requested that the NOI be made publicly available. The Committee remains interested in consulting on details regarding environmental due diligence along with alternatives and choices associated with infrastructure removal and site restoration.

Dr. Jesse Eiben summarized his written testimony urging the Board to consider the total impacts of ecological effects of construction (including decommissioning) and not just single projects. Also make sure it is clear that the two telescope sites are not likely to be ideal restoration sites for endemic arthropods, especially the wēkiu bug. Lastly, to his knowledge, there has not been public justification to the Board, or from the Board, or from the Governor's Office concerning why or how accelerating three telescope decommissioning processes and potentially changing management of 10,000 acres from OMKM to the DLNR Department of Forestry and Wildlife (DOFAW) is to be handled to ensure continued high quality and accountable environmental stewardship of alpine stone desert of Maunakea.

Department of Land and Natural Resources
The Department of Land and Natural Resources, Office of Conservation and Coastal Lands (OCCL) indicated that an Environmental Assessment (EA) should be prepared along with completion of the Site Decommissioning Plan and that a CDUP will be required.

Comprehensive Management Plan Compliance
The decommissioning process is detailed in the 2010 Decommissioning Plan for the Maunakea Observatories, a sub-plan to the 2009 Maunakea Comprehensive Management Plan. The OMKM and Caltech are committed to implementing the decommissioning process in accordance with these plans. Should the Board approve the NOI, OMKM will work with Caltech to establish a "Decommissioning Advisory Committee" to help guide preparation of the Site Deconstruction and Removal Plan, Site Restoration Plan, and Environmental Assessment. This committee would include subject matter experts in fields such as construction management (i.e. civil engineering) and landscape architecture, planning, environmental consulting as well as representation from the Kahu Kū Mauna Council, the Environment Committee, and the Maunakea Management Board.

Recommendation
Approval of CSO's NOI is recommended. CSO has fulfilled the content requirements of the NOI, including existing historical documents. Should the Board approve the NOI, OMKM will work with Caltech to conduct the Environmental Due Diligence review for submittal to the Board for approval and establish the Decommissioning Advisory Committee to advise on preparing a Site Decommissioning Plan and Environmental Assessment.

Discussion
Chair Mooers stated the critical decision here is to see if CSO reviewed their three options and if this is the appropriate action to take. He believes CSO has evaluated all their options and that this is the appropriate course of action for them.

Ms. Springer commented since CSO indicated their intent as far back as 2009, it seems as though they have been moving progressively and deliberately towards this NOI.

Dr. Simons stated they have seen this coming for years and the need to decommission it is mostly driven by the lack of finances. CSO has been a state-of-the-art telescope. There simply is not enough money to keep it afloat and now is the time, as they have hinted for years, to remove the facility. From his perspective within the observatory community, CSO has met the requirements of the NOI and people should understand that when you lack the resources to run these facilities it is a natural consequence to take it down.

Dr. Chun stated relative to this particular matter, he does not see any public submission questioning its decommissioning, or removal, or any desire to take over. He assumes that at some level that conversation has been thought through by different people. He did want to go back to Dr. Eiben's testimony because somewhere in this process, and it may not be during the NOI step, we have to be thinking about the collective impact of decommissioning. He is not sure where in the process this would fit.

Chair Mooers commented that during Chapter 343, the portion that talks about cumulative impacts when doing the environmental analysis would be the opportunity to review cumulative impacts in conjunction with Chapter 343.

Sunil Golwala, CSO director, stated the issue of total impact is one of the things that will be considered and discussed in future plans for submittal. We need to consider not just the impact of the removal of the observatory and the infrastructure, but impacts elsewhere on the mountain such as fill in holes in the foundation. There will be an analysis of different options to see what these total impacts are.

Ms. Springer asked about outreach to the community concerning the letters received. She felt a letter acknowledging receipt would be the standard operating procedure.

Action
It was moved by Doug Simons and seconded by Greg Chun to approve Caltech Submillimeter Observatory's Notice of Intent to decommission its telescope. The motion was carried unanimously.

G. Hoku Keʻa Telescope Notice of Intent to Decommission
The University of Hawaii at Hilo (UHH) is requesting approval of their Notice of Intent (NOI) to decommission its telescope. Pursuant to the 2009 Comprehensive Management Plan and the 2010 Decommissioning Plan, the UHH submitted its NOI to decommission in September 2015. Hoku Keʻa telescope is located in an observatory structure originally constructed in 1968, and renovated under a permit issues in 2007, for teaching and educational purposes.

Proposed Activities
UHH indicated in its NOI it intends to remove the observatory and restore the site (as opposed to transferring the site to a 3rd party or retrofit the facility for a different use). UHH intends to deconstruct and remove the telescope and observatory structure and restore the site according to a Site Deconstruction and Removal Plan and Site Restoration Plan, both of which will be developed and implemented in accordance with the DP. For documentation and site-specific detail, UHH references the 2006 Environmental Assessment and 2007 Conservation District Use Permit Application.

Kahu Kū Mauna
Kahu Kū Mauna Council was consulted on April 12, 2016. The Council noted that Hoku Keʻa's decommissioning NOI had very limited detail, especially compared to CSO's NOI, and thus the Council had no comments other than to reiterate their position that any decommissioning proceed with preparation of the Site Deconstruction Plan assuming a starting point of complete infrastructure removal and full restoration, reaffirming the stated DP expectation.

At the Council's meeting, three letters were submitted and given in-person. These were testimonies by members of the Native Hawaiian community stating their position against the decommissioning of the Hoku Kea and UKIRT telescopes. The Keaukaha Community Association and Panaʻewa Hawaiian Home Lands Community Association each submitted a letter expressing concern over the potential loss of on-mountain, site-specific education and training opportunities while expressing an interest to "adopt" Hoku Keʻa and UKIRT and continue to have the UHH operate the telescopes should UHH decide not to change their position on the decommissioning of both telescopes.

Keaukaha and Panaʻewa communities together are effectively acting as a third party by 'adopting' Hoku Keʻa as a demonstration of their support and commitment to the educational and work force opportunities provided by Maunakea astronomy. The third letter was from an individual also expressing similar concerns over the loss of on-mountain, site-specific education and training for local, especially Native Hawaiian, students.

Maunakea Environment Committee
Dr. Eiben's written testimony and comments also apply to Hoku Keʻa's decommissioning. Written testimony was also received by Ms. Heather Kaluna. In summary she urges to not remove the telescope and references the governor's press release from May 2015 and the political implications with TMT. Her vision for Hoku Keʻa is that it can help serve as a bridge within the community and help broaden the base for support for as long as astronomy remains on the mountain.

Department of Land and Natural Resources
The Department of Land and Natural Resources, Office of Conservation and Coastal Lands (OCCL) indicated that an Environmental Assessment should be prepared along with completion of the Site Decommissioning Plan and that a Board of Land and Natural Resources issued CDUP will be required.

Comprehensive Management Plan Compliance
The decommissioning process is detailed in the 2010 Decommissioning Plan for the Maunakea Observatories, a sub-plan to the 2009 Maunakea Comprehensive Management Plan.

OMKM
Office of Mauna Kea Management

University of Hawai'i at Hilo
640 N. A'ohoku Place, Room 203, Hilo, Hawai'i 96720
Telephone (808) 933-0734 Facsimile (808) 933-3208
Mailing Address: 200 W. Kawili Street, Hilo, Hawai'i 96720

MEMORANDUM

December 20, 2019

TO: David Lassner
President

VIA: Bonnie Irwin
Chancellor, UH Hilo

FROM: Stephanie Nagata
Director

SUBJECT: Review and Approval of Caltech Submillimeter Observatory's (CSO): *Notice of Intent to Decommission*, *Phase I Environmental Site Assessment*, and *Asbestos, Lead Paint and Mold Survey Report*

I. Request

Your review and consideration for approval is requested of Caltech's Notice of Intent (NOI) to decommission, *Phase I Environmental Site Assessment* (ESA I) and *Asbestos, Lead Paint and Mold Survey Report* (Hazmat). Links to these documents are provided below.

II. Background

Pursuant to the Board of Land and Natural Resources approved 2010 Decommissioning Plan for the Mauna Kea Observatories (DP), various documents in an observatory decommissioning process shall be approved by the Maunakea Management Board (MKMB) followed by approval by the University of Hawai'i President. Among the documents requiring the President's approval are the NOI, and environmental due diligence reports, including ESA I and Hazmat.

The CSO's NOI was approved by the MKMB on May 11, 2016, following consultation with Kahu Kū Mauna on April 12, 2016.

The ESA I and Hazmat reports were approved by the MKMB on September 27, 2019. Kahu Kū Mauna was consulted on the ESA I and Hazmat on August 29, 2018 and May 16, 2019, respectively. Both of these documents are part of CSO's environmental due diligence. As described in the Phase I assessment, additional steps in the environmental due diligence process will include a Phase II Environmental Site Assessment which will be completed during the site deconstruction process. This is a State of Hawai'i, Department of Health requirement based on a hydraulic oil spill that occurred in 2009. Hazardous material abatement of lead paint and mold, will also be required during the facility deconstruction process.

Observatory decommissioning refers to a process that results in the *partial or total* removal of all structures associated with an observatory facility, and the restoration of the site, to the *greatest extent possible*, to its preconstruction condition. The DP defines *facility* as the physical structures existing on site at each observatory and *infrastructure* as non-facility structures, including all supporting structures beyond a facility footprint such as utility lines and roads, if common or shared.

The decommissioning process includes preparation of: 1) a Notice of Intent to decommission (NOI), 2) an environmental due diligence review, 3) an Environmental Assessment, and 4) a Conservation District Use Application including a Site Deconstruction and Removal Plan, a Site Restoration Plan, a funding plan, and if necessary a remedial action plan, with each of these steps approved by the MKMB and University of Hawai'i President. The Board of Land and Natural Resources will then be asked to approve a Conservation District Use Permit authorizing the implementation of an approved decommissioning plan.

The CMP and DP emphasize *community* involvement. To this end, various reviewers of decommissioning related materials shall include the Office of Maunakea Management, Kahu Kū Mauna, and the MKMB. In addition other community groups, including the MKMB Environment Committee, Decommissioning Review Committee, and a Decommissioning Working Group (comprised of university staff) also participate in the review process prior to submission of the documents to the Maunakea Management Board for its review and approval. OMKM is responsible for overall coordination of the decommissioning process as well as overseeing the deconstruction and site restoration process. OMKM also serves as the liaison with the Department of Land and Natural Resources' Office of Conservation and Coastal Lands.

The current focus in the CSO decommissioning process is the preparation of an Environmental Assessment in compliance with: Hawai'i Revised Statutes Chapter 343.

APPROVE / DISAPPROVE

Bonnie Irwin, Chancellor, UH Hilo

APPROVE / DISAPPROVE

David Lassner

David Lassner, President

Links

1. Notice of Intent:
   https://www.dropbox.com/s/fu6wtq037vtthqi/NOIwithDLNRapproval_2019-12-20.pdf?dl=0
2. Notice of Intent addendum:
   https://www.dropbox.com/s/28jso6m9d8l70bn/NOIaddendum_2019-12-20.pdf?dl=0
3. Due Diligence - Phase I Environmental Site Assessment:
   https://www.dropbox.com/s/4mwioesqk3tex7z/CSO-DueDiligence_Phase1_2019-12-20.pdf?dl=0
4. Due Diligence - Asbestos, Lead Paint and Mold Survey Report (aka HazMat):
   https://www.dropbox.com/s/cdhahbmekat0nlb/CSO-DueDiligence_HazMat_2019-12-20.pdf?dl=0

c: Sunil Golwala, Caltech
c: Greg Chun, Executive Director of Maunakea Stewardship

Appendix B. Phase I Environmental Site Assessment

CALIFORNIA INSTITUTE OF TECHNOLOGY
DIVISION OF PHYSICS, MATHEMATICS, AND ASTRONOMY
MAIL CODE 367-17, 1200 E. CALIFORNIA BOULEVARD, PASADENA, CA 91125
EMAIL: GOLWALA@CALTECH.EDU; VOICE: 626-395-8003; FAX: 626-395-2366

June 14, 2018

Office of Mauna Kea Management
Attn: Stephanie Nagata, Director
640 N. Aʻohōkū Place, Room 203

Re: Caltech Submillimeter Observatory Decommissioning
Phase I Environmental Site Assessment

Dear Ms. Nagata,

On November 18, 2015, the Provost of the California Institute of Technology submitted to your office a Notice of Intent to Decommission the Caltech Submillimeter Observatory located on Maunakea, in accordance with the *Decommissioning Plan for the Mauna Kea Observatories*, a sub-plan of the *Mauna Kea Comprehensive Management Plan*. I submitted on March 22, 2016, an addendum to this Notice of Intent, consisting of an updated site plan.

With this letter, we hereby undertake the next step in the decommissioning process by submitting, in compliance with the *Decommissioning Plan for the Mauna Kea Observatories*, a sub-plan of the *Mauna Kea Comprehensive Management Plan*, a Phase I Environmental Site Assessment. The assessment was undertaken by ENPRO Environmental, Kailau, HI 96734. The first page of the attachment includes a letter of clarification provided by ENPRO regarding Section 4.1.3 Geology/Hydrogeology and should be considered an integral piece of the report.

As you will note upon reading the report, the only significant issue identified in the Phase I Environmental Site Assessment is the possibility of remaining contamination due to the 2009 hydraulic oil spill and, possibly, a prior spill at an unknown prior date (perhaps during construction of the CSO). The report recommends a Phase II Environmental Site Assessment in connection to this spill, to be undertaken at a later point during decommissioning when the spill area is made fully accessible. The Phase II ESA may result in a recommendation for remediation.

Sincerely,

Sunil Golwala
Professor of Physics
California Institute of Technology
Director, Caltech Submillimeter Observatory

June 14, 2018

Sunil Golwala
California Institute of Technology
1200 East California Boulevard
Pasadena, California 91125

RE: Letter of Clarification
Phase I Environmental Site Assessment
Caltech Submillimeter Observatory
Mauna Kea Summit
Hawaii Island, Hawaii
ENPRO Project Number: 1512-00532-PHI

Dear Sunil Golwala,

This letter is to clarify ENPRO's March 21, 2016 Phase I Environmental Site Assessment report for the Caltech Submillimeter Observatory (CSO) at the Mauna Kea Summit on Hawaii Island, Hawaii, identified by TMK (3) 4-4-015: 009 (the "project site").

At the time the report was prepared, ENPRO Environmental (ENPRO) documented the general hydrology of the Waimea Aquifer System of the West Mauna Kea Aquifer Sector as described in Mink and Lau's 1993 *Aquifer Identification and Classification for the Island of Hawaii: Groundwater Protection Strategy for Hawaii*. While the West Mauna Kea Aquifer extends from the coastline to the summit of Mauna Kea, the Mink and Lau reference primarily describes groundwater production near the shore. The shallow, unconfined aquifer occurs approximately 10,000 feet below the summit of Mauna Kea.

At the request of California Institute of Technology, ENPRO has reviewed the following documents:

1. Leopold, M. et al. (2016), Subsurface Architecture of Two Tropical Alpine Desert Cinder Cones that Hold Water. *Journal of Geophysical Research.*

2. NASA (2005), Final Environmental Impact Statement for the Outrigger Telescopes Project, Volume I.

3. Schorghofer, N. et al (2017), State of High-Altitude Permafrost on Tropical Maunakea Volcano, Hawaii. *Permafrost and Periglac. Process.*

According to the documents reviewed, the nearest groundwater wells are in Waikii (State Well Numbers 5239-01 and 02), approximately 13 miles west of the project site. At the Mauna Kea summit, low-permeability dikes constitute a significant percentage of the entire rock mass, resulting in a significant reduction of overall effective permeability. Any groundwater compartments formed by intersecting dikes are very small and wells generally cannot be successfully developed in them.

None of the above documents alter the recommendations made by ENPRO in the Phase 1 Environmental Site Assessment dated March 21, 2016. However, the documents indicate that there is no shallow groundwater present at the CSO site.

Sincerely,

Kim Rottas
Environmental Professional

Prepared for:

California Institute of Technology
1200 East California Boulevard
Pasadena, California 91125

Phase I Environmental Site Assessment

Caltech Submillimeter Observatory

Mauna Kea Summit
Hawaii Island, Hawaii

Prepared by:

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ENPRO Environmental Contact:

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Environmental Technician
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ENPRO Project Number: 1512-00532-PH1
Date of Report: March 24, 2016
On-Site Investigation: January 6, 2016

PROJECT AT A GLANCE™

Assessment Component	Not Requested	Acceptable (†)	Routine Solution	Phase II ESA	Estimated Cost (‡)	Report Reference Section	
						Project Site	Adjoining Property
Historical Review		X					
Regulatory Review				**(1)***	**$15,000-$20,000**		
Operations		**X**					
Hazardous Materials			X				
Underground Storage Tanks		X					
Aboveground Storage Tanks		X					
Solid Waste		X					
Surface Areas							
Wells		(N/A)					
PCBs		X					
Asbestos	X						
Lead Based Paint	X						
Lead in Drinking Water	X						
Radon	X						
Mold	X						
Data Gaps						9.2	

***BOLD** = Identified issues. **Numbers [(1)] reference Action Items listed on the following page.**

(†) = Based on this preliminary study, it appears that further investigation in this area is not a priority concern for this site at the present time.

(‡) = Costs depicted are for investigation/program development activities. Remediation costs, if required, will be identified as a result of investigation/program development activities

Conditions noted in the Project at a Glance™ table represent the overall conditions of the property. More specific details on assessment components may be included in the text of this report; therefore the Project at a Glance™ should not be used as a stand-alone document.

ACTION ITEMS

Based on our investigation, ENPRO has concluded that there is sufficient risk to warrant additional action AND investigation. ENPRO has identified the following action items and makes the following recommendations:

(1) **Hydraulic oil release in May 2009 resulted in the excavation of contaminated soil beneath the slab of the observatory. Incidentally, additional contaminated backfill was discovered just below the slab. This contaminated backfill is believed to be the result of a previous incident occurring possibly during the construction of the observatory. Cleanup of the May 2009 hydraulic oil release has been completed to the satisfaction of the Department of Health. However, a *No Further Action* designation is pending additional investigation and cleanup to be undertaken when the observatory decommissions.**

ENPRO recommends multi-increment sampling of the soil at the project site and analysis for contaminants of potential concern associated with the hydraulic fluid release.

Further details regarding ENPRO's conclusions and recommendations may be found in Section 1.1 and section 9.0 of this report.

TABLE OF CONTENTS

1.0 Executive Summary

California Institute of Technology retained ENPRO Environmental (ENPRO) to conduct a Phase I Environmental Site Assessment of the Caltech Submillimeter Observatory located at the summit of Mauna Kea (the "project site"). The objective of this assessment was to provide an independent, professional opinion regarding *recognized environmental conditions* (RECs), as defined by the American Society for Testing and Materials (ASTM), associated with the project site.

This assessment was performed under the conditions of, and in accordance with ENPRO's Proposal Number 15K-0639-ITO dated November 30, 2015, the *ASTM E 1527-13, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process,* and *All Appropriate Inquiries* (AAI) which includes 40 CFR Part 312, §312.21 and §312.31. Any exceptions, additions to, or deletions from the ASTM or AAI practice, details of the work performed, sources of information, and findings are presented in the report. Limitations of the assessment are described in Sections 2.5 and 2.6.

The project site, currently owned by Department of Land and Natural Resources, is 0.75 acres.

The historical research presented in this report indicates that the project site was undeveloped land until 1985, when the property was developed into an observatory.

1.1 Findings and Conclusions

ASTM E-1527-13 defines three categories of *recognized environmental conditions (RECs)* which may impact the project site.

- A REC is defined as the presence or likely presence of any hazardous substance or petroleum product in, on, or at the property: 1) due to any release to the environment, 2) under conditions indicative of a release to the environment, or 3) under conditions that pose a material threat of a future release to the environment

- Historical RECs (H-RECs) are defined as a past release of any hazardous substance or petroleum product that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authorities or meeting *unrestricted* use criteria established by a regulatory authority, without subjecting the property to any required controls

- Controlled RECs (C-RECs) are defined as a REC resulting from a past release that has been addressed to the satisfaction of the applicable regulatory authority, with hazardous substances or petroleum products allowed to remain in place, subject to the implementation of required controls, such as property use restrictions, activity and use limitations (AULs), institutional controls, or engineering controls

Additionally, ASTM E-1527-13 allows for the identification of *de minimis conditions*. A *de minimis condition* is defined as a condition that generally does not represent a threat to human health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate government agencies.

We have performed a *Phase I Environmental Site Assessment* in conformance with the scope and limitations of ASTM Practice E 1527-13 of the Caltech Submillimeter Observatory near the summit of Mauna Kea, the *property*. Any exceptions to, or deletions from, this practice are described in Section 2.6 of this *report*.

This assessment has revealed no evidence of *recognized environmental conditions (RECs)* in connection with the *property* except for the following:

- REC 1 Hydraulic Fluid Release. This finding is considered a *recognized environmental condition* because, despite the release being cleaned up to the satisfaction of the Department of Health there is a *No Further Action* status pending further soil testing under the slab after the decommissioning of the observatory.

Recommendations for additional actions or investigations regarding the above findings are listed in Section 9.0.

The following *de minimis conditions* were identified at the project site:

- Minor oil leak within the dome of the observatory.

- Small drums containing contaminated glycol stored within the dome without secondary containment.

- Oil staining on the concrete slab at the base of the observatory.

- Used hydraulic oil drums without secondary containment

Recommendations for additional actions regarding the above *de minimis conditions* are listed in Section 10.0.

1.2 SIGNIFICANT DATA GAPS

A data gap is defined as a lack of, or inability to obtain, information required by the ASTM E 1527-13 despite good faith efforts by the environmental professional to gather such information. A data gap by itself is not inherently significant. The significance is determined by other information and professional experience as to whether the data gap raises reasonable concerns about activities that may present a *recognized environmental condition*. According to *ASTM E 1527-13, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, and *All Appropriate Inquiries* (AAI) which includes 40 CFR Part 312, §312.21 and §312.31, the Phase I Environmental Site Assessment report shall identify and comment on significant data gaps that affect the ability of the environmental professional to identify *recognized environmental conditions* and identify the sources of information that were consulted to address the data gap

The following significant data gap was encountered by ENPRO when conducting this Phase I ESA:

- Department of Health (DOH), Hazard Evaluation and Emergency Response (HEER) Office does not have any records regarding releases at the Caltech Submillimeter Observatory other than the hydraulic oil release of May 2009. It is believed that a release occurred during the construction of the observatory resulting in soil contamination. Without these records the type of contaminant, amount of contaminant released and extent of contamination cannot be determined.

1.3 CONTINUED VIABILITY STATEMENT

An Environmental Site Assessment meeting or exceeding the requirements of ASTM E 1527-13 and completed less than 180 days prior to the date of acquisition of the property, or (for transactions not involving an acquisition) the date of the intended transaction, is presumed to be valid. The period of validity may be extended to one year from the date of the investigation, provided that the following components of the inquiries are conducted or updated within 180 days of the date of purchase or the date of the intended transaction:

(i) *Interviews* with *owners, operators*, and *occupants*;

(ii) Searches for recorded environmental cleanup liens;

(iii) Reviews of federal, tribal, state, and local government records;

(iv) Visual inspections of the *property* and of *adjoining properties*; and

(v) The declaration by the *environmental professional* responsible for the assessment or update

2.0 Introduction

California Institute of Technology (the Client) retained ENPRO to conduct a Phase I Environmental Site Assessment of the Caltech Submillimeter Observatory near the summit of Mauna Kea, (the "project site").

2.1 Location and Legal Description

The project site, located near the summit of Mauna Kea, is in a conservation setting (Figures 1 and 2). The longitude and latitude for the project site address are in Table 1.

The project site is further described by the County of Hawaii Real Property Tax Office as Tax Map Key (3) 4-4-015: 009; a 0.75 acre portion. It is located in an area zoned "Conservation".

Table 1

Location and Legal Description of Project Site

Location Description	Project Site
Address	Mauna Kea Summit
TMK	(3) 4-4-015:009 ; a 0.75 acre portion
Latitude (North)	19.822500 - 19° 49' 21''
Longitude (West)	-155.475800 - 155° 28' 33''
Elevation	13,350 feet above sea level
Distance and Direction to Surface Waters	Pacific Ocean, 18.5 miles to northeast, Lake Waiau, approximately 1 mile to the south

2.2 Site and Vicinity General Characteristics

The project site is located near the north central part of the island of Hawaii. The project site included one rectangular-shaped parcel totaling approximately 0.75 acres. On-site structures were constructed over approximately fifty percent of the project site. Primary access to the site was from Mauna Kea Access Road, north of the project site.

2.3 PURPOSE

The objective of this environmental site assessment is to provide an independent, professional opinion regarding recognized environmental conditions, as defined by the American Society for Testing and Materials (*ASTM, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, Designation: E 1527-13*), associated with the project site. The term *recognized environmental condition* is defined as the presence or likely presence of any hazardous substances or petroleum products in, on, or at a property; 1) due to any release to the environment, 2) under conditions indicative of a release to the environment, or 3) under conditions that pose a material threat of a future release. The term includes hazardous substances or petroleum products even under conditions in compliance with laws. The term is not intended to include *de minimis* conditions that generally do not present a material risk of harm to public health or the environment and that generally would not be the subject of an enforcement action if brought to the attention of appropriate governmental agencies. A condition determined to be *de minimis* is not a *recognized environmental condition*.

Recognized environmental conditions (RECs) which have been subject to previous investigation to delineate the extent of contamination and/or have been subject to remediation may be further classified as *historical RECs (H-RECs)* or *controlled RECs (C-RECs)*, in accordance with *ASTM, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process, Designation: E 1527-13*, if they meet the following requirements:

- *H-RECs* are defined as a past release of any hazardous substance or petroleum product that has occurred in connection with the property and has been addressed to the satisfaction of the applicable regulatory authorities or meeting *unrestricted* use criteria established by a regulatory authority, without subjecting the property to any required controls

- *C-RECs* are defined as a *REC* resulting from a past release that has been addressed to the satisfaction of the applicable regulatory authority, with hazardous substances or petroleum products allowed to remain in place, subject to the implementation of required controls, such as property use restrictions, activity and use limitations (AULs), institutional controls, or engineering controls

2.4 DETAILED SCOPE OF SERVICES

This assessment was performed under the conditions of, and in accordance with ENPRO's Proposal Number 15K-0639-ITO dated November 30, 2015, and in accordance with the *ASTM E 1527-13, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process,* and *All Appropriate Inquiries* (AAI) which includes 40 CFR Part 312, §312.21 and §312.31. The scope of services in conducting this assessment included:

Records Review

- A review of environmental records, including regulatory agency reports, permits, registrations, and consultant's reports for evidence of *recognized environmental conditions* available from the property owner or site contact.
- An investigation of historical use of the project site by examining locally available aerial photographs, fire insurance maps, property tax files, recorded land title records, USGS topographical maps, building department records, zoning/land use records and/or other readily available historical information for evidence of prior land use that could have led to *recognized environmental conditions*.
- A review of an environmental database search report of federal and state regulatory agency records pertinent to the project site and offsite facilities located within ASTM-specified search distances from the project site.
- A review of regulatory agency files and records if the property, or any of the adjoining properties, is identified on one or more of the standard environmental record sources in the database search, to determine if a *REC, H-REC, C-REC,* or *de minimis* condition exists at the property in connection with the listing.
- A review of readily available information describing the general geology and topography of the project site, local groundwater characteristics, sources of water, power and sewer, and proximity to ecologically sensitive receptors that may be impacted by *recognized environmental conditions.*
- A review of title and judicial records for environmental liens and activity and use limitations (AULs) on behalf of the user, to meet the requirements of 40 CFR 312.20 and 312.25.

Site Reconnaissance

- A site walkthrough inspection of the property for visible evidence of *recognized environmental conditions* including existing or potential soil and groundwater contamination, as evidenced by staining or discoloration; stressed vegetation; indications of waste dumping or burial; pits, ponds or lagoons; containers of hazardous substances or petroleum products; electrical and hydraulic equipment that may contain polychlorinated biphenyls (PCBs), such as transformers or lifts; and underground and aboveground storage tanks.

- A site property line visual assessment of adjacent properties for evidence of potential offsite *recognized environmental conditions* that may affect the project site.

Interviews

- Interviews with available key site personnel regarding current and previous site activities on the property, especially those involving the use of hazardous substances and petroleum products. Required interviews shall include the following persons:
  - The User, defined as the party seeking to use Practice E 1527-13 to complete an environmental assessment of the property. A User has specific obligations for completing a successful application of this practice.
  - The property owner
  - A key site manager, who shall be identified by the owner, *prior to the site visit*, as a person with good knowledge of the uses and physical characteristics of the property (for example, a property manager, chief physical plant supervisor, or head maintenance person).
  - Occupants
  - Past users, when available
  - Neighbors, where the property is abandoned and the *environmental professional* determines there is evidence of potential unauthorized uses of the property.

Interviews are summarized in Section 8 of this report. Completed property questionnaires are presented in the Appendix.

2.5 SIGNIFICANT ASSUMPTIONS

ENPRO, in part, has relied on information supplied by the Client or the Client's agent(s), listed in Section 3.0, and assumes such information to be factual.

The commercial regulatory database search report, summarizing federal and state regulatory agency records, is provided by a contracted data research firm. The information provided is assumed to be correct unless otherwise noted.

Unless otherwise discovered during review, all other sources of information, whether verbal or written, are assumed to be factual.

2.6 LIMITATIONS AND EXCEPTIONS

Access was provided to all known areas of the project site.

As a matter of necessity, ENPRO relies largely on readily available sources of information such as the Client, public records, interviews, and contracted research firms for recognizing potential environmental liabilities at a project site/facility. Requests for information resources are made to collect relevant data on current and past practices conducted at the project site/facility. ENPRO may not receive all information requested or be able to confirm received information during the course of the environmental site assessment. Therefore, ENPRO shall not be held responsible for errors, omissions, or misrepresentations resulting from missing documentation or from inaccurate information provided by such sources.

2.7 SPECIAL TERMS AND CONDITIONS

The client has requested the draft report even if owners have not submitted questionnaires, with the understanding that information may change once the questionnaires are received.

3.0 User Provided Information

Per ASTM, the "User" is the party seeking to use Practice ASTM E 1527-13 to perform an environmental site assessment of the property. A user may include a purchaser, a potential tenant, an owner, a lender or a property manager, all associated with the property. According to ASTM, "the user has specific obligations for completing a successful application of this practice." A Property Questionnaire was completed by Mr. Simon Radford, operations manager, on behalf of the User (California Institute of Technology). A copy of the completed Property Questionnaire is included in the appendix section of this report. Additional User provided information is detailed in Section 8.1.

3.1 Environmental Cleanup Liens and Activity and Use Limitations (AUL) Review

On behalf of the User, ENPRO reviewed a search report for environmental liens and AULs prepared by AFX Research, LLC. The report did not identify any environmental liens or AULs associated with the project site. A copy of the AUL and environmental lien search report is included in the appendix section.

3.2 Specialized Knowledge

Mr. Radford reported the following specialized knowledge of *recognized environmental conditions* in connection with the property:

- Hydraulic fluid release in May 2009

3.3 Commonly Known or Reasonably Ascertainable Information

No commonly known areas of environmental concern were noted in the vicinity of the project site.

3.4 Valuation Reduction for Environmental Impairment

Mr. Radford did not provide information on any reduction of valuation due to environmental impairment.

3.5 OBVIOUS INDICATORS OF PRESENCE OR LIKELY PRESENCE OF CONTAMINATION AT THE PROPERTY

The client identified the following indicators that point to the presence or likely presence of contamination at the property:

- Release of hydraulic fluid occurred approximately six years ago. A *No Further Action* designation from DOH is pending further testing beneath the slab following decommissioning.

3.6 REASONS FOR PERFORMING PHASE I ENVIRONMENTAL SITE ASSESSMENT

The client, Mr. Radford, stated that the purpose for conducting the Phase I Environmental Site Assessment was for the decommissioning of the telescope in accordance with the *Decommissioning Plan for the Mauna Kea Observatories*.

4.0 Records Review

This section presents a review of physical setting sources, standard and additional environmental records sources, and historical use information on the property and surrounding area.

4.1 Physical Setting Sources

4.1.1 TOPOGRAPHY

Review of the topographic map published by the U.S. Geological Survey (2013) indicated the following:

The project site was located near the summit of Mauna Kea in the north-central part of the Big Island of Hawaii. The project site elevation was approximately 13,350 feet above mean sea level.

No individual structures were depicted on the project site.

The project site region was steeply (moderately) sloping in all directions. The nearest body of water was Lake Waiau located one mile to the south. The project site is not within 150 meters of a surface water body.

4.1.2 SOILS

A review of the soil type of the area was performed. The soil survey of the island of Hawaii is published by the USDA Natural Resources Conservation Service in cooperation with the United States Department of Agriculture (USDA) Soil Conservation Service and University of Hawaii Agricultural Experiment Station. USDA soil survey data is available at http://websoilsurvey.nrcs.usda.gov/app/ and was accessed on January 7, 2015. The following information is pertinent to the project site:

The project site was situated on soil classified as Cinder Land (rCL).

Cinder Land consists of bedded cinders, pumice and ash. The soils formed in alluvium derived from basic igneous rock in humid uplands.

Permeability for Cinder Land is described as high (over 20 inches per hour). The soil is described as having a low corrosivity for uncoated steel and concrete.

Cinder Land commonly supports some grass, but is not good pastureland because of its loose consistency. This land is a source of material for surfacing roads.

4.1.3 GEOLOGY/HYDROGEOLOGY

Groundwater beneath the project site occurs in two distinct aquifers within the Waimea Aquifer System of the West Mauna Kea Aquifer Sector. The shallow aquifer is classified as a high level, unconfined, perched aquifer, occurring on an impermeable formation. The groundwater status is reported as currently used, for drinking water. The salinity of the groundwater within this aquifer is described as fresh (<250 milligrams per liter Cl^-). The groundwater is further described as irreplaceable, with a high vulnerability to contamination (Mink and Lau, 1993).

The deeper aquifer is classified as a high level, unconfined, dike aquifer, occurring in dike compartments. The groundwater status is reported as being potentially used for drinking water purposes. The salinity of the groundwater within this aquifer is described as fresh (<250 milligrams per liter Cl^-). The groundwater is further described as irreplaceable, with a moderate vulnerability to contamination (Mink and Lau, 1993).

The hydrogeologic gradient in the vicinity of the project site is not known.

5.0 HISTORICAL RECORDS REVIEW

According to *ASTM E 1527-13, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, the historical search of the property must cover a period of time back to the property's first developed use, or back to 1940, whichever is earlier.

As part of this assessment, ENPRO reviewed several historical sources of information, including aerial photographs, fire insurance maps, USGS topographic maps, building department records, chain of title documents, property tax records and zoning/land use records. The earliest available historical information was the Tax Map Key map dated 1938, when the project site was not yet developed. The first developed use of the site occurred in 1985, when the Caltech Submillimeter Observatory was constructed.

5.1 TITLE RECORDS

Readily available records at the County of Hawaii Tax Assessor's Office were reviewed to assess past ownership of the project site. Significant ownership transactions are summarized below:

Table 2

Summary of Title Information

Tax Map Key	Date	Property Transaction
(3) 4-4-015: 009	1960s	Owned by State of Hawaii
(3) 4-4-015: 009	08/19/68	Leased to the University of Hawaii
(3) 4-4-015: 009	2/10/1984	Sub-leased to the University of Hawaii Science and Engineering Research Council

No readily apparent evidence of *recognized environmental conditions* that are expected to impact the project site was noted in the ownership records reviewed

Copies of the title records reviewed for this project are provided in the appendix.

5.2 HISTORICAL USE INFORMATION ON THE PROPERTY

5.2.1 HISTORICAL SANBORN MAPS

A copy of the correspondence from EDR/Sanborn, indicating no coverage was available for the project site, is included in the appendix section of this report.

5.2.2 HISTORICAL TOPOGRAPHIC MAPS

The following topographic maps were reviewed as part of this assessment:

- A 1956 Topographic map. The scale of this map was one inch equals one-quarter mile. No structures were depicted at the project site.
- A 1982 Topographic map. The scale of this map was one inch equals one-quarter. No structures were depicted at the project site.
- A 1993 Topographic map. The scale of this map was one inch equals one-quarter mile. No structures were depicted at the project site.

- A 2013 Topographic map. The scale of the map was one inch equals one-quarter mile. No structures were depicted at the project site.

Copies of the historic topographic maps reviewed for this project are provided in the appendix section of this report.

5.2.3 HISTORICAL AERIAL PHOTOGRAPHS

The following aerial photographs were reviewed as part of this assessment:

- EDR, dated 1954. The scale of this photograph was approximately one inch equals 750 feet. The project site appeared to be undeveloped,
- EDR, dated 1977. The scale of this photograph was approximately one inch equals 750 feet. The project site appeared to be undeveloped.
- REDI, dated 1992. The scale of this photograph was approximately one inch equals 1,000 feet. The project site appeared to be developed similar to what was observed at the time of our site reconnaissance.
- EDR, dated 1995. The scale of this photograph was approximately one inch equals 1,000 feet. The project site appeared to be developed similar to what was observed at the time of our site reconnaissance.
- EDR, dated 2001. The scale of the photograph was approximately one inch equals 500 feet. The project site appeared to be developed similar to what was observed at the time of our site reconnaissance.

Copies of the historic aerial photographs reviewed for this project are provided in the appendix section of this report.

5.3 HISTORICAL USE INFORMATION ON ADJOINING PROPERTIES

5.3.1 HISTORICAL SANBORN MAPS

A copy of the correspondence from EDR/Sanborn, indicating no coverage was available for the project site, is included in the appendix section of this report.

5.3.2 HISTORICAL TOPOGRAPHIC MAPS

The following topographic maps were reviewed as part of this assessment:

- A 1956 Topographic map. The scale of this map was one inch equals one-quarter mile. No structures were depicted adjoining the project site.
- A 1982 Topographic map. The scale of this map was one inch equals one-quarter mile. Several structures were depicted adjoining the project site.
- A 1993 Topographic map. The scale of this map was one inch equals one-quarter mile. Several structures were depicted adjoining the project site.
- A 2013 Topographic map. The scale of this map was one inch equals one-quarter mile. No structures were depicted adjoining the project site.

Copies of the historic topographic maps reviewed for this project are provided in the appendix section of this report.

5.3.3 HISTORICAL AERIAL PHOTOGRAPHS

The following aerial photographs were reviewed as part of this assessment:

- EDR, dated 1954. The scale of this photograph was approximately one inch equals 750 feet. The properties adjoining the project site appeared to be undeveloped.
- EDR, dated 1977. The scale of this photograph was approximately one inch equals 750 feet. The adjoining properties appear to be developed with several structures.
- REDI, dated 1992. The scale of this photograph was approximately one inch equals 1,000 feet. The adjoining properties appear to be developed with several structures
- EDR, dated 1995. The scale of this photograph was approximately one inch equals 1,000 feet. The adjoining properties appeared to be developed similar to what was observed at the time of our site reconnaissance.
- EDR, dated 2001. The scale of the photograph was approximately one inch equals 500 feet. The adjoining properties appeared to be developed similar to what was observed at the time of our site reconnaissance.

Copies of the historic aerial photographs reviewed for this project are provided in the appendix section of this report.

5.4 PREVIOUS ENVIRONMENTAL REPORTS

No previous environmental reports were available for review.

6.0 Regulatory Database Review

6.1 Standard Environmental Record Resources: Federal, State and Local Database Search

The regulatory database search report prepared by Environmental Data Resources, Inc. (EDR) was reviewed to evaluate the project site and listed properties within ASTM-recommended search distances. Federal, state and local databases reviewed are included in the Appendix section of this report.

Project site

The project site was not listed in the EDR regulatory database search report.

Adjacent and Nearby Properties

No adjacent or nearby properties were listed in the EDR regulatory database search report, within the ASTM minimum search distances.

6.2 Additional Environmental Record Resources: State and Local Agency Environmental Record Sources

Based on ENPRO's review of the EDR regulatory database search report, regulatory files from the State of Hawaii Department of Health (DOH) were requested and reviewed. Our review considers both proximity to the project site and local hydrogeologic conditions to identify which sites and which environmental violations may be interpreted to have a potential impact to the project site's environmental conditions.

ENPRO additionally requested information on the project site from the County of Hawaii Fire Department and reviewed documents from the Hawaii Department of Planning and Permitting.

6.2.1 Department of Health, Solid and Hazardous Waste Branch

Based on our review of the EDR regulatory database search report, we requested the following regulatory files from the State of Hawaii Department of Health (DOH), Solid and Hazardous Waste Branch (SHWB):

- TMK (3) 4-4-015: 009

The State of Hawaii Department of Health (DOH), Solid and Hazardous Waste Branch indicated that no regulatory files existed for TMK (3) 4-4-015: 009.

6.2.2 DEPARTMENT OF HEALTH, HAZARD EVALUATION AND EMERGENCY RESPONSE (HEER) OFFICE

Based on our review of the EDR regulatory database search report, we requested the following regulatory files from the State of Hawaii Department of Health (DOH), Hazard Evaluation and Emergency Response (HEER) Office:

- TMK (3) 4-4-015:009

The HEER Office provided the following:

1) **Caltech Submillimeter Observatory**

- Release Notification dated January 15, 2016 discussing the May 27, 2009 release of 22.7 gallons of hydraulic oil. Excavation and removal of contaminated soil was completed. There is remaining impacted soil under the slab believed to be from previous releases. A *No Further Action* designation is pending further testing of the soil under the slab to be conducted after the decommissioning of the observatory.

It is ENPRO's opinion that this is a *recognized environmental condition.* The release of hydraulic fluid is considered a REC because it has not been cleaned up to the satisfaction of the Department of Health and further testing is required.

6.2.3 BUILDING, PLANNING, AND/OR ZONING DEPARTMENTS

The County of Hawaii Department of Planning and Permitting database was reviewed on January 8, 2016 to obtain historical use information for the project site. Based on our review of the planning and permitting database, evidence of *recognized environmental conditions* associated with the project site was not discovered.

6.2.4 FIRE DEPARTMENT

The County of Hawaii Fire Communication Center was contacted on December 30, 2015 to obtain information regarding any fires, complaints, permits, violations involving hazardous materials use, USTs or ASTs on record for the project site and/or adjoining properties. ENPRO has not received a response from the County Fire Communication

Center as of the date of this report. Should our review of these files at a later date impact our findings, conclusions or recommendations, ENPRO shall forward an addendum letter to such effect.

6.3 VAPOR ENCROACHMENT SCREENING IN PROPERTY INVOLVED IN REAL ESTATE TRANSACTIONS

ENPRO reviewed the regulatory database search provided by EDR and other regulatory records for recorded releases within the recommended radii for vapor encroachment. The EDR provides an initial search of all ASTM E 2600-10 standard government record databases and EDR proprietary historical records related to former dry cleaners, gas stations and manufactured gas plants the 1/3 mile and 1/10 mile approximate minimum distances defined in ASTM E 2600-10 for chemicals of concern (COC)-contaminated sites. This measurement is based upon the distance from the known or suspect contaminated property to the target property boundary polygon. ENPRO's review of EDR's vapor encroachment screening (VES) takes into account the following factors:

- The land use of the *target property* (TP)
- Type of COC
- Location of known or suspect contaminated property is in the area of concern (AOC) having COC
- Characteristics of the soil
- Depth to groundwater
- Vapor conduits that may result in significant preferential pathways
- Cleanup status of contaminated property

Potential vapor encroachment conditions (VECs) evaluated included all *recognized environmental conditions*, including H-RECs and C-RECs with identified releases of petroleum products or other potentially volatile contaminants of concern.

ENPRO's VES did not identify any potential VECs within the recommended radii provided in ASTM E 2600-10 with the potential to impact the project site, except for the release of hydraulic oil six years ago at the project site. The release has been addressed to the satisfaction of the applicable regulatory authority. During excavation and removal of contaminated soil, additional contaminated soil was discovered. It is believed this contamination occurred during construction of the observatory. Assuming the contaminated soil is addressed during decommissioning, ENPRO has not identified any VECs associated with this property.

7.0 Site Reconnaissance

Site reconnaissance was performed by Ms. Heather Schauer on January 6, 2016. The site reconnaissance was conducted on foot. All areas of the property were available for inspection.

7.1 Current Use of the Property

The project site is an observatory with a 10.4 meter telescope, a pump shed, a transformer, a generator and an outbuilding used for storage.

7.2 Descriptions of Structures, Roads & Other Improvements

Three buildings were observed at the project site as described below:

- Telescope, approximately three stories, approximate construction date 1985.
- Pump shed, single story, approximate construction date 1985.
- Outbuilding, single story, approximate construction date 1985.

Mr. Simon Radford, Operations Manager for the Caltech Submillimeter Observatory, reported that the following companies/agencies provide project site utilities and service:

Electricity:	HELCO (Hawaii Electric Light Company)
Gas or other fuel:	Propane provided by Airgas
Water:	Trucked in by Island Topsoil from County Water Station
Sewer:	Cesspool
Refuse:	Off-site
Other Utilities:	Hydraulic systems are maintained by in-house technicians

7.3 CURRENT USES OF ADJACENT AND NEARBY PROPERTIES

The area surrounding the project site consisted of observatories and vacant land. Adjoining properties were observed from the project site and from public access lands for signs of *recognized environmental conditions* and their potential to pose an environmental concern to the project site. These properties are listed in the following table:

Table 3

Summary of Adjacent and Nearby Property Use

Direction	Name	Use
West	James Clerk Maxwell Telescope	Observatory
North	Conservation District	Vacant
East	Conservation District	Vacant
South	Conservation District	Vacant

Table 4 summarizes the site inspection and findings. All features that were observed during the site reconnaissance, or that were discovered to have been historically present at the project site, are noted in the table. Also indicated in the table are items that may present concerns to the project site. Additional information about items noted in the table can be found in the referenced section of this report.

Table 4

Site Inspection Findings

Onsite Environmental Features	Currently / Historically Present	Possible Environmental Concern	Report Section
Hazardous substances or Petroleum Products	Yes	Yes	7.4
Underground Storage Tank, UST	No	No	
Aboveground Storage Tank, AST	Yes	No	7.5.2
Odors	No	No	
Air Emissions *(stacks, hoods, other point sources)*	No	No	

Table 4 (continued)

Site Inspection Findings

Onsite Environmental Features	Currently / Historically Present	Possible Environmental Concern	Report Section
Pools of Liquid	Yes	No	7.9
Drums	Yes	No	7.9
Unidentified Substance Containers	Yes	No	7.9
Electrical Equipment/Possible PCBs	Yes	No	7.7.1
Hydraulic Equipment/Possible PCBs	Yes	No	7.7.2
Stains or Corrosion	Yes	No	7.9
Drains	Yes	No	7.9
Sumps	No	No	
Pits, Ponds, or Lagoons	No	No	
Stained Soil or Pavement	Yes	No	7.9
Stressed Vegetation	No	No	
Evidence of Spills or Releases	Yes	Yes	7.9
Artificially Filled Areas *(Solid Waste Disposal)*	No	No	
Waste Water	No	No	
Wells	No	No	
Septic Systems *(cisterns, cess pools, dry wells)*	Yes	No	7.9
Dry Cleaning Operations	No	No	
Agricultural Use *(pesticides/herbicides/fungicides)*	No	No	
Oil/Gas Production or Exploration	No	No	
Remedial Activities	No	No	
Other			

7.4 HAZARDOUS SUBSTANCES AND PETROLEUM PRODUCTS

Project Site

Visual observation for the use and/or storage of hazardous substances and petroleum products was performed.

Hazardous substances and/or petroleum products were observed generated, stored, accumulated, transported, or disposed on site. Glycol was located in drums in various locations within the dome of the observatory. There were also numerous hoses labeled “Glycol”.

Hydraulic oil drums and buckets labeled “Used Hydraulic Oil” were observed within the dome and within the flammables storage locker outside.

None of the hazardous substances and/or petroleum products observed on the project site during the site reconnaissance appeared to be causing or contributing to any site contamination.

Adjoining or Nearby Sites

No activities were observed on adjoining or nearby properties that would indicate that hazardous substances and/or petroleum products are likely to be used, generated, stored, accumulated, transported, or disposed.

7.5 STORAGE TANKS

7.5.1 UNDERGROUND STORAGE TANKS

Project Site

Visual observations for manways, vent pipes, fill connections, concrete pressure dispersion pads, and dispenser pumps were conducted throughout the project site. Evidence indicating historical or current existence of USTs was not observed.

Adjoining or Nearby Sites

Visual observations for manways, vent pipes, fill connections, concrete pressure dispersion pads, and dispenser pumps were conducted throughout the accessible areas of adjacent properties. No evidence of the presence of USTs was noted.

7.5.2 ABOVEGROUND STORAGE TANKS

Project Site

Visual observations for vent pipes, secondary containment walls, or other evidence of above ground storage tanks were conducted throughout the project site. An above ground water storage tank was observed within the dome of the observatory.

Adjoining or Nearby Sites

Visual observations for vent pipes, secondary containment walls, or other evidence of above ground storage tanks were conducted throughout the accessible areas of adjacent properties. No evidence of the presence of ASTs was noted.

7.6 SOLID WASTE

Project Site

At the time of our investigation, non-hazardous solid waste was not generated onsite.

Adjoining or Nearby Sites

At the time of our investigation, non-hazardous solid waste was observed to be generated on adjoining or nearby site. Waste was in the form of general refuse and was disposed of off-site.

7.7 POLYCHLORINATED BIPHENYLS (PCBS)

Visual observation for electrical equipment or electrical components that use dielectric fluid, hydraulic lift equipment and fluorescent light ballasts that potentially include PCB-containing fluids was conducted. PCBs (polychlorinated biphenyl) are heavily regulated under the Toxic Substances Control Act (TSCA), which obligates a property owner to clean up any spills occurring on their property.

7.7.1 ELECTRICAL TRANSFORMERS/CAPACITORS

One vaulted transformer belonging to Hawaiian Electric Light Company (HELCO) was observed on the site. No evidence of leakage or corrosion on the outside of the vaulted transformer was noted during the project site reconnaissance.

An inquiry was sent to HELCO regarding the PCB content of the vaulted transformer. HELCO responded to the inquiry and indicated the transformers were "non-PCB" or "PCB-free.

Since the transformers are owned and operated by HELCO, HELCO is responsible for remediating any environmental impacts they might cause. Details regarding correspondence with HECO can be found in the appendix section of this report.

No privately-owned transformer equipment was observed within the facility.

7.7.2 HYDRAULIC EQUIPMENT

Visual observation for hydraulic equipment or components containing hydraulic fluid that potentially contains PCBs was conducted.

The ENPRO investigator observed evidence of hydraulic equipment throughout the project site. Hydraulic equipment included a hydraulic rotating mechanism and hydraulic pistons.

7.7.3 FLUORESCENT LIGHT BALLASTS

Fluorescent light fixtures are present at the project site. Many fluorescent light fixtures manufactured prior to 1980 may have contained ballasts with PCBs. Since the project site was constructed after 1980, PCB-containing light ballast should not be a concern.

7.8 WELLS

Evidence of wells (supply, monitoring or dry wells) was not observed during the assessment.

7.9 OTHER OBSERVATIONS

The following describes additional observations of the project site:

Odors:	Not observed
Pools of liquid:	Not observed
Drums:	Observed
Drains and Sumps:	Not observed*
Pits, ponds, lagoons:	Not observed
Stained soil or pavement:	Observed
Stressed vegetation:	Not observed
Waste water features:	Not observed

Septic systems: Observed

* Mr. Radford indicated there had been a drain at the base of the telescope which was sealed after the hydraulic oil release in May 2009.

A minor hydraulic fluid leak was observed at the base of the observatory which resulted in a small puddle.

Several drums were observed at the project site. A large drum labeled “Residue of Used Chevron Aw42 Hydraulic Oil” was under the boards at the base of the observatory. The drum was determined to be empty. An unmarked drum containing used oily rags and miscellaneous refuse was observed on the second level. Two small drums labeled “contaminated” and containing used glycol were noted on the third level.

Minor staining was observed on the asphalt in the parking area. Staining was also observed on the concrete at the base of the observatory.

A man-hole cover, associated with the cesspool, was observed to the south of the potable-water shed.

8.0 INTERVIEWS

Interviews with individuals having past or present knowledge of the project site, such as owners, key site managers, occupants, and neighbors are routinely conducted to obtain information indicating *recognized environmental conditions* in connection with the property. The following individuals were available to interview:

Table 5

Key Site Interviews

Interviewee Name	Relationship to Property	Length of Time Familiar with Property	Date of Interview
Mr. Simon Radford	Operations Manager	5.5yrs	1/06/2016
Ms. Stephanie Nagata	Master Lease Holder	15.5yrs	1/28/2016
Mr. Russell Tsuji	Owner	1 yr	3/7/2016

The ASTM Standard states that the following persons should be interviewed regarding the historical use(s) of the property:

- The User
- The property owner
- A key site manager, who shall be identified by the owner, *prior to the site visit*, as a person with good knowledge of the uses and physical characteristics of the property (for example, a property manager, chief physical plant supervisor, or head maintenance person).
- Occupants
- Past users, when available
- Neighbors, where the property is abandoned and the *environmental professional* determines there is evidence of potential unauthorized uses of the property.

8.1 KEY SITE MANAGER

Mr. Simon Radford, Operations Manager, was interviewed in person at the time of the site visit on January 6, 2016.

Project Site

Mr. Simon Radford has been familiar with the project site for 5.5 years and reported the following significant environmental issues regarding the project site:

A hydraulic fluid release in May 2009 resulted in 22.7 gallons of fluid being released onto the floor of the observatory. Most fluid was recovered but approximately five gallons was believed to have escaped down a floor drain. Myounghee Noh and Associates, LLC, hand excavated the drain hole for lab analysis. Based on the laboratory results, backfill was removed from under the concrete slab to a depth of 55-57 inches and width and length of 4 feet. Mr. Radford noted the drain has since been plugged.

Adjoining and Adjacent Properties

Mr. Simon Radford has been familiar with the project site for 5.5 years and reported no information regarding past or present contamination and/or activities on adjacent properties that may have resulted in contamination of the project site.

8.2 MASTER LEASE HOLDER

Ms. Stephanie Nagata, Director OMKM, completed a Property Questionnaire supplied by ENPRO Environmental regarding the project site. A copy of the completed Property Questionnaire is included in the appendix section of this report.

Project Site

Ms. Stephanie Nagata has been familiar with the project site for 15.5 years and reported the following significant environmental issues regarding the project site:

A hydraulic fluid release in May 2009 resulted in 22.7 gallons of fluid being released onto the floor of the observatory. Most fluid was recovered but approximately five gallons was believed to have escaped down a floor drain.

Adjoining and Adjacent Properties

Ms. Stephanie Nagata has been familiar with the project site for 15.5 years and reported no information regarding past or present contamination and/or activities on adjacent properties that may have resulted in contamination of the project site.

8.3 OWNER

Mr. Russell Tsuji, Department of Land and Natural Resources, Land Division, completed a Property Questionnaire supplied by ENPRO Environmental regarding the project site. A copy of the completed Property Questionnaire is included in the appendix section of this report.

Project Site

Mr. Russell Tsuji has been familiar with the project site approximately one year and reported no information regarding past or present contamination and/or activities on the property that may have resulted in contamination of the project site.

Adjoining and Adjacent Properties

Mr. Russell Tsuji has been familiar with the project site approximately one year and reported no information regarding past or present contamination and/or activities on adjacent properties that may have resulted in contamination of the project site.

9.0 Evaluation

This section documents the findings, opinions, and conclusions of the Phase I Environmental Site Assessment. ASTM E 1527-13 does not require the *environmental professional* to provide recommendations regarding identified environmental conditions at the project site. As a service to its clients, ENPRO provides recommendations to further evaluate and/or address environmental concerns in Section 10.0 of this report.

9.1 Findings and Conclusions

We have performed a *Phase I Environmental Site Assessment* in conformance with the scope and limitations of ASTM Practice E 1527-13 of the Caltech Submillimeter Observatory, the *property*. Any exceptions to, or deletions from, this practice are described in Section 2.6 of this *report*. This assessment has revealed no evidence of *recognized environmental conditions (RECs)* in connection with the *property* **except for the following:**

- REC 1 Hydraulic Fluid Release. This finding is considered a *recognized environmental condition* because, despite the release being cleaned up to the satisfaction of the Department of Health there is a *No Further Action* status pending further soil testing under the slab after the decommissioning of the observatory.

Regulatory Records Review Summary (Section 6.0)

DOH HEER records indicated a release of 22.7 gallons of hydraulic oil occurred in May 2009. 3,500 pounds of backfill was removed and disposed of at the West Hawaii Landfill. The lateral extent of contamination was not determined. A *No Further Action* designation is pending additional investigation and cleanup to be undertaken when the observatory is decommissioned. Therefore, ENPRO recommends multi-increment sampling of the soil at the project site and analysis for contaminants of potential concern associated with the hydraulic fluid release following dismantling of the Caltech Submillimeter Observatory.

9.2 DATA GAPS

Data gaps are not uncommon in environmental site assessments. A data gap by itself is not inherently significant. The significance is determined by other information and professional experience as to whether the data gap raises reasonable concerns about activities that may present a *recognized environmental condition*. According to *ASTM E 1527-13, Standard Practice for Environmental Site Assessments: Phase I Environmental Site Assessment Process*, and *All Appropriate Inquiries* (AAI) which includes 40 CFR Part 312, §312.21 and §312.31, the Phase I Environmental Site Assessment report shall identify and comment on significant data gaps that affect the ability of the environmental professional to identify *recognized environmental conditions* and identify the sources of information that were consulted to address the data gap.

The following significant data gap was encountered by ENPRO when conduction this Phase 1 ESA:

- DOH HEER Office does not have any records regarding releases at the Caltech Submillimeter Observatory other than the hydraulic oil release of May 2009. It is believed that a release occurred during the construction of the observatory resulting in soil contamination. Without these records the type of contaminant, amount of contaminant released and extent of contamination cannot be determined.

ENPRO attempted to contact the individual(s) listed in the table below to obtain information regarding the project site, however, no response has been received as of the date of this report. This represents a data gap for the project site that may or may not impact our conclusions and recommendations for this property.

Table 6

Unavailable Project Contacts

Interviewee Name	Relationship to Property	Date Contact Attempted	Purpose of Contact
Mr. Sam Lemmo	Owner, DLNR Office of Conservation and Coastal Lands	1/15/216	Property Questionnaire

Should a response from any of the above individuals be received at a later date and impact our findings, conclusions or recommendations, ENPRO shall forward an addendum letter to such effect.

9.3 CERTIFICATIONS

ENPRO has completed a Phase I Environmental Site Assessment (ESA) in conformance with the scope and limitations of ASTM Practice E 1527-13 of Caltech Submillimeter Observatory at the summit of Mauna Kea on the Island of Hawaii, Hawaii (the “project site”). This assessment was performed at the request of California Institute of Technology (the “Client”) using the methods and procedures consistent with good commercial and customary practices designed to conform to acceptable industry standards.

The information and opinions rendered in this report are intended for the Client for the purposes stated herein (see Sections 1.2 and 2.3). This report is not for the use or benefit of, nor may it be relied upon by any other person or entity, for any purpose except as described below without the advance written consent of ENPRO. ENPRO shall not distribute nor publish this report without the consent of the Client except as required by law or court order. The information and opinions expressed in this report are given in response to a limited assignment and should be considered and implemented in light of that assignment.

The Client may rely upon this report in evaluating a request for one or more extensions of credit to be secured directly or indirectly by the subject property (including mortgage and mezzanine loans) and the acquisition of the direct or indirect interest in the subject property as applicable.

In expressing the opinions stated in this report, ENPRO has exercised a degree of skill and care ordinarily exercised by a reasonable prudent environmental professional in the same community and in the same time frame given the same or similar facts and circumstances. Documentation and data provided by the Client, designated representatives of the Client or other interested third parties, or from the public domain, and referred to in the preparation of this assessment, have been used and referenced with the understanding that ENPRO assumes no responsibility or liability for their accuracy.

The independent conclusions represent our professional judgment based on information and data available to us during the course of this assignment. Factual information regarding operations, conditions, and test data provided by the Client or their representatives has been assumed to be correct and complete. The conclusions presented are based on the data provided, observations, and conditions that existed on the date of the site visit.

If you have any questions regarding this report, please contact the ENPRO contact listed on the cover of this report at (808) 748-2108.

Researched by: Heather Schauer, Environmental Technician

Surveyed by: Heather Schauer, Environmental Technician

Written by: Heather Schauer, Environmental Technician

Supervised by: Kenton Beal, Executive Vice President

I declare that to the best of my professional knowledge and belief, I meet the definition of Environmental Professional as defined in §312.10 of 40 CFR Part 312.

I have the specific qualifications based on education, training, and experience to assess a property of the nature, history, and setting of the subject *property* (project site). I have developed and performed the all appropriate inquiries in conformance with the standards and practices set forth in 40 CFR Part 312.

Reviewed by: ______________________

Kenton Beal
Technical Director, ENPRO Environmental

10.0 Non-Scope Services

ASTM E 1527-13 does not require recommendations. A User should consider whether recommendations for additional inquiries or other services are desired. Recommendations are an additional service that may be useful in the User's analysis of the property. Unless otherwise directed by the Client, it is ENPRO's standard practice to include recommendations for addressing all identified *RECs* at the subject property.

ENPRO may also make recommendations regarding conditions identified at the project site which are not considered *RECs*, such as the proper storage of hazardous materials, the potential presence of asbestos containing materials, and the presence of ecological or cultural resources. Except where otherwise specified, there are no legal or regulatory requirements for the Client or the property owner to follow the recommendations presented in this report.

10.1 Recommendations

Based on the *RECs* identified in this investigation, ENPRO recommends the following additional actions and/or investigations:

(1) REC 1 Hydraulic Oil Release. Conduct Phase II multi-increment sampling of the soil at the project site and analysis for contaminants of potential concern associated with the hydraulic fluid release following dismantling if the Caltech Submillimeter Observatory.

Associated cost estimate for Phase II ESA……………$15,000-$20,000*

* - Assuming observatory has been dismantled and removed.

10.2 Additional Environmental Concerns, Non-ASTM

The following environmental conditions were evaluated for the potential to impact the property though they are not considered *recognized environmental conditions* as defined by ASTM.

Asbestos-Containing Materials

In July 1989, under the Toxic Substances Control Act (TSCA), the United States Environmental Protection Agency (USEPA) promulgated an Asbestos Ban Phaseout Rule. Beginning in 1990 and taking effect in three stages, the rule prohibits the importation, manufacture, and processing of ninety-four percent of all remaining asbestos products in the United States over a period of seven years. Presently, asbestos has not been prohibited from all construction building materials.

No sampling for asbestos containing materials was conducted as part of this investigation.

Suspect asbestos containing materials should be sampled and analyzed for possible asbestos content prior to activities (e.g., renovation, demolition,) that may damage or disturb the material. If the materials are asbestos-containing, the building owner must comply with applicable USEPA National Emissions Standards for Hazardous Air Pollutants (NESHAPS), OSHA, state and local regulations.

Radon

Radon is a naturally occurring radioactive gas formed by the decay of uranium in bedrock and soil. The potential adverse health effects associated with radon gas depend on several factors including concentration of the gas and duration of exposure. The concentration of radon gas in a building depends on subsurface soil conditions, the integrity of the building's foundation, and the building's ventilation system.

Due to the geologic composition of basalt bedrock and the soils that derive from them, as well as the composition of marine-related sediments found in Hawaii, the State of Hawaii has been determined to have a low radon potential (G.M. Reimer, U.S. Geological Survey). Therefore, investigation of radon is not recommended for this property.

Lead-Based Paint

There is no commercial property definition of what is a lead-based paint. Regulations specifically addressing lead-based paint include Housing and Urban Development (HUD) (1995) guidelines and the Consumer Product Safety Act (1977). These regulations are for housing and consumer products.

OSHA regulations apply to worker protection during renovation and demolition activities.

Sensitive Ecological Areas

According to the EDR report, no areas were depicted as sensitive ecological areas or federal wetlands.

Decommissioning and Disposal

At the time of decommissioning all hazardous materials and petroleum products must be properly managed and disposed.

11.0 REFERENCES

Publications:

Names of Publication: Aquifer Identification and Classification for the Island of Hawaii : Groundwater Protection Strategy For Hawaii
Author of Publication: Mink, J.F. and L.S. Lau
Published by: Water Resources Research Center, University of Hawaii at Manoa, Honolulu, Hawaii
Date of Publication: 1993
Information Obtained: Groundwater data

Names of Publication: Ownership records and Tax Map Key maps
Author of Publication: County of Hawaii
Information Obtained: Ownership records

Names of Publication: Aerial Photographs
Author of Publication: EDR
Published by: EDR
Date of Publication: 1954, 1977, 1992, 1995, 2001
Information Obtained: Historical use

Names of Publication: Code of Federal Regulations, Title 40, Part 761, Rules for Controlling PCBs under the Toxic Substance Control Act,
Author of Publication: U.S. Environmental Protection Agency
Date of Publication: December 14, 1990
Information Obtained: PCB regulations

Names of Publication: Soil Survey for the Island of Hawaii, State of Hawaii
Author of Publication: Foote, Donald E. et al.
Published by: U.S. Department of Agriculture, Soil Conservation Service, in cooperation with the University of Hawaii Agricultural Experiment Station. Also available at http://websoilsurvey.nrcs.usda.gov/app/ accessed on January 7, 2016.

Date of Publication:	1973
Information Obtained:	Soil classification

Names of Publication:	The EDR Radius Map Report
Author of Publication:	Environmental Data Resources, Inc.
Date of Publication:	December 30, 2015
Information Obtained:	Regulatory database records

Names of Publication:	Topographic Maps, Mauna Kea Quadrangle, Hawaii
Author of Publication:	United States Geological Survey (USGS)
Date of Publication:	1956, 1982, 1993, 2013
Information Obtained:	Historical use

Contacts:

Agency or Business:	California Institute of Technology
Name/Title of Representative:	Mr. Simon Radford
Location of Agency or Business:	Pasadena, California
Telephone Number:	808-333-4871
Date Information was Received:	January 6, 2016
Information Obtained:	Historical and current property use

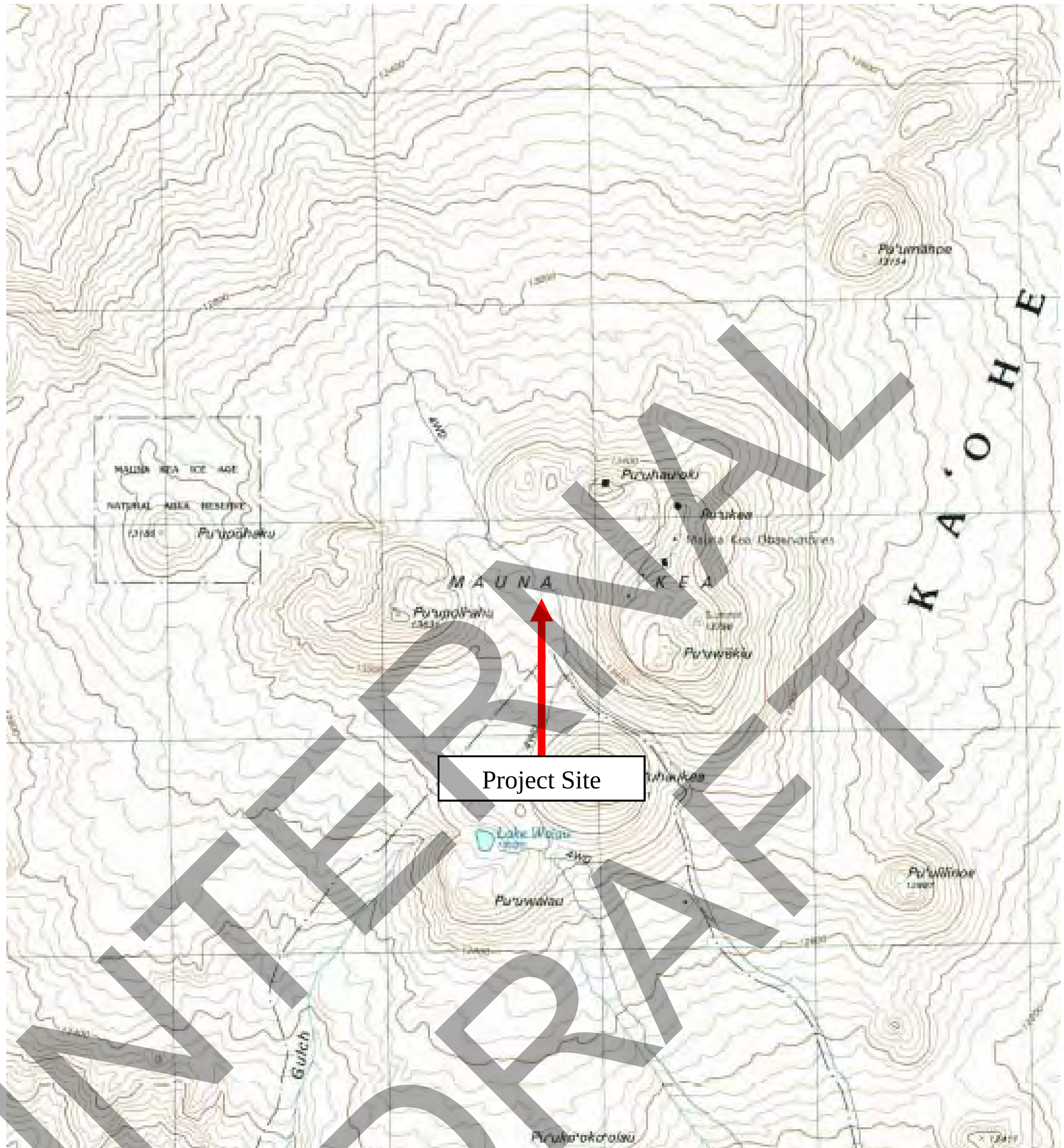
Agency or Business:	Solid and Hazardous Waste Branch (SHWB)
Location of Agency or Business:	919 Ala Moana Boulevard
Telephone Number:	808-586-4226
Date Information was Received:	January 11, 2016
Information Obtained:	Regulatory records

Agency or Business:	Hazard Evaluation and Emergency Response (HEER)
Location of Agency or Business:	919 Ala Moana Boulevard
Telephone Number:	808-586-4249
Date Information was Received:	January 19, 2016
Information Obtained:	Regulatory records

APPENDICES

Site Figures
Site Photographs
Historical Research
Regulatory Records Documentation
Records of Communication/Interview
Qualifications of Environmental Professionals

SITE FIGURES

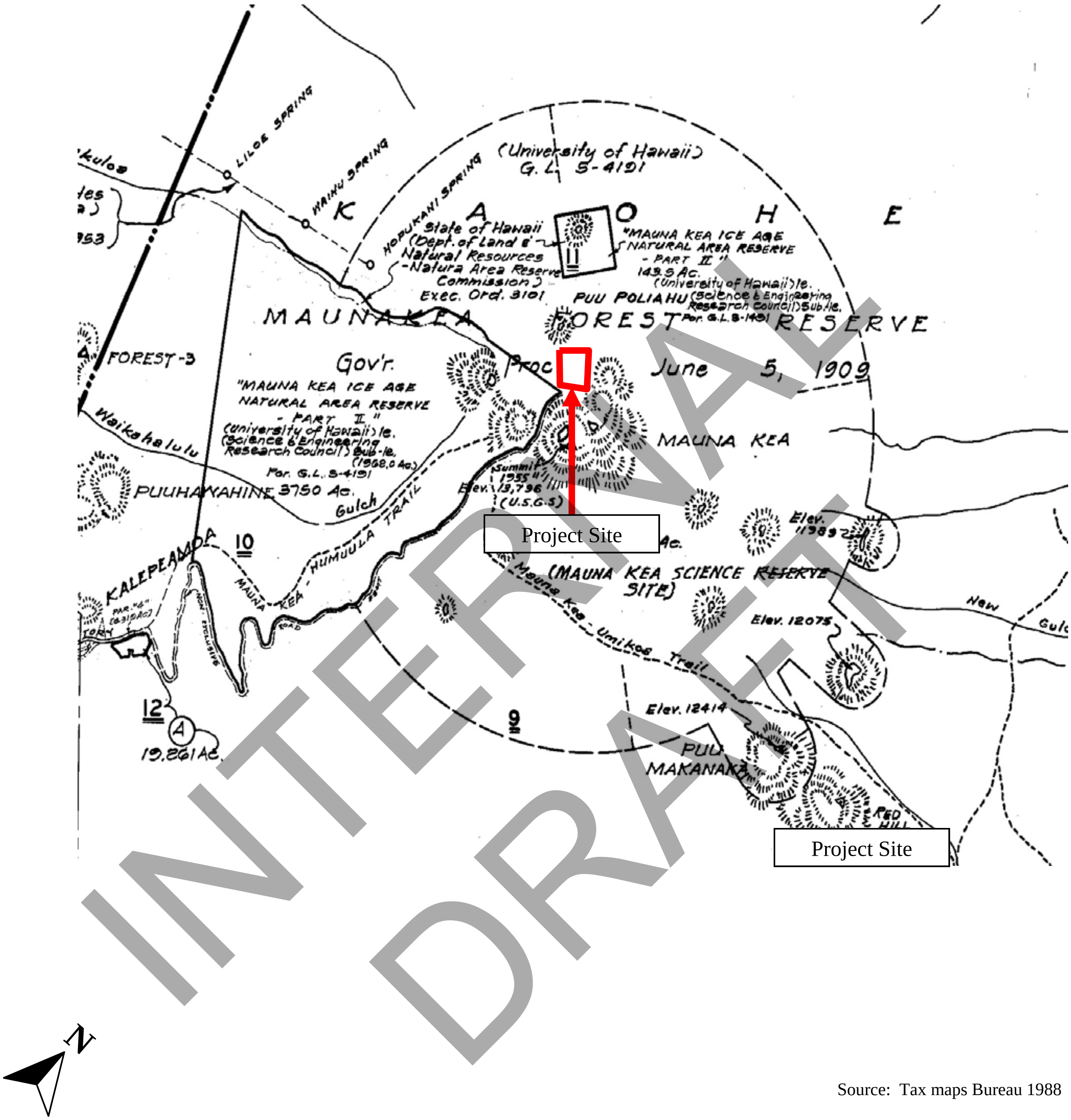


N

Source: U.S. Geological Survey, 1993

Figure 1
TOPOGRAPHIC MAP

Scale: 1 inch = 1, 320 feet



Source: Tax maps Bureau 1988

Figure 2
TAX MAP KEY (3) 4-4-015: 009

Scale: 1 inch = Approximately 1,500 feet

N

Source: EDR 2001

Figure 5
AERIAL PHOTOGRAPH

Scale: 1 inch = Approximately 750 feet

N

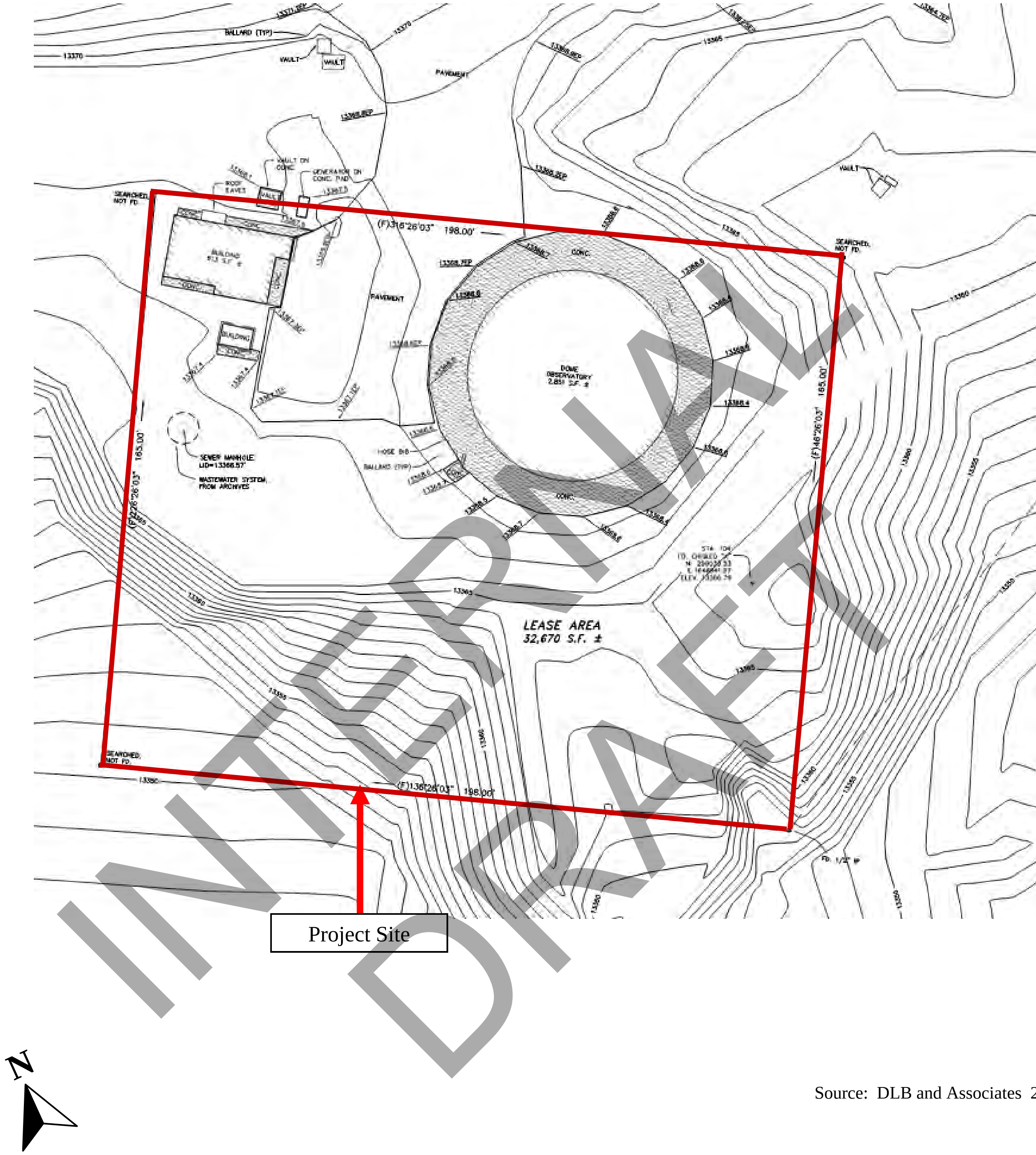
Source: Google Earth 2016

Figure 6
Aerial Photograph

Scale: 1 inch = Approximately 750 feet

environmental ENPRO

Project Number 1512-00532-PH1
Mauna Kea Summit



Source: DLB and Associates 2015

Figure 5
TOPOGRAPHIC MAP

Scale: 1 inch = 60 feet

SITE PHOTOGRAPHS

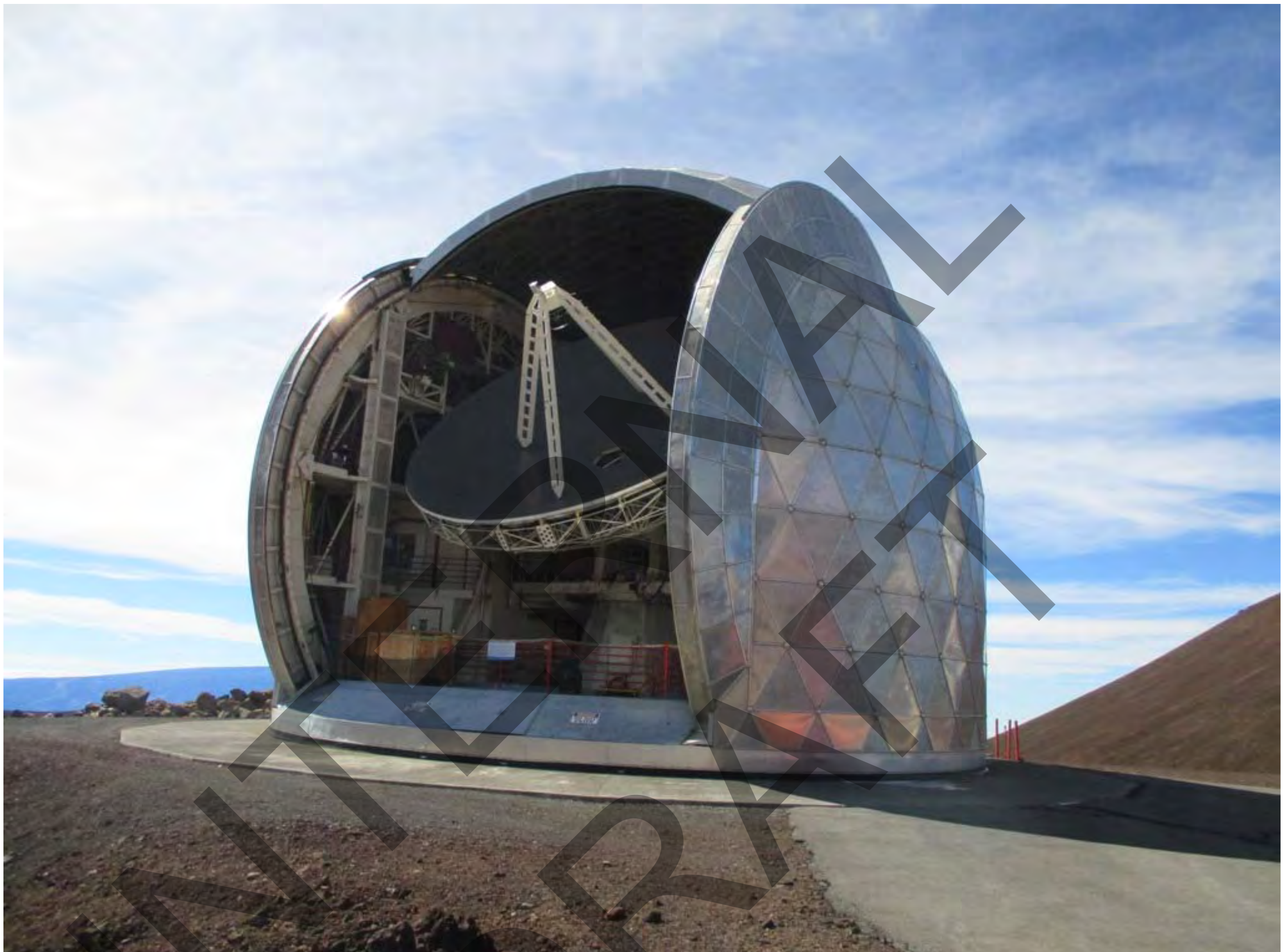


Photo 1

Caltech Submillimeter Observatory, Facing North

Photo 2

Adjacent Property to the North, Mauna Kea Summit, Astronomy Precinct

Photo 3

Adjancent Property to the North, Mauna Kea Summit, Astronomy Precinct

Project Number: 1512-00532-PH1
Caltech Submillimter Observatory
Date of Photos: January 6, 2016

Photo 4

Cesspool Man-Hole Cover

Photo 5

Drums Containing Used Glycol

Photo 6

Empty Drum under the Wooden Planks at the Base of the Telescope

Photo 7

Glycol Pipes Running Throughout the Observatory

Photo 8

HELCO Transformer Box on the Property, Non-PCB Containing

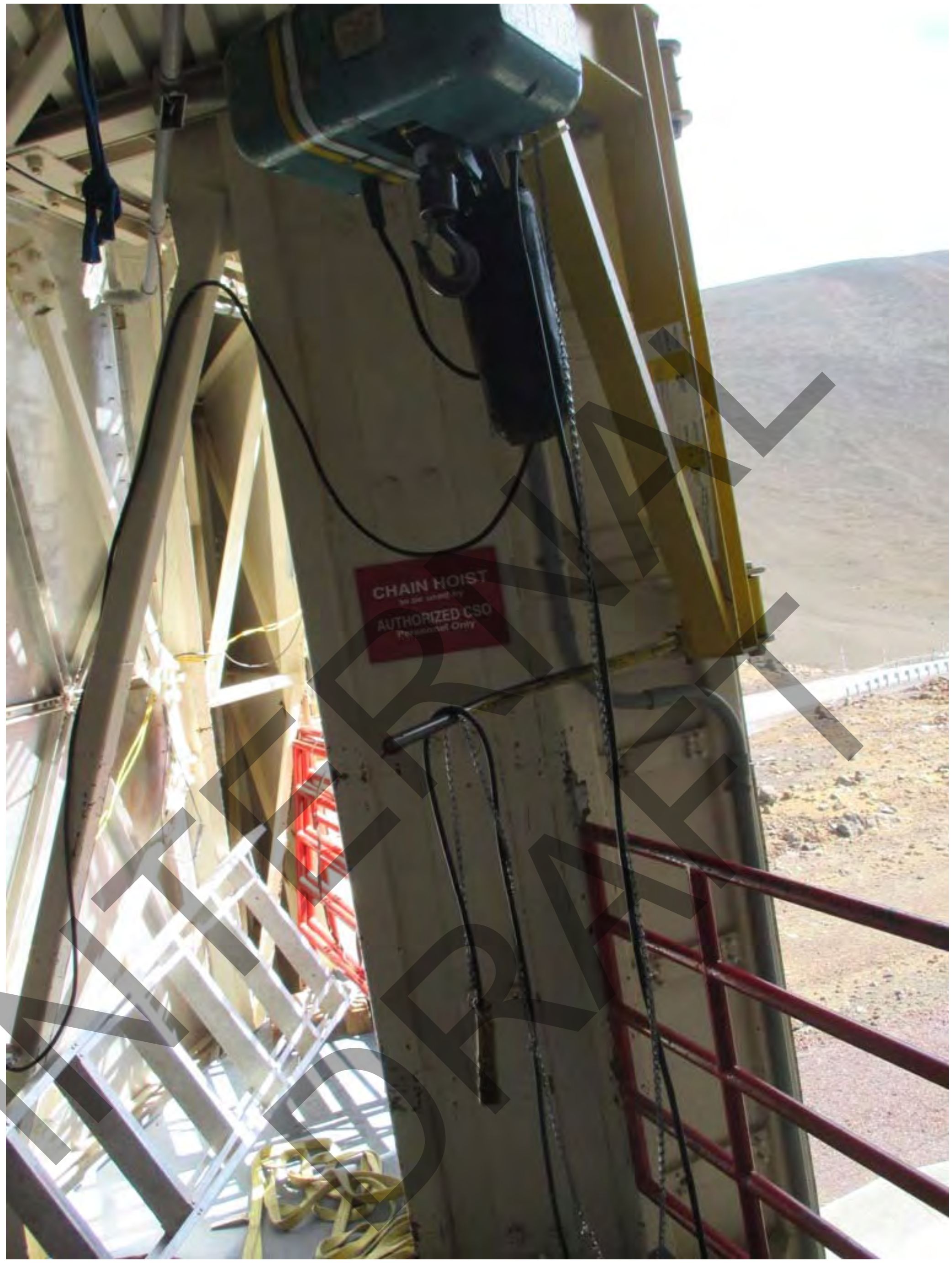


Photo 9

Hydraulic Chain Hoist

Photo 10

Hydraulic Lift

Photo 11

Hydraulic Mechanisms, Rotate the Dome

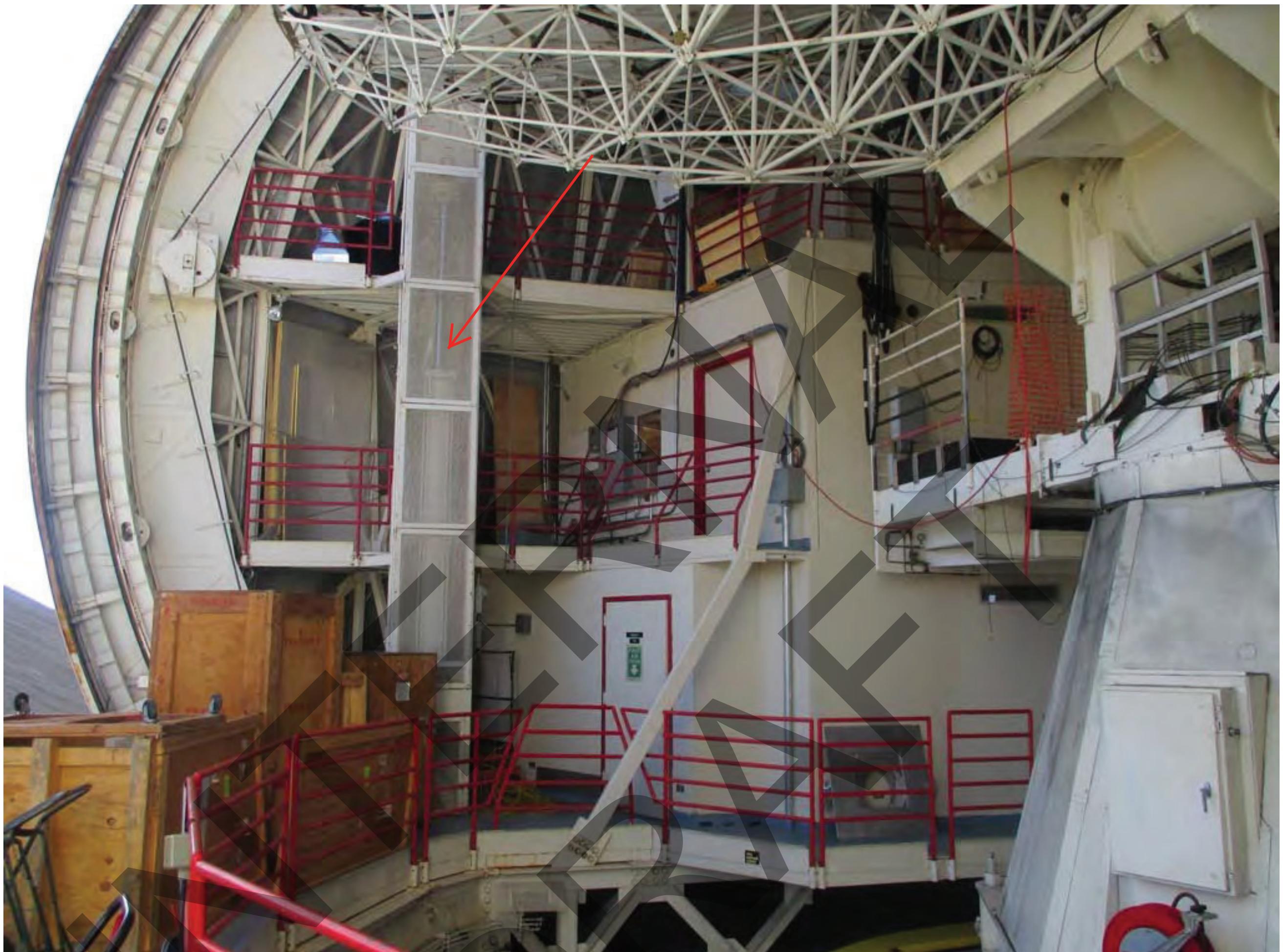


Photo 12

Hydraulic Piston

Photo 13

Inside the Flammables Storage, Outside the Observatory, Propane Tanks and Miscellaneous

Photo 14

5 Gallon Buckets of Used Hydraulic Oil, Flammables Storage

Photo 15

Minor Fluid Leak Under the First Level Platform

Photo 16

Potable Water Pump

environmental ENPRO

Project Number: 1512-00532-PH1
Caltech Submillimter Observatory
Date of Photos: January 6, 2016

Photo 17

Potable Water Spigot

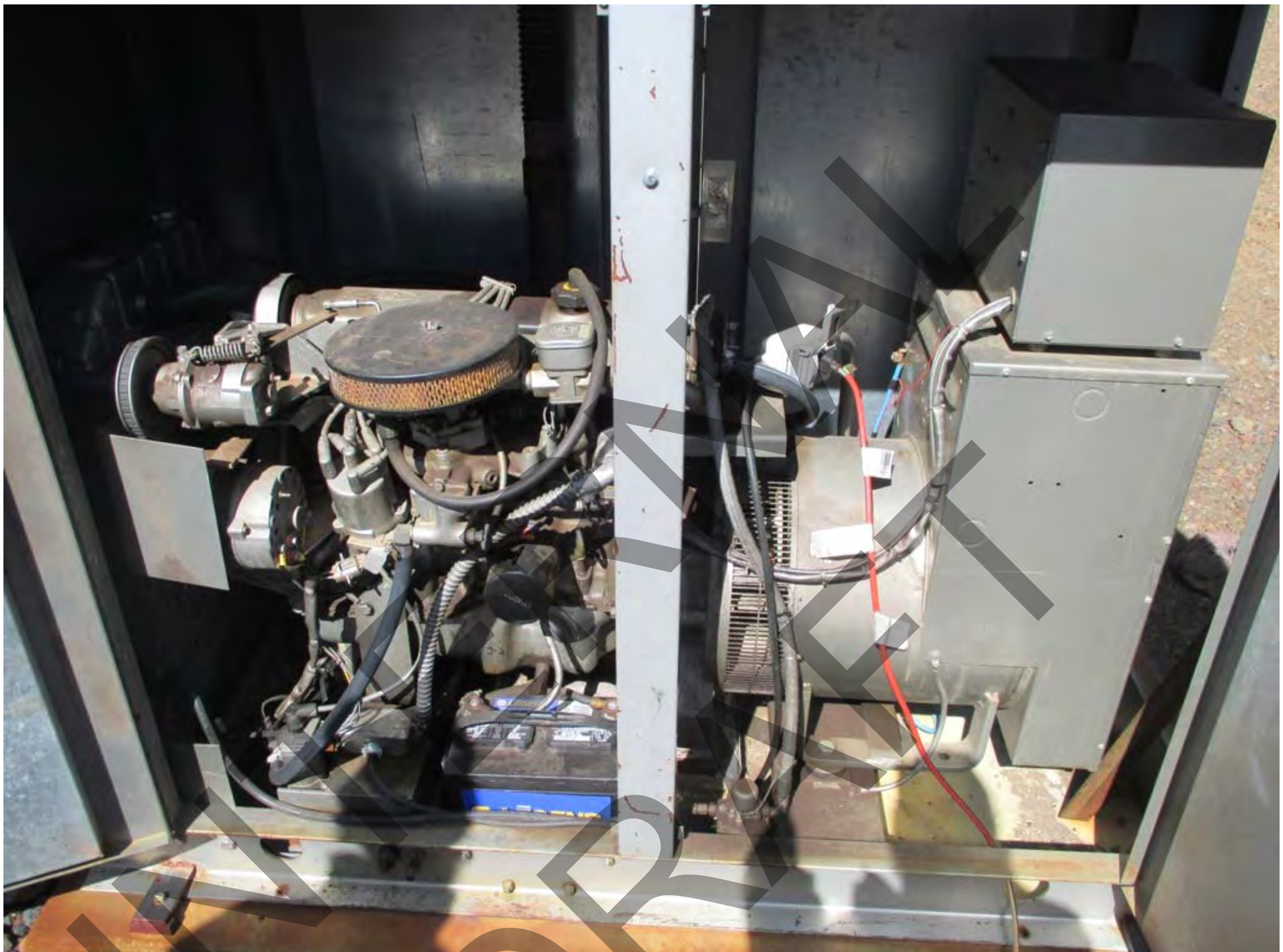


Photo 18

Propane Generator, Outside on the Property

Photo 19

Sewage Connection

Photo 20

Stained Concrete at the Base of the Observatory

Photo 21

Staining on Asphalt of Parking Area

Photo 22

Unlabeled Drum on the Second Level

HISTORICAL RESEARCH

Caltech Submillimeter Observatory
Mauna Kea Access Road
Paauilo, HI 96776

Inquiry Number: 4502574.2s
December 30, 2015

The EDR Radius Map™ Report with GeoCheck®

EDR® Environmental Data Resources Inc

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

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SECTION | **PAGE**

GEOCHECK ADDENDUM

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

MAUNA KEA ACCESS ROAD
PAAUILO, HI 96776

COORDINATES

Latitude (North):	19.8225000 - 19˚ 49' 21.00''
Longitude (West):	155.4754000 - 155˚ 28' 31.44''
Universal Tranverse Mercator:	Zone 5
UTM X (Meters):	240704.7
UTM Y (Meters):	2193609.0
Elevation:	13343 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property Map:	5949268 MAUNA KEA, HI
Version Date:	2013

MAPPED SITES SUMMARY

Target Property Address:
MAUNA KEA ACCESS ROAD
PAAUILO, HI 96776

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION
1	UNIVERSITY OF HAWAII	MAUNA KEA SUMMIT	LUST, UST	Higher	1780, 0.337, East

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

DATABASES WITH NO MAPPED SITES

No mapped sites were found in EDR's search of available ("reasonably ascertainable ") government records either on the target property or within the search radius around the target property for the following databases:

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL . . . . National Priority List
Proposed NPL . . . . Proposed National Priority List Sites
NPL LIENS . . . . Federal Superfund Liens

Federal Delisted NPL site list

Delisted NPL . . . . National Priority List Deletions

Federal CERCLIS list

FEDERAL FACILITY . . . . Federal Facility Site Information listing
CERCLIS . . . . Comprehensive Environmental Response, Compensation, and Liability Information System

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP . . . . CERCLIS No Further Remedial Action Planned

Federal RCRA CORRACTS facilities list

CORRACTS . . . . Corrective Action Report

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF . . . . RCRA - Treatment, Storage and Disposal

Federal RCRA generators list

RCRA-LQG . . . . RCRA - Large Quantity Generators
RCRA-SQG . . . . RCRA - Small Quantity Generators
RCRA-CESQG . . . . RCRA - Conditionally Exempt Small Quantity Generator

Federal institutional controls / engineering controls registries

LUCIS . . . . Land Use Control Information System
US ENG CONTROLS . . . . Engineering Controls Sites List

US INST CONTROL Sites with Institutional Controls

Federal ERNS list

ERNS Emergency Response Notification System

State- and tribal - equivalent CERCLIS

SHWS Sites List

State and tribal landfill and/or solid waste disposal site lists

SWF/LF Permitted Landfills in the State of Hawaii

State and tribal leaking storage tank lists

INDIAN LUST Leaking Underground Storage Tanks on Indian Land

State and tribal registered storage tank lists

FEMA UST Underground Storage Tank Listing
UST Underground Storage Tank Database
INDIAN UST Underground Storage Tanks on Indian Land

State and tribal institutional control / engineering control registries

ENG CONTROLS Engineering Control Sites
INST CONTROL Sites with Institutional Controls

State and tribal voluntary cleanup sites

VCP Voluntary Response Program Sites
INDIAN VCP Voluntary Cleanup Priority Listing

State and tribal Brownfields sites

BROWNFIELDS Brownfields Sites

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS A Listing of Brownfields Sites

Local Lists of Landfill / Solid Waste Disposal Sites

INDIAN ODI Report on the Status of Open Dumps on Indian Lands
ODI Open Dump Inventory
DEBRIS REGION 9 Torres Martinez Reservation Illegal Dump Site Locations

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL National Clandestine Laboratory Register
CDL Clandestine Drug Lab Listing

US CDL	Clandestine Drug Labs

Local Land Records

LIENS 2	CERCLA Lien Information

Records of Emergency Release Reports

HMIRS	Hazardous Materials Information Reporting System
SPILLS	Release Notifications
SPILLS 90	SPILLS 90 data from FirstSearch

Other Ascertainable Records

RCRA NonGen / NLR	RCRA - Non Generators / No Longer Regulated
FUDS	Formerly Used Defense Sites
DOD	Department of Defense Sites
SCRD DRYCLEANERS	State Coalition for Remediation of Drycleaners Listing
US FIN ASSUR	Financial Assurance Information
EPA WATCH LIST	EPA WATCH LIST
2020 COR ACTION	2020 Corrective Action Program List
TSCA	Toxic Substances Control Act
TRIS	Toxic Chemical Release Inventory System
SSTS	Section 7 Tracking Systems
ROD	Records Of Decision
RMP	Risk Management Plans
RAATS	RCRA Administrative Action Tracking System
PRP	Potentially Responsible Parties
PADS	PCB Activity Database System
ICIS	Integrated Compliance Information System
FTTS	FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)
MLTS	Material Licensing Tracking System
COAL ASH DOE	Steam-Electric Plant Operation Data
COAL ASH EPA	Coal Combustion Residues Surface Impoundments List
PCB TRANSFORMER	PCB Transformer Registration Database
RADINFO	Radiation Information Database
HIST FTTS	FIFRA/TSCA Tracking System Administrative Case Listing
DOT OPS	Incident and Accident Data
CONSENT	Superfund (CERCLA) Consent Decrees
INDIAN RESERV	Indian Reservations
UMTRA	Uranium Mill Tailings Sites
LEAD SMELTERS	Lead Smelter Sites
US AIRS	Aerometric Information Retrieval System Facility Subsystem
US MINES	Mines Master Index File
FINDS	Facility Index System/Facility Registry System
AIRS	List of Permitted Facilities
DRYCLEANERS	Permitted Drycleaner Facility Listing
Financial Assurance	Financial Assurance Information Listing
UIC	Underground Injection Wells Listing

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP	EDR Proprietary Manufactured Gas Plants

EDR Hist Auto .... EDR Exclusive Historic Gas Stations
EDR Hist Cleaner .... EDR Exclusive Historic Dry Cleaners

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS .... Recovered Government Archive State Hazardous Waste Facilities List
RGA LF .... Recovered Government Archive Solid Waste Facilities List
RGA LUST .... Recovered Government Archive Leaking Underground Storage Tank

SURROUNDING SITES: SEARCH RESULTS

Surrounding sites were identified in the following databases.

Elevations have been determined from the USGS Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified. Sites with an elevation equal to or higher than the target property have been differentiated below from sites with an elevation lower than the target property.
Page numbers and map identification numbers refer to the EDR Radius Map report where detailed data on individual sites can be reviewed.

Sites listed in ***bold italics*** are in multiple databases.

Unmappable (orphan) sites are not considered in the foregoing analysis.

STANDARD ENVIRONMENTAL RECORDS

State and tribal leaking storage tank lists

LUST: The Leaking Underground Storage Tank Incident Reports contain an inventory of reported leaking underground storage tank incidents. The data come from the Department of Health's Active Leaking Underground Storage Tank Log Listing.

A review of the LUST list, as provided by EDR, and dated 09/04/2015 has revealed that there is 1 LUST site within approximately 0.5 miles of the target property.

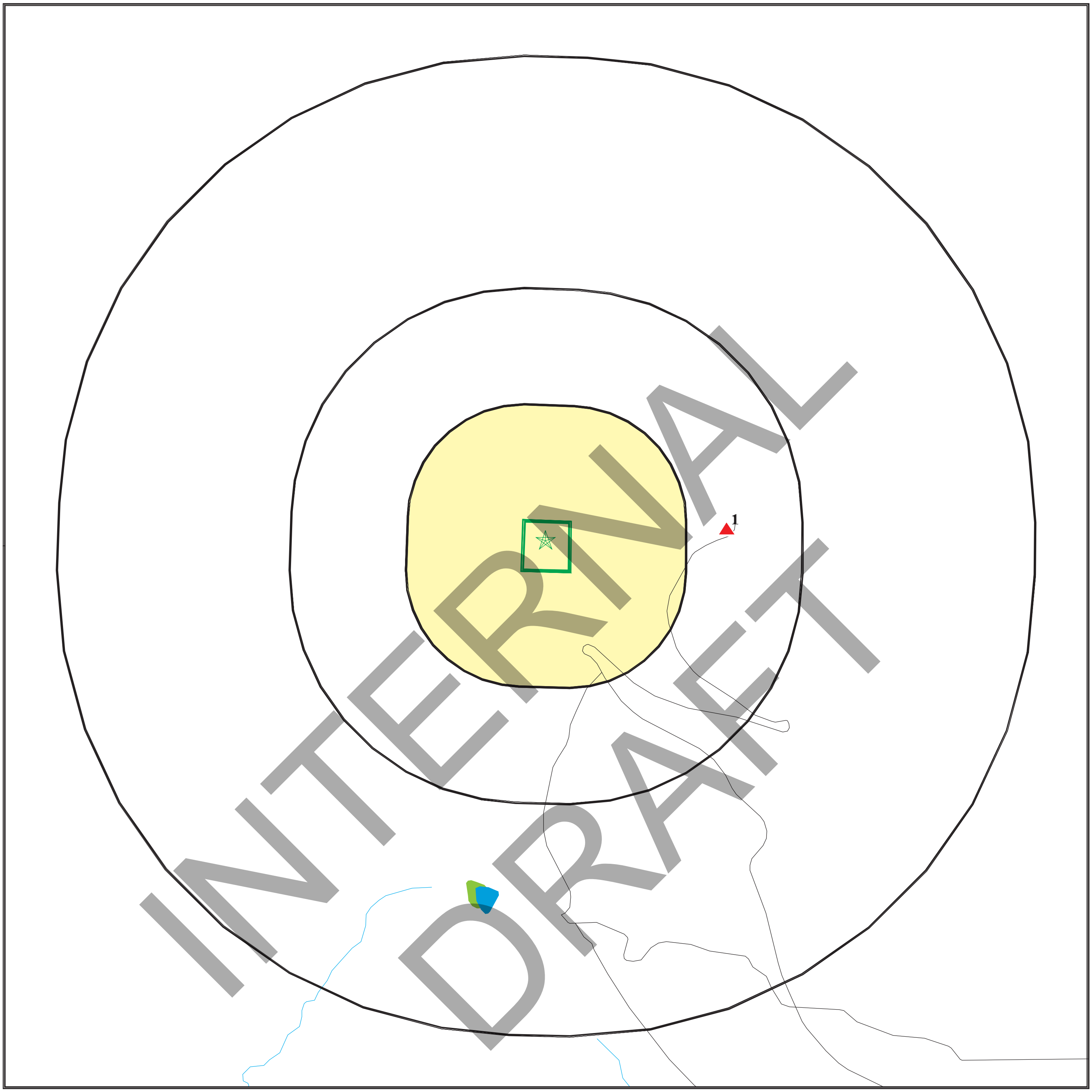
Equal/Higher Elevation	Address	Direction / Distance	Map ID	Page
UNIVERSITY OF HAWAII	***MAUNA KEA SUMMIT***	***E 1/4 - 1/2 (0.337 mi.)***	***1***	***7***

Release ID: 020006
Facility Id: 9-603620
Facility Status: Site Cleanup Completed (NFA)

EXECUTIVE SUMMARY

There were no unmapped sites in this report.

OVERVIEW MAP - 4502574.2S



Target Property
Sites at elevations higher than or equal to the target property
Sites at elevations lower than the target property
Manufactured Gas Plants
National Priority List Sites
Dept. Defense Sites

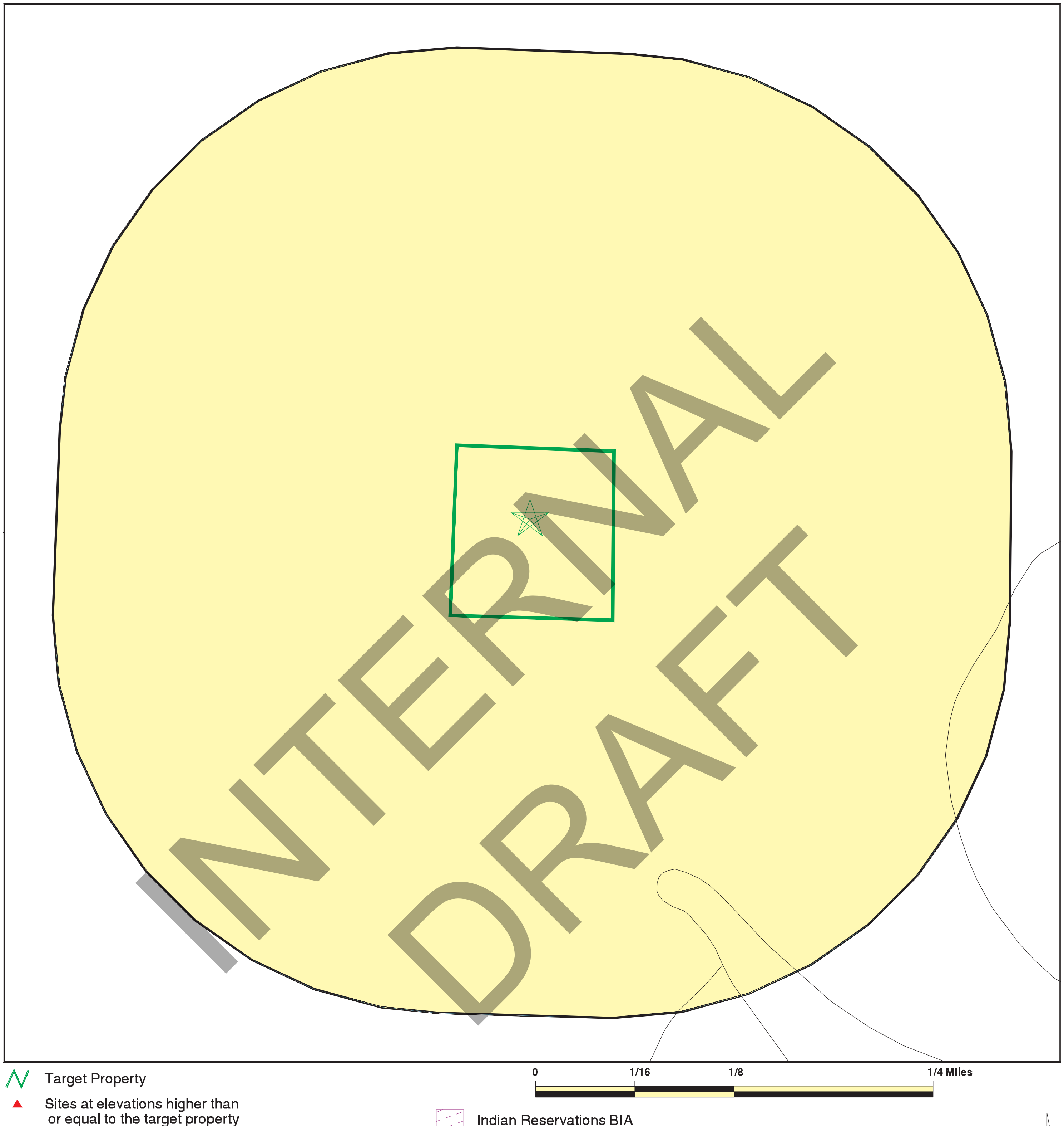
0 1/4 1/2 1 Miles

Indian Reservations BIA
100-year flood zone
500-year flood zone
National Wetland Inventory
State Wetlands

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Caltech Submillimeter Observatory	CLIENT:	ENPRO, Env. Professionals
ADDRESS:	Mauna Kea Access Road Paauilo HI 96776	CONTACT:	Heather Schauer
		INQUIRY #:	4502574.2s
LAT/LONG:	19.8225 / 155.4754	DATE:	December 30, 2015 1:34 pm

DETAIL MAP - 4502574.2S



Target Property
Sites at elevations higher than or equal to the target property
Sites at elevations lower than the target property
Manufactured Gas Plants
Sensitive Receptors
National Priority List Sites
Dept. Defense Sites

Indian Reservations BIA
100-year flood zone
500-year flood zone

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME:	Caltech Submillimeter Observatory	CLIENT:	ENPRO, Env. Professionals
ADDRESS:	Mauna Kea Access Road Paauilo HI 96776	CONTACT:	Heather Schauer
		INQUIRY #:	4502574.2s
LAT/LONG:	19.8225 / 155.4754	DATE:	December 30, 2015 1:35 pm

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
STANDARD ENVIRONMENTAL RECORDS								
Federal NPL site list								
NPL	1.000		0	0	0	0	NR	0
Proposed NPL	1.000		0	0	0	0	NR	0
NPL LIENS	TP		NR	NR	NR	NR	NR	0
Federal Delisted NPL site list								
Delisted NPL	1.000		0	0	0	0	NR	0
Federal CERCLIS list								
FEDERAL FACILITY	0.500		0	0	0	NR	NR	0
CERCLIS	0.500		0	0	0	NR	NR	0
Federal CERCLIS NFRAP site List								
CERCLIS-NFRAP	0.500		0	0	0	NR	NR	0
Federal RCRA CORRACTS facilities list								
CORRACTS	1.000		0	0	0	0	NR	0
Federal RCRA non-CORRACTS TSD facilities list								
RCRA-TSDF	0.500		0	0	0	NR	NR	0
Federal RCRA generators list								
RCRA-LQG	0.250		0	0	NR	NR	NR	0
RCRA-SQG	0.250		0	0	NR	NR	NR	0
RCRA-CESQG	0.250		0	0	NR	NR	NR	0
Federal institutional controls / engineering controls registries								
LUCIS	0.500		0	0	0	NR	NR	0
US ENG CONTROLS	0.500		0	0	0	NR	NR	0
US INST CONTROL	0.500		0	0	0	NR	NR	0
Federal ERNS list								
ERNS	TP		NR	NR	NR	NR	NR	0
State- and tribal - equivalent CERCLIS								
SHWS	1.000		0	0	0	0	NR	0
State and tribal landfill and/or solid waste disposal site lists								
SWF/LF	0.500		0	0	0	NR	NR	0
State and tribal leaking storage tank lists								
LUST	0.500		0	0	1	NR	NR	1
INDIAN LUST	0.500		0	0	0	NR	NR	0
State and tribal registered storage tank lists								
FEMA UST	0.250		0	0	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
UST	0.250		0	0	NR	NR	NR	0
INDIAN UST	0.250		0	0	NR	NR	NR	0
State and tribal institutional control / engineering control registries								
ENG CONTROLS	0.500		0	0	0	NR	NR	0
INST CONTROL	0.500		0	0	0	NR	NR	0
State and tribal voluntary cleanup sites								
VCP	0.500		0	0	0	NR	NR	0
INDIAN VCP	0.500		0	0	0	NR	NR	0
State and tribal Brownfields sites								
BROWNFIELDS	0.500		0	0	0	NR	NR	0
ADDITIONAL ENVIRONMENTAL RECORDS								
Local Brownfield lists								
US BROWNFIELDS	0.500		0	0	0	NR	NR	0
Local Lists of Landfill / Solid Waste Disposal Sites								
INDIAN ODI	0.500		0	0	0	NR	NR	0
ODI	0.500		0	0	0	NR	NR	0
DEBRIS REGION 9	0.500		0	0	0	NR	NR	0
Local Lists of Hazardous waste / Contaminated Sites								
US HIST CDL	TP		NR	NR	NR	NR	NR	0
CDL	TP		NR	NR	NR	NR	NR	0
US CDL	TP		NR	NR	NR	NR	NR	0
Local Land Records								
LIENS 2	TP		NR	NR	NR	NR	NR	0
Records of Emergency Release Reports								
HMIRS	TP		NR	NR	NR	NR	NR	0
SPILLS	TP		NR	NR	NR	NR	NR	0
SPILLS 90	TP		NR	NR	NR	NR	NR	0
Other Ascertainable Records								
RCRA NonGen / NLR	0.250		0	0	NR	NR	NR	0
FUDS	1.000		0	0	0	0	NR	0
DOD	1.000		0	0	0	0	NR	0
SCRD DRYCLEANERS	0.500		0	0	0	NR	NR	0
US FIN ASSUR	TP		NR	NR	NR	NR	NR	0
EPA WATCH LIST	TP		NR	NR	NR	NR	NR	0
2020 COR ACTION	0.250		0	0	NR	NR	NR	0
TSCA	TP		NR	NR	NR	NR	NR	0
TRIS	TP		NR	NR	NR	NR	NR	0

MAP FINDINGS SUMMARY

Database	Search Distance (Miles)	Target Property	< 1/8	1/8 - 1/4	1/4 - 1/2	1/2 - 1	> 1	Total Plotted
SSTS	TP		NR	NR	NR	NR	NR	0
ROD	1.000		0	0	0	0	NR	0
RMP	TP		NR	NR	NR	NR	NR	0
RAATS	TP		NR	NR	NR	NR	NR	0
PRP	TP		NR	NR	NR	NR	NR	0
PADS	TP		NR	NR	NR	NR	NR	0
ICIS	TP		NR	NR	NR	NR	NR	0
FTTS	TP		NR	NR	NR	NR	NR	0
MLTS	TP		NR	NR	NR	NR	NR	0
COAL ASH DOE	TP		NR	NR	NR	NR	NR	0
COAL ASH EPA	0.500		0	0	0	NR	NR	0
PCB TRANSFORMER	TP		NR	NR	NR	NR	NR	0
RADINFO	TP		NR	NR	NR	NR	NR	0
HIST FTTS	TP		NR	NR	NR	NR	NR	0
DOT OPS	TP		NR	NR	NR	NR	NR	0
CONSENT	1.000		0	0	0	0	NR	0
INDIAN RESERV	1.000		0	0	0	0	NR	0
UMTRA	0.500		0	0	0	NR	NR	0
LEAD SMELTERS	TP		NR	NR	NR	NR	NR	0
US AIRS	TP		NR	NR	NR	NR	NR	0
US MINES	0.250		0	0	NR	NR	NR	0
FINDS	TP		NR	NR	NR	NR	NR	0
AIRS	TP		NR	NR	NR	NR	NR	0
DRYCLEANERS	0.250		0	0	NR	NR	NR	0
Financial Assurance	TP		NR	NR	NR	NR	NR	0
UIC	TP		NR	NR	NR	NR	NR	0
EDR HIGH RISK HISTORICAL RECORDS								
EDR Exclusive Records								
EDR MGP	1.000		0	0	0	0	NR	0
EDR Hist Auto	0.125		0	NR	NR	NR	NR	0
EDR Hist Cleaner	0.125		0	NR	NR	NR	NR	0
EDR RECOVERED GOVERNMENT ARCHIVES								
Exclusive Recovered Govt. Archives								
RGA HWS	TP		NR	NR	NR	NR	NR	0
RGA LF	TP		NR	NR	NR	NR	NR	0
RGA LUST	TP		NR	NR	NR	NR	NR	0
- Totals --		0	0	0	1	0	0	1

NOTES:

TP = Target Property

NR = Not Requested at this Search Distance

Sites may be listed in more than one database

1 **East** **1/4-1/2** **0.337 mi.** **1780 ft.**	**UNIVERSITY OF HAWAII 88" TELESCOPE** **MAUNA KEA SUMMIT** **HILO, HI 96720**	**LUST** **UST**	**U003711786** **N/A**

Relative: **Higher**

Actual: **13777 ft.**

LUST:

Facility ID:	9-603620
Facility Status:	Site Cleanup Completed (NFA)
Facility Status Date:	09/08/2003
Release ID:	020006
Project Officer:	Shaobin Li

UST:

Facility ID:	9-603620
Owner:	UNIVERSITY OF HAWAII - INSTITUTE OF ASTROMONY
Owner Address:	2680 WOODLAWN DRIVE
Owner City,St,Zip:	Hilo, 96720 96720
Latitude:	19.823195
Longitude:	-155.469895
Horizontal Reference Datum Name:	Not reported
Horizontal Collection Method Name:	Not reported

Tank ID:	R-1
Date Installed:	01/01/1965
Tank Status:	**Permanently Out of Use**
Date Closed:	11/14/2001
Tank Capacity:	4000
Substance:	Diesel

Count: 0 records.

ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

To maintain currency of the following federal and state databases, EDR contacts the appropriate governmental agency on a monthly or quarterly basis, as required.

Number of Days to Update: Provides confirmation that EDR is reporting records that have been updated within 90 days from the date the government agency made the information available to the public.

STANDARD ENVIRONMENTAL RECORDS

Federal NPL site list

NPL: National Priority List

National Priorities List (Superfund). The NPL is a subset of CERCLIS and identifies over 1,200 sites for priority cleanup under the Superfund Program. NPL sites may encompass relatively large areas. As such, EDR provides polygon coverage for over 1,000 NPL site boundaries produced by EPA's Environmental Photographic Interpretation Center (EPIC) and regional EPA offices.

Date of Government Version: 03/26/2015
Date Data Arrived at EDR: 04/08/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 75

Source: EPA
Telephone: N/A
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Quarterly

NPL Site Boundaries

Sources:

EPA's Environmental Photographic Interpretation Center (EPIC)
Telephone: 202-564-7333

EPA Region 1
Telephone 617-918-1143

EPA Region 3
Telephone 215-814-5418

EPA Region 4
Telephone 404-562-8033

EPA Region 5
Telephone 312-886-6686

EPA Region 10
Telephone 206-553-8665

EPA Region 6
Telephone: 214-655-6659

EPA Region 7
Telephone: 913-551-7247

EPA Region 8
Telephone: 303-312-6774

EPA Region 9
Telephone: 415-947-4246

Proposed NPL: Proposed National Priority List Sites

A site that has been proposed for listing on the National Priorities List through the issuance of a proposed rule in the Federal Register. EPA then accepts public comments on the site, responds to the comments, and places on the NPL those sites that continue to meet the requirements for listing.

Date of Government Version: 03/26/2015
Date Data Arrived at EDR: 04/08/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 75

Source: EPA
Telephone: N/A
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Quarterly

NPL LIENS: Federal Superfund Liens

Federal Superfund Liens. Under the authority granted the USEPA by CERCLA of 1980, the USEPA has the authority to file liens against real property in order to recover remedial action expenditures or when the property owner received notification of potential liability. USEPA compiles a listing of filed notices of Superfund Liens.

Date of Government Version: 10/15/1991
Date Data Arrived at EDR: 02/02/1994
Date Made Active in Reports: 03/30/1994
Number of Days to Update: 56

Source: EPA
Telephone: 202-564-4267
Last EDR Contact: 08/15/2011
Next Scheduled EDR Contact: 11/28/2011
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal Delisted NPL site list

Delisted NPL: National Priority List Deletions

The National Oil and Hazardous Substances Pollution Contingency Plan (NCP) establishes the criteria that the EPA uses to delete sites from the NPL. In accordance with 40 CFR 300.425.(e), sites may be deleted from the NPL where no further response is appropriate.

Date of Government Version: 03/26/2015
Date Data Arrived at EDR: 04/08/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 75

Source: EPA
Telephone: N/A
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Quarterly

Federal CERCLIS list

FEDERAL FACILITY: Federal Facility Site Information listing

A listing of National Priority List (NPL) and Base Realignment and Closure (BRAC) sites found in the Comprehensive Environmental Response, Compensation and Liability Information System (CERCLIS) Database where EPA Federal Facilities Restoration and Reuse Office is involved in cleanup activities.

Date of Government Version: 03/26/2015
Date Data Arrived at EDR: 04/08/2015
Date Made Active in Reports: 06/11/2015
Number of Days to Update: 64

Source: Environmental Protection Agency
Telephone: 703-603-8704
Last EDR Contact: 10/09/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Varies

CERCLIS: Comprehensive Environmental Response, Compensation, and Liability Information System

CERCLIS contains data on potentially hazardous waste sites that have been reported to the USEPA by states, municipalities, private companies and private persons, pursuant to Section 103 of the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA). CERCLIS contains sites which are either proposed to or on the National Priorities List (NPL) and sites which are in the screening and assessment phase for possible inclusion on the NPL.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 94

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 11/23/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Quarterly

Federal CERCLIS NFRAP site List

CERCLIS-NFRAP: CERCLIS No Further Remedial Action Planned

Archived sites are sites that have been removed and archived from the inventory of CERCLIS sites. Archived status indicates that, to the best of EPA's knowledge, assessment at a site has been completed and that EPA has determined no further steps will be taken to list this site on the National Priorities List (NPL), unless information indicates this decision was not appropriate or other considerations require a recommendation for listing at a later time. This decision does not necessarily mean that there is no hazard associated with a given site; it only means that, based upon available information, the location is not judged to be a potential NPL site.

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 11/11/2013
Date Made Active in Reports: 02/13/2014
Number of Days to Update: 94

Source: EPA
Telephone: 703-412-9810
Last EDR Contact: 11/23/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Quarterly

Federal RCRA CORRACTS facilities list

CORRACTS: Corrective Action Report

CORRACTS identifies hazardous waste handlers with RCRA corrective action activity.

Date of Government Version: 06/09/2015
Date Data Arrived at EDR: 06/26/2015
Date Made Active in Reports: 09/16/2015
Number of Days to Update: 82

Source: EPA
Telephone: 800-424-9346
Last EDR Contact: 12/18/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Quarterly

Federal RCRA non-CORRACTS TSD facilities list

RCRA-TSDF: RCRA - Treatment, Storage and Disposal

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Transporters are individuals or entities that move hazardous waste from the generator offsite to a facility that can recycle, treat, store, or dispose of the waste. TSDFs treat, store, or dispose of the waste.

Date of Government Version: 06/09/2015
Date Data Arrived at EDR: 06/26/2015
Date Made Active in Reports: 09/16/2015
Number of Days to Update: 82

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 12/18/2015
Next Scheduled EDR Contact: 04/11/2016
Data Release Frequency: Quarterly

Federal RCRA generators list

RCRA-LQG: RCRA - Large Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Large quantity generators (LQGs) generate over 1,000 kilograms (kg) of hazardous waste, or over 1 kg of acutely hazardous waste per month.

Date of Government Version: 06/09/2015
Date Data Arrived at EDR: 06/26/2015
Date Made Active in Reports: 09/16/2015
Number of Days to Update: 82

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 12/18/2015
Next Scheduled EDR Contact: 04/11/2016
Data Release Frequency: Quarterly

RCRA-SQG: RCRA - Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Small quantity generators (SQGs) generate between 100 kg and 1,000 kg of hazardous waste per month.

Date of Government Version: 06/09/2015
Date Data Arrived at EDR: 06/26/2015
Date Made Active in Reports: 09/16/2015
Number of Days to Update: 82

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 12/18/2015
Next Scheduled EDR Contact: 04/11/2016
Data Release Frequency: Quarterly

RCRA-CESQG: RCRA - Conditionally Exempt Small Quantity Generators

RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Conditionally exempt small quantity generators (CESQGs) generate less than 100 kg of hazardous waste, or less than 1 kg of acutely hazardous waste per month.

Date of Government Version: 06/09/2015
Date Data Arrived at EDR: 06/26/2015
Date Made Active in Reports: 09/16/2015
Number of Days to Update: 82

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 12/18/2015
Next Scheduled EDR Contact: 04/11/2016
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Federal institutional controls / engineering controls registries

LUCIS: Land Use Control Information System

LUCIS contains records of land use control information pertaining to the former Navy Base Realignment and Closure properties.

Date of Government Version: 05/28/2015
Date Data Arrived at EDR: 05/29/2015
Date Made Active in Reports: 06/11/2015
Number of Days to Update: 13

Source: Department of the Navy
Telephone: 843-820-7326
Last EDR Contact: 11/13/2015
Next Scheduled EDR Contact: 02/29/2016
Data Release Frequency: Varies

US ENG CONTROLS: Engineering Controls Sites List

A listing of sites with engineering controls in place. Engineering controls include various forms of caps, building foundations, liners, and treatment methods to create pathway elimination for regulated substances to enter environmental media or effect human health.

Date of Government Version: 09/10/2015
Date Data Arrived at EDR: 09/11/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 53

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 11/24/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Varies

US INST CONTROL: Sites with Institutional Controls

A listing of sites with institutional controls in place. Institutional controls include administrative measures, such as groundwater use restrictions, construction restrictions, property use restrictions, and post remediation care requirements intended to prevent exposure to contaminants remaining on site. Deed restrictions are generally required as part of the institutional controls.

Date of Government Version: 09/10/2015
Date Data Arrived at EDR: 09/11/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 53

Source: Environmental Protection Agency
Telephone: 703-603-0695
Last EDR Contact: 11/24/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Varies

Federal ERNS list

ERNS: Emergency Response Notification System

Emergency Response Notification System. ERNS records and stores information on reported releases of oil and hazardous substances.

Date of Government Version: 06/22/2015
Date Data Arrived at EDR: 06/26/2015
Date Made Active in Reports: 09/16/2015
Number of Days to Update: 82

Source: National Response Center, United States Coast Guard
Telephone: 202-267-2180
Last EDR Contact: 09/29/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Annually

State- and tribal - equivalent CERCLIS

SHWS: Sites List

Facilities, sites or areas in which the Office of Hazard Evaluation and Emergency Response has an interest, has investigated or may investigate under HRS 128D (includes CERCLIS sites).

Date of Government Version: 12/02/2014
Date Data Arrived at EDR: 12/22/2014
Date Made Active in Reports: 01/27/2015
Number of Days to Update: 36

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 11/25/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Semi-Annually

State and tribal landfill and/or solid waste disposal site lists

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

SWF/LF: Permitted Landfills in the State of Hawaii

Solid Waste Facilities/Landfill Sites. SWF/LF type records typically contain an inventory of solid waste disposal facilities or landfills in a particular state. Depending on the state, these may be active or inactive facilities or open dumps that failed to meet RCRA Subtitle D Section 4004 criteria for solid waste landfills or disposal sites.

Date of Government Version: 09/17/2012
Date Data Arrived at EDR: 04/03/2013
Date Made Active in Reports: 05/10/2013
Number of Days to Update: 37

Source: Department of Health
Telephone: 808-586-4245
Last EDR Contact: 10/02/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Varies

State and tribal leaking storage tank lists

LUST: Leaking Underground Storage Tank Database

Leaking Underground Storage Tank Incident Reports. LUST records contain an inventory of reported leaking underground storage tank incidents. Not all states maintain these records, and the information stored varies by state.

Date of Government Version: 09/04/2015
Date Data Arrived at EDR: 09/25/2015
Date Made Active in Reports: 11/06/2015
Number of Days to Update: 42

Source: Department of Health
Telephone: 808-586-4228
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Semi-Annually

INDIAN LUST R8: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Colorado, Montana, North Dakota, South Dakota, Utah and Wyoming.

Date of Government Version: 04/30/2015
Date Data Arrived at EDR: 05/05/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 48

Source: EPA Region 8
Telephone: 303-312-6271
Last EDR Contact: 10/08/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Quarterly

INDIAN LUST R7: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in Iowa, Kansas, and Nebraska

Date of Government Version: 03/30/2015
Date Data Arrived at EDR: 04/28/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 55

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 10/08/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN LUST R6: Leaking Underground Storage Tanks on Indian Land

LUSTs on Indian land in New Mexico and Oklahoma.

Date of Government Version: 05/13/2015
Date Data Arrived at EDR: 08/03/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 71

Source: EPA Region 6
Telephone: 214-665-6597
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN LUST R1: Leaking Underground Storage Tanks on Indian Land

A listing of leaking underground storage tank locations on Indian Land.

Date of Government Version: 02/03/2015
Date Data Arrived at EDR: 04/30/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 53

Source: EPA Region 1
Telephone: 617-918-1313
Last EDR Contact: 10/27/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN LUST R4: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Florida, Mississippi and North Carolina.

Date of Government Version: 07/30/2015
Date Data Arrived at EDR: 08/07/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 67

Source: EPA Region 4
Telephone: 404-562-8677
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Semi-Annually

INDIAN LUST R10: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Alaska, Idaho, Oregon and Washington.

Date of Government Version: 07/21/2015
Date Data Arrived at EDR: 07/29/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 76

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Quarterly

INDIAN LUST R5: Leaking Underground Storage Tanks on Indian Land
Leaking underground storage tanks located on Indian Land in Michigan, Minnesota and Wisconsin.

Date of Government Version: 07/28/2015
Date Data Arrived at EDR: 08/07/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 67

Source: EPA, Region 5
Telephone: 312-886-7439
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN LUST R9: Leaking Underground Storage Tanks on Indian Land
LUSTs on Indian land in Arizona, California, New Mexico and Nevada

Date of Government Version: 01/08/2015
Date Data Arrived at EDR: 01/08/2015
Date Made Active in Reports: 02/09/2015
Number of Days to Update: 32

Source: Environmental Protection Agency
Telephone: 415-972-3372
Last EDR Contact: 10/30/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Quarterly

State and tribal registered storage tank lists

FEMA UST: Underground Storage Tank Listing
A listing of all FEMA owned underground storage tanks.

Date of Government Version: 01/01/2010
Date Data Arrived at EDR: 02/16/2010
Date Made Active in Reports: 04/12/2010
Number of Days to Update: 55

Source: FEMA
Telephone: 202-646-5797
Last EDR Contact: 10/08/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Varies

UST: Underground Storage Tank Database
Registered Underground Storage Tanks. UST's are regulated under Subtitle I of the Resource Conservation and Recovery Act (RCRA) and must be registered with the state department responsible for administering the UST program. Available information varies by state program.

Date of Government Version: 09/04/2015
Date Data Arrived at EDR: 09/25/2015
Date Made Active in Reports: 11/06/2015
Number of Days to Update: 42

Source: Department of Health
Telephone: 808-586-4228
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Semi-Annually

INDIAN UST R1: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 1 (Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island, Vermont and ten Tribal Nations).

Date of Government Version: 02/03/2015
Date Data Arrived at EDR: 04/30/2015
Date Made Active in Reports: 06/22/2015
Number of Days to Update: 53

Source: EPA, Region 1
Telephone: 617-918-1313
Last EDR Contact: 10/27/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN UST R6: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 6 (Louisiana, Arkansas, Oklahoma, New Mexico, Texas and 65 Tribes).

Date of Government Version: 05/13/2015
Date Data Arrived at EDR: 08/03/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 71

Source: EPA Region 6
Telephone: 214-665-7591
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Semi-Annually

INDIAN UST R7: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 7 (Iowa, Kansas, Missouri, Nebraska, and 9 Tribal Nations).

Date of Government Version: 09/23/2014
Date Data Arrived at EDR: 11/25/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 65

Source: EPA Region 7
Telephone: 913-551-7003
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN UST R4: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 4 (Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee and Tribal Nations)

Date of Government Version: 07/30/2015
Date Data Arrived at EDR: 08/07/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 67

Source: EPA Region 4
Telephone: 404-562-9424
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Semi-Annually

INDIAN UST R5: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 5 (Michigan, Minnesota and Wisconsin and Tribal Nations).

Date of Government Version: 07/28/2015
Date Data Arrived at EDR: 08/07/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 67

Source: EPA Region 5
Telephone: 312-886-6136
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

INDIAN UST R10: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 10 (Alaska, Idaho, Oregon, Washington, and Tribal Nations).

Date of Government Version: 07/21/2015
Date Data Arrived at EDR: 07/29/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 76

Source: EPA Region 10
Telephone: 206-553-2857
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Quarterly

INDIAN UST R9: Underground Storage Tanks on Indian Land

The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 9 (Arizona, California, Hawaii, Nevada, the Pacific Islands, and Tribal Nations).

Date of Government Version: 12/14/2014
Date Data Arrived at EDR: 02/13/2015
Date Made Active in Reports: 03/13/2015
Number of Days to Update: 28

Source: EPA Region 9
Telephone: 415-972-3368
Last EDR Contact: 10/30/2015
Next Scheduled EDR Contact: 02/09/2016
Data Release Frequency: Quarterly

INDIAN UST R8: Underground Storage Tanks on Indian Land
The Indian Underground Storage Tank (UST) database provides information about underground storage tanks on Indian land in EPA Region 8 (Colorado, Montana, North Dakota, South Dakota, Utah, Wyoming and 27 Tribal Nations).

Date of Government Version: 07/28/2015
Date Data Arrived at EDR: 08/14/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 60

Source: EPA Region 8
Telephone: 303-312-6137
Last EDR Contact: 07/22/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Quarterly

State and tribal institutional control / engineering control registries

ENG CONTROLS: Engineering Control Sites
A listing of sites with engineering controls in place.

Date of Government Version: 12/02/2014
Date Data Arrived at EDR: 12/22/2014
Date Made Active in Reports: 01/27/2015
Number of Days to Update: 36

Source: Department of Health
Telephone: 404-586-4249
Last EDR Contact: 11/25/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

INST CONTROL: Sites with Institutional Controls
Voluntary Remediation Program and Brownfields sites with institutional controls in place.

Date of Government Version: 12/02/2014
Date Data Arrived at EDR: 12/22/2014
Date Made Active in Reports: 01/27/2015
Number of Days to Update: 36

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 11/25/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

State and tribal voluntary cleanup sites

INDIAN VCP R7: Voluntary Cleanup Priority Lisitng
A listing of voluntary cleanup priority sites located on Indian Land located in Region 7.

Date of Government Version: 03/20/2008
Date Data Arrived at EDR: 04/22/2008
Date Made Active in Reports: 05/19/2008
Number of Days to Update: 27

Source: EPA, Region 7
Telephone: 913-551-7365
Last EDR Contact: 04/20/2009
Next Scheduled EDR Contact: 07/20/2009
Data Release Frequency: Varies

INDIAN VCP R1: Voluntary Cleanup Priority Listing
A listing of voluntary cleanup priority sites located on Indian Land located in Region 1.

Date of Government Version: 09/29/2014
Date Data Arrived at EDR: 10/01/2014
Date Made Active in Reports: 11/06/2014
Number of Days to Update: 36

Source: EPA, Region 1
Telephone: 617-918-1102
Last EDR Contact: 09/29/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Varies

VCP: Voluntary Response Program Sites
Sites participating in the Voluntary Response Program. The purpose of the VRP is to streamline the cleanup process in a way that will encourage prospective developers, lenders, and purchasers to voluntarily cleanup properties.

Date of Government Version: 12/02/2014
Date Data Arrived at EDR: 12/22/2014
Date Made Active in Reports: 01/27/2015
Number of Days to Update: 36

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 11/25/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

State and tribal Brownfields sites

BROWNFIELDS: Brownfields Sites

With certain legal exclusions and additions, the term ‘brownfield site’ means real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant.

Date of Government Version: 12/02/2014
Date Data Arrived at EDR: 12/22/2014
Date Made Active in Reports: 01/27/2015
Number of Days to Update: 36

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 11/25/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

ADDITIONAL ENVIRONMENTAL RECORDS

Local Brownfield lists

US BROWNFIELDS: A Listing of Brownfields Sites

Brownfields are real property, the expansion, redevelopment, or reuse of which may be complicated by the presence or potential presence of a hazardous substance, pollutant, or contaminant. Cleaning up and reinvesting in these properties takes development pressures off of undeveloped, open land, and both improves and protects the environment. Assessment, Cleanup and Redevelopment Exchange System (ACRES) stores information reported by EPA Brownfields grant recipients on brownfields properties assessed or cleaned up with grant funding as well as information on Targeted Brownfields Assessments performed by EPA Regions. A listing of ACRES Brownfield sites is obtained from Cleanups in My Community. Cleanups in My Community provides information on Brownfields properties for which information is reported back to EPA, as well as areas served by Brownfields grant programs.

Date of Government Version: 06/22/2015
Date Data Arrived at EDR: 06/24/2015
Date Made Active in Reports: 09/02/2015
Number of Days to Update: 70

Source: Environmental Protection Agency
Telephone: 202-566-2777
Last EDR Contact: 12/21/2015
Next Scheduled EDR Contact: 04/04/2016
Data Release Frequency: Semi-Annually

Local Lists of Landfill / Solid Waste Disposal Sites

INDIAN ODI: Report on the Status of Open Dumps on Indian Lands

Location of open dumps on Indian land.

Date of Government Version: 12/31/1998
Date Data Arrived at EDR: 12/03/2007
Date Made Active in Reports: 01/24/2008
Number of Days to Update: 52

Source: Environmental Protection Agency
Telephone: 703-308-8245
Last EDR Contact: 11/06/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Varies

ODI: Open Dump Inventory

An open dump is defined as a disposal facility that does not comply with one or more of the Part 257 or Part 258 Subtitle D Criteria.

Date of Government Version: 06/30/1985
Date Data Arrived at EDR: 08/09/2004
Date Made Active in Reports: 09/17/2004
Number of Days to Update: 39

Source: Environmental Protection Agency
Telephone: 800-424-9346
Last EDR Contact: 06/09/2004
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

DEBRIS REGION 9: Torres Martinez Reservation Illegal Dump Site Locations

A listing of illegal dump sites location on the Torres Martinez Indian Reservation located in eastern Riverside County and northern Imperial County, California.

Date of Government Version: 01/12/2009
Date Data Arrived at EDR: 05/07/2009
Date Made Active in Reports: 09/21/2009
Number of Days to Update: 137

Source: EPA, Region 9
Telephone: 415-947-4219
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: No Update Planned

Local Lists of Hazardous waste / Contaminated Sites

US HIST CDL: National Clandestine Laboratory Register

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 08/12/2015
Date Data Arrived at EDR: 09/04/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 60

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 08/31/2015
Next Scheduled EDR Contact: 12/14/2015
Data Release Frequency: No Update Planned

CDL: Clandestine Drug Lab Listing

A listing of clandestine drug lab site locations.

Date of Government Version: 08/04/2010
Date Data Arrived at EDR: 09/10/2010
Date Made Active in Reports: 10/22/2010
Number of Days to Update: 42

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 11/24/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Varies

US CDL: Clandestine Drug Labs

A listing of clandestine drug lab locations. The U.S. Department of Justice ("the Department") provides this web site as a public service. It contains addresses of some locations where law enforcement agencies reported they found chemicals or other items that indicated the presence of either clandestine drug laboratories or dumpsites. In most cases, the source of the entries is not the Department, and the Department has not verified the entry and does not guarantee its accuracy. Members of the public must verify the accuracy of all entries by, for example, contacting local law enforcement and local health departments.

Date of Government Version: 08/12/2015
Date Data Arrived at EDR: 09/04/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 60

Source: Drug Enforcement Administration
Telephone: 202-307-1000
Last EDR Contact: 11/25/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Quarterly

Local Land Records

LIENS 2: CERCLA Lien Information

A Federal CERCLA ('Superfund') lien can exist by operation of law at any site or property at which EPA has spent Superfund monies. These monies are spent to investigate and address releases and threatened releases of contamination. CERCLIS provides information as to the identity of these sites and properties.

Date of Government Version: 02/18/2014
Date Data Arrived at EDR: 03/18/2014
Date Made Active in Reports: 04/24/2014
Number of Days to Update: 37

Source: Environmental Protection Agency
Telephone: 202-564-6023
Last EDR Contact: 10/30/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

Records of Emergency Release Reports

HMIRS: Hazardous Materials Information Reporting System
Hazardous Materials Incident Report System. HMIRS contains hazardous material spill incidents reported to DOT.

Date of Government Version: 06/24/2015
Date Data Arrived at EDR: 06/26/2015
Date Made Active in Reports: 09/02/2015
Number of Days to Update: 68

Source: U.S. Department of Transportation
Telephone: 202-366-4555
Last EDR Contact: 09/29/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Annually

SPILLS: Release Notifications
Releases of hazardous substances to the environment reported to the Office of Hazard Evaluation and Emergency Response since 1988.

Date of Government Version: 12/02/2014
Date Data Arrived at EDR: 12/22/2014
Date Made Active in Reports: 01/28/2015
Number of Days to Update: 37

Source: Department of Health
Telephone: 808-586-4249
Last EDR Contact: 11/25/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

SPILLS 90: SPILLS90 data from FirstSearch
Spills 90 includes those spill and release records available exclusively from FirstSearch databases. Typically, they may include chemical, oil and/or hazardous substance spills recorded after 1990. Duplicate records that are already included in EDR incident and release records are not included in Spills 90.

Date of Government Version: 03/10/2012
Date Data Arrived at EDR: 01/03/2013
Date Made Active in Reports: 02/11/2013
Number of Days to Update: 39

Source: FirstSearch
Telephone: N/A
Last EDR Contact: 01/03/2013
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

Other Ascertainable Records

RCRA NonGen / NLR: RCRA - Non Generators / No Longer Regulated
RCRAInfo is EPA's comprehensive information system, providing access to data supporting the Resource Conservation and Recovery Act (RCRA) of 1976 and the Hazardous and Solid Waste Amendments (HSWA) of 1984. The database includes selective information on sites which generate, transport, store, treat and/or dispose of hazardous waste as defined by the Resource Conservation and Recovery Act (RCRA). Non-Generators do not presently generate hazardous waste.

Date of Government Version: 06/09/2015
Date Data Arrived at EDR: 06/26/2015
Date Made Active in Reports: 09/16/2015
Number of Days to Update: 82

Source: Environmental Protection Agency
Telephone: (415) 495-8895
Last EDR Contact: 12/18/2015
Next Scheduled EDR Contact: 04/11/2016
Data Release Frequency: Varies

FUDS: Formerly Used Defense Sites
The listing includes locations of Formerly Used Defense Sites properties where the US Army Corps of Engineers is actively working or will take necessary cleanup actions.

Date of Government Version: 01/31/2015
Date Data Arrived at EDR: 07/08/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 97

Source: U.S. Army Corps of Engineers
Telephone: 202-528-4285
Last EDR Contact: 12/11/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Varies

DOD: Department of Defense Sites
This data set consists of federally owned or administered lands, administered by the Department of Defense, that have any area equal to or greater than 640 acres of the United States, Puerto Rico, and the U.S. Virgin Islands.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 11/10/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 62

Source: USGS
Telephone: 888-275-8747
Last EDR Contact: 10/16/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Semi-Annually

FEDLAND: Federal and Indian Lands

Federally and Indian administrated lands of the United States. Lands included are administrated by: Army Corps of Engineers, Bureau of Reclamation, National Wild and Scenic River, National Wildlife Refuge, Public Domain Land, Wilderness, Wilderness Study Area, Wildlife Management Area, Bureau of Indian Affairs, Bureau of Land Management, Department of Justice, Forest Service, Fish and Wildlife Service, National Park Service.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 02/06/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 339

Source: U.S. Geological Survey
Telephone: 888-275-8747
Last EDR Contact: 10/16/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: N/A

SCRD DRYCLEANERS: State Coalition for Remediation of Drycleaners Listing

The State Coalition for Remediation of Drycleaners was established in 1998, with support from the U.S. EPA Office of Superfund Remediation and Technology Innovation. It is comprised of representatives of states with established drycleaner remediation programs. Currently the member states are Alabama, Connecticut, Florida, Illinois, Kansas, Minnesota, Missouri, North Carolina, Oregon, South Carolina, Tennessee, Texas, and Wisconsin.

Date of Government Version: 03/07/2011
Date Data Arrived at EDR: 03/09/2011
Date Made Active in Reports: 05/02/2011
Number of Days to Update: 54

Source: Environmental Protection Agency
Telephone: 615-532-8599
Last EDR Contact: 11/19/2015
Next Scheduled EDR Contact: 02/29/2016
Data Release Frequency: Varies

US FIN ASSUR: Financial Assurance Information

All owners and operators of facilities that treat, store, or dispose of hazardous waste are required to provide proof that they will have sufficient funds to pay for the clean up, closure, and post-closure care of their facilities.

Date of Government Version: 09/01/2015
Date Data Arrived at EDR: 09/03/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 61

Source: Environmental Protection Agency
Telephone: 202-566-1917
Last EDR Contact: 11/13/2015
Next Scheduled EDR Contact: 02/29/2016
Data Release Frequency: Quarterly

EPA WATCH LIST: EPA WATCH LIST

EPA maintains a "Watch List" to facilitate dialogue between EPA, state and local environmental agencies on enforcement matters relating to facilities with alleged violations identified as either significant or high priority. Being on the Watch List does not mean that the facility has actually violated the law only that an investigation by EPA or a state or local environmental agency has led those organizations to allege that an unproven violation has in fact occurred. Being on the Watch List does not represent a higher level of concern regarding the alleged violations that were detected, but instead indicates cases requiring additional dialogue between EPA, state and local agencies - primarily because of the length of time the alleged violation has gone unaddressed or unresolved.

Date of Government Version: 08/30/2013
Date Data Arrived at EDR: 03/21/2014
Date Made Active in Reports: 06/17/2014
Number of Days to Update: 88

Source: Environmental Protection Agency
Telephone: 617-520-3000
Last EDR Contact: 11/10/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Quarterly

2020 COR ACTION: 2020 Corrective Action Program List

The EPA has set ambitious goals for the RCRA Corrective Action program by creating the 2020 Corrective Action Universe. This RCRA cleanup baseline includes facilities expected to need corrective action. The 2020 universe contains a wide variety of sites. Some properties are heavily contaminated while others were contaminated but have since been cleaned up. Still others have not been fully investigated yet, and may require little or no remediation. Inclusion in the 2020 Universe does not necessarily imply failure on the part of a facility to meet its RCRA obligations.

Date of Government Version: 04/22/2013
Date Data Arrived at EDR: 03/03/2015
Date Made Active in Reports: 03/09/2015
Number of Days to Update: 6

Source: Environmental Protection Agency
Telephone: 703-308-4044
Last EDR Contact: 11/13/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Varies

TSCA: Toxic Substances Control Act

Toxic Substances Control Act. TSCA identifies manufacturers and importers of chemical substances included on the TSCA Chemical Substance Inventory list. It includes data on the production volume of these substances by plant site.

Date of Government Version: 12/31/2012
Date Data Arrived at EDR: 01/15/2015
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 14

Source: EPA
Telephone: 202-260-5521
Last EDR Contact: 09/25/2015
Next Scheduled EDR Contact: 01/04/2016
Data Release Frequency: Every 4 Years

TRIS: Toxic Chemical Release Inventory System

Toxic Release Inventory System. TRIS identifies facilities which release toxic chemicals to the air, water and land in reportable quantities under SARA Title III Section 313.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 02/12/2015
Date Made Active in Reports: 06/02/2015
Number of Days to Update: 110

Source: EPA
Telephone: 202-566-0250
Last EDR Contact: 11/24/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Annually

SSTS: Section 7 Tracking Systems

Section 7 of the Federal Insecticide, Fungicide and Rodenticide Act, as amended (92 Stat. 829) requires all registered pesticide-producing establishments to submit a report to the Environmental Protection Agency by March 1st each year. Each establishment must report the types and amounts of pesticides, active ingredients and devices being produced, and those having been produced and sold or distributed in the past year.

Date of Government Version: 12/31/2009
Date Data Arrived at EDR: 12/10/2010
Date Made Active in Reports: 02/25/2011
Number of Days to Update: 77

Source: EPA
Telephone: 202-564-4203
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Annually

ROD: Records Of Decision

Record of Decision. ROD documents mandate a permanent remedy at an NPL (Superfund) site containing technical and health information to aid in the cleanup.

Date of Government Version: 11/25/2013
Date Data Arrived at EDR: 12/12/2013
Date Made Active in Reports: 02/24/2014
Number of Days to Update: 74

Source: EPA
Telephone: 703-416-0223
Last EDR Contact: 12/11/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Annually

RMP: Risk Management Plans

When Congress passed the Clean Air Act Amendments of 1990, it required EPA to publish regulations and guidance for chemical accident prevention at facilities using extremely hazardous substances. The Risk Management Program Rule (RMP Rule) was written to implement Section 112(r) of these amendments. The rule, which built upon existing industry codes and standards, requires companies of all sizes that use certain flammable and toxic substances to develop a Risk Management Program, which includes a(n): Hazard assessment that details the potential effects of an accidental release, an accident history of the last five years, and an evaluation of worst-case and alternative accidental releases; Prevention program that includes safety precautions and maintenance, monitoring, and employee training measures; and Emergency response program that spells out emergency health care, employee training measures and procedures for informing the public and response agencies (e.g the fire department) should an accident occur.

Date of Government Version: 08/01/2015
Date Data Arrived at EDR: 08/26/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 69

Source: Environmental Protection Agency
Telephone: 202-564-8600
Last EDR Contact: 10/26/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

RAATS: RCRA Administrative Action Tracking System

RCRA Administration Action Tracking System. RAATS contains records based on enforcement actions issued under RCRA pertaining to major violators and includes administrative and civil actions brought by the EPA. For administration actions after September 30, 1995, data entry in the RAATS database was discontinued. EPA will retain a copy of the database for historical records. It was necessary to terminate RAATS because a decrease in agency resources made it impossible to continue to update the information contained in the database.

Date of Government Version: 04/17/1995
Date Data Arrived at EDR: 07/03/1995
Date Made Active in Reports: 08/07/1995
Number of Days to Update: 35

Source: EPA
Telephone: 202-564-4104
Last EDR Contact: 06/02/2008
Next Scheduled EDR Contact: 09/01/2008
Data Release Frequency: No Update Planned

PRP: Potentially Responsible Parties

A listing of verified Potentially Responsible Parties

Date of Government Version: 10/25/2013
Date Data Arrived at EDR: 10/17/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 3

Source: EPA
Telephone: 202-564-6023
Last EDR Contact: 11/13/2015
Next Scheduled EDR Contact: 02/22/2016
Data Release Frequency: Quarterly

PADS: PCB Activity Database System

PCB Activity Database. PADS Identifies generators, transporters, commercial storers and/or brokers and disposers of PCB's who are required to notify the EPA of such activities.

Date of Government Version: 07/01/2014
Date Data Arrived at EDR: 10/15/2014
Date Made Active in Reports: 11/17/2014
Number of Days to Update: 33

Source: EPA
Telephone: 202-566-0500
Last EDR Contact: 10/29/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Annually

ICIS: Integrated Compliance Information System

The Integrated Compliance Information System (ICIS) supports the information needs of the national enforcement and compliance program as well as the unique needs of the National Pollutant Discharge Elimination System (NPDES) program.

Date of Government Version: 01/23/2015
Date Data Arrived at EDR: 02/06/2015
Date Made Active in Reports: 03/09/2015
Number of Days to Update: 31

Source: Environmental Protection Agency
Telephone: 202-564-5088
Last EDR Contact: 10/08/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Quarterly

GOVERNMENT RECORDS SEARCHED / DATA CURRENCY TRACKING

FTTS: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

FTTS tracks administrative cases and pesticide enforcement actions and compliance activities related to FIFRA, TSCA and EPCRA (Emergency Planning and Community Right-to-Know Act). To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA/Office of Prevention, Pesticides and Toxic Substances
Telephone: 202-566-1667
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Quarterly

FTTS INSP: FIFRA/ TSCA Tracking System - FIFRA (Federal Insecticide, Fungicide, & Rodenticide Act)/TSCA (Toxic Substances Control Act)

A listing of FIFRA/TSCA Tracking System (FTTS) inspections and enforcements.

Date of Government Version: 04/09/2009
Date Data Arrived at EDR: 04/16/2009
Date Made Active in Reports: 05/11/2009
Number of Days to Update: 25

Source: EPA
Telephone: 202-566-1667
Last EDR Contact: 11/18/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Quarterly

MLTS: Material Licensing Tracking System

MLTS is maintained by the Nuclear Regulatory Commission and contains a list of approximately 8,100 sites which possess or use radioactive materials and which are subject to NRC licensing requirements. To maintain currency, EDR contacts the Agency on a quarterly basis.

Date of Government Version: 06/26/2015
Date Data Arrived at EDR: 07/10/2015
Date Made Active in Reports: 10/13/2015
Number of Days to Update: 95

Source: Nuclear Regulatory Commission
Telephone: 301-415-7169
Last EDR Contact: 12/07/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Quarterly

COAL ASH DOE: Steam-Electric Plant Operation Data

A listing of power plants that store ash in surface ponds.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 08/07/2009
Date Made Active in Reports: 10/22/2009
Number of Days to Update: 76

Source: Department of Energy
Telephone: 202-586-8719
Last EDR Contact: 07/13/2015
Next Scheduled EDR Contact: 10/28/2015
Data Release Frequency: Varies

COAL ASH EPA: Coal Combustion Residues Surface Impoundments List

A listing of coal combustion residues surface impoundments with high hazard potential ratings.

Date of Government Version: 07/01/2014
Date Data Arrived at EDR: 09/10/2014
Date Made Active in Reports: 10/20/2014
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: N/A
Last EDR Contact: 12/11/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Varies

PCB TRANSFORMER: PCB Transformer Registration Database

The database of PCB transformer registrations that includes all PCB registration submittals.

Date of Government Version: 02/01/2011
Date Data Arrived at EDR: 10/19/2011
Date Made Active in Reports: 01/10/2012
Number of Days to Update: 83

Source: Environmental Protection Agency
Telephone: 202-566-0517
Last EDR Contact: 10/29/2015
Next Scheduled EDR Contact: 02/08/2016
Data Release Frequency: Varies

RADINFO: Radiation Information Database

The Radiation Information Database (RADINFO) contains information about facilities that are regulated by U.S. Environmental Protection Agency (EPA) regulations for radiation and radioactivity.

Date of Government Version: 07/07/2015
Date Data Arrived at EDR: 07/09/2015
Date Made Active in Reports: 09/16/2015
Number of Days to Update: 69

Source: Environmental Protection Agency
Telephone: 202-343-9775
Last EDR Contact: 10/07/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Quarterly

HIST FTTS: FIFRA/TSCA Tracking System Administrative Case Listing

A complete administrative case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2007
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

HIST FTTS INSP: FIFRA/TSCA Tracking System Inspection & Enforcement Case Listing

A complete inspection and enforcement case listing from the FIFRA/TSCA Tracking System (FTTS) for all ten EPA regions. The information was obtained from the National Compliance Database (NCDB). NCDB supports the implementation of FIFRA (Federal Insecticide, Fungicide, and Rodenticide Act) and TSCA (Toxic Substances Control Act). Some EPA regions are now closing out records. Because of that, and the fact that some EPA regions are not providing EPA Headquarters with updated records, it was decided to create a HIST FTTS database. It included records that may not be included in the newer FTTS database updates. This database is no longer updated.

Date of Government Version: 10/19/2006
Date Data Arrived at EDR: 03/01/2007
Date Made Active in Reports: 04/10/2007
Number of Days to Update: 40

Source: Environmental Protection Agency
Telephone: 202-564-2501
Last EDR Contact: 12/17/2008
Next Scheduled EDR Contact: 03/17/2008
Data Release Frequency: No Update Planned

DOT OPS: Incident and Accident Data

Department of Transporation, Office of Pipeline Safety Incident and Accident data.

Date of Government Version: 07/31/2012
Date Data Arrived at EDR: 08/07/2012
Date Made Active in Reports: 09/18/2012
Number of Days to Update: 42

Source: Department of Transporation, Office of Pipeline Safety
Telephone: 202-366-4595
Last EDR Contact: 11/07/2015
Next Scheduled EDR Contact: 02/15/2016
Data Release Frequency: Varies

CONSENT: Superfund (CERCLA) Consent Decrees

Major legal settlements that establish responsibility and standards for cleanup at NPL (Superfund) sites. Released periodically by United States District Courts after settlement by parties to litigation matters.

Date of Government Version: 12/31/2014
Date Data Arrived at EDR: 04/17/2015
Date Made Active in Reports: 06/02/2015
Number of Days to Update: 46

Source: Department of Justice, Consent Decree Library
Telephone: Varies
Last EDR Contact: 09/28/2015
Next Scheduled EDR Contact: 01/11/2016
Data Release Frequency: Varies

BRS: Biennial Reporting System

The Biennial Reporting System is a national system administered by the EPA that collects data on the generation and management of hazardous waste. BRS captures detailed data from two groups: Large Quantity Generators (LQG) and Treatment, Storage, and Disposal Facilities.

Date of Government Version: 12/31/2013
Date Data Arrived at EDR: 02/24/2015
Date Made Active in Reports: 09/30/2015
Number of Days to Update: 218

Source: EPA/NTIS
Telephone: 800-424-9346
Last EDR Contact: 11/24/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Biennially

INDIAN RESERV: Indian Reservations

This map layer portrays Indian administered lands of the United States that have any area equal to or greater than 640 acres.

Date of Government Version: 12/31/2005
Date Data Arrived at EDR: 12/08/2006
Date Made Active in Reports: 01/11/2007
Number of Days to Update: 34

Source: USGS
Telephone: 202-208-3710
Last EDR Contact: 10/16/2015
Next Scheduled EDR Contact: 01/25/2016
Data Release Frequency: Semi-Annually

UMTRA: Uranium Mill Tailings Sites

Uranium ore was mined by private companies for federal government use in national defense programs. When the mills shut down, large piles of the sand-like material (mill tailings) remain after uranium has been extracted from the ore. Levels of human exposure to radioactive materials from the piles are low; however, in some cases tailings were used as construction materials before the potential health hazards of the tailings were recognized.

Date of Government Version: 09/14/2010
Date Data Arrived at EDR: 10/07/2011
Date Made Active in Reports: 03/01/2012
Number of Days to Update: 146

Source: Department of Energy
Telephone: 505-845-0011
Last EDR Contact: 11/19/2015
Next Scheduled EDR Contact: 03/07/2016
Data Release Frequency: Varies

LEAD SMELTER 1: Lead Smelter Sites

A listing of former lead smelter site locations.

Date of Government Version: 11/25/2014
Date Data Arrived at EDR: 11/26/2014
Date Made Active in Reports: 01/29/2015
Number of Days to Update: 64

Source: Environmental Protection Agency
Telephone: 703-603-8787
Last EDR Contact: 10/05/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Varies

LEAD SMELTER 2: Lead Smelter Sites

A list of several hundred sites in the U.S. where secondary lead smelting was done from 1931and 1964. These sites may pose a threat to public health through ingestion or inhalation of contaminated soil or dust

Date of Government Version: 04/05/2001
Date Data Arrived at EDR: 10/27/2010
Date Made Active in Reports: 12/02/2010
Number of Days to Update: 36

Source: American Journal of Public Health
Telephone: 703-305-6451
Last EDR Contact: 12/02/2009
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

US AIRS (AFS): Aerometric Information Retrieval System Facility Subsystem (AFS)

The database is a sub-system of Aerometric Information Retrieval System (AIRS). AFS contains compliance data on air pollution point sources regulated by the U.S. EPA and/or state and local air regulatory agencies. This information comes from source reports by various stationary sources of air pollution, such as electric power plants, steel mills, factories, and universities, and provides information about the air pollutants they produce. Action, air program, air program pollutant, and general level plant data. It is used to track emissions and compliance data from industrial plants.

Date of Government Version: 07/22/2015
Date Data Arrived at EDR: 07/24/2015
Date Made Active in Reports: 09/02/2015
Number of Days to Update: 40

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 12/22/2015
Next Scheduled EDR Contact: 04/11/2016
Data Release Frequency: Annually

US AIRS MINOR: Air Facility System Data

A listing of minor source facilities.

Date of Government Version: 07/22/2015
Date Data Arrived at EDR: 07/24/2015
Date Made Active in Reports: 09/02/2015
Number of Days to Update: 40

Source: EPA
Telephone: 202-564-2496
Last EDR Contact: 12/22/2015
Next Scheduled EDR Contact: 04/11/2016
Data Release Frequency: Annually

US MINES: Mines Master Index File

Contains all mine identification numbers issued for mines active or opened since 1971. The data also includes violation information.

Date of Government Version: 05/14/2015
Date Data Arrived at EDR: 06/03/2015
Date Made Active in Reports: 09/02/2015
Number of Days to Update: 91

Source: Department of Labor, Mine Safety and Health Administration
Telephone: 303-231-5959
Last EDR Contact: 12/03/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Semi-Annually

US MINES 2: Ferrous and Nonferrous Metal Mines Database Listing

This map layer includes ferrous (ferrous metal mines are facilities that extract ferrous metals, such as iron ore or molybdenum) and nonferrous (Nonferrous metal mines are facilities that extract nonferrous metals, such as gold, silver, copper, zinc, and lead) metal mines in the United States.

Date of Government Version: 12/05/2005
Date Data Arrived at EDR: 02/29/2008
Date Made Active in Reports: 04/18/2008
Number of Days to Update: 49

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Varies

US MINES 3: Active Mines & Mineral Plants Database Listing

Active Mines and Mineral Processing Plant operations for commodities monitored by the Minerals Information Team of the USGS.

Date of Government Version: 04/14/2011
Date Data Arrived at EDR: 06/08/2011
Date Made Active in Reports: 09/13/2011
Number of Days to Update: 97

Source: USGS
Telephone: 703-648-7709
Last EDR Contact: 12/04/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Varies

FINDS: Facility Index System/Facility Registry System

Facility Index System. FINDS contains both facility information and 'pointers' to other sources that contain more detail. EDR includes the following FINDS databases in this report: PCS (Permit Compliance System), AIRS (Aerometric Information Retrieval System), DOCKET (Enforcement Docket used to manage and track information on civil judicial enforcement cases for all environmental statutes), FURS (Federal Underground Injection Control), C-DOCKET (Criminal Docket System used to track criminal enforcement actions for all environmental statutes), FFIS (Federal Facilities Information System), STATE (State Environmental Laws and Statutes), and PADS (PCB Activity Data System).

Date of Government Version: 07/20/2015
Date Data Arrived at EDR: 09/09/2015
Date Made Active in Reports: 11/03/2015
Number of Days to Update: 55

Source: EPA
Telephone: (415) 947-8000
Last EDR Contact: 12/10/2015
Next Scheduled EDR Contact: 03/21/2016
Data Release Frequency: Quarterly

AIRS: List of Permitted Facilities

A listing of permitted facilities in the state.

Date of Government Version: 10/06/2015
Date Data Arrived at EDR: 10/08/2015
Date Made Active in Reports: 11/06/2015
Number of Days to Update: 29

Source: Department of Health
Telephone: 808-586-4200
Last EDR Contact: 10/05/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Varies

DRYCLEANERS: Permitted Drycleaner Facility Listing

A listing of permitted drycleaner facilities in the state.

Date of Government Version: 10/05/2015
Date Data Arrived at EDR: 10/08/2015
Date Made Active in Reports: 11/16/2015
Number of Days to Update: 39

Source: Department of Health
Telephone: 808-586-4200
Last EDR Contact: 10/05/2015
Next Scheduled EDR Contact: 01/18/2016
Data Release Frequency: Varies

Financial Assurance: Financial Assurance Information Listing

A listing of financial assurance information for underground storage tank facilities. Financial assurance is intended to ensure that resources are available to pay for the cost of closure, post-closure care, and corrective measures if the owner or operator of a regulated facility is unable or unwilling to pay.

Date of Government Version: 09/28/2015
Date Data Arrived at EDR: 09/29/2015
Date Made Active in Reports: 11/06/2015
Number of Days to Update: 38

Source: Department of Health
Telephone: 808-586-4226
Last EDR Contact: 12/11/2015
Next Scheduled EDR Contact: 03/28/2016
Data Release Frequency: Varies

UIC: Underground Injection Wells Listing

A listing of underground injection well locations.

Date of Government Version: 02/07/2013
Date Data Arrived at EDR: 02/12/2013
Date Made Active in Reports: 04/09/2013
Number of Days to Update: 56

Source: Department of Health
Telephone: 808-586-4258
Last EDR Contact: 11/24/2015
Next Scheduled EDR Contact: 03/14/2016
Data Release Frequency: Varies

EDR HIGH RISK HISTORICAL RECORDS

EDR Exclusive Records

EDR MGP: EDR Proprietary Manufactured Gas Plants

The EDR Proprietary Manufactured Gas Plant Database includes records of coal gas plants (manufactured gas plants) compiled by EDR's researchers. Manufactured gas sites were used in the United States from the 1800's to 1950's to produce a gas that could be distributed and used as fuel. These plants used whale oil, rosin, coal, or a mixture of coal, oil, and water that also produced a significant amount of waste. Many of the byproducts of the gas production, such as coal tar (oily waste containing volatile and non-volatile chemicals), sludges, oils and other compounds are potentially hazardous to human health and the environment. The byproduct from this process was frequently disposed of directly at the plant site and can remain or spread slowly, serving as a continuous source of soil and groundwater contamination.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: No Update Planned

EDR Hist Auto: EDR Exclusive Historic Gas Stations

EDR has searched selected national collections of business directories and has collected listings of potential gas station/filling station/service station sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include gas station/filling station/service station establishments. The categories reviewed included, but were not limited to gas, gas station, gasoline station, filling station, auto, automobile repair, auto service station, service station, etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR Hist Cleaner: EDR Exclusive Historic Dry Cleaners

EDR has searched selected national collections of business directories and has collected listings of potential dry cleaner sites that were available to EDR researchers. EDR's review was limited to those categories of sources that might, in EDR's opinion, include dry cleaning establishments. The categories reviewed included, but were not limited to dry cleaners, cleaners, laundry, laundromat, cleaning/laundry, wash & dry etc. This database falls within a category of information EDR classifies as "High Risk Historical Records", or HRHR. EDR's HRHR effort presents unique and sometimes proprietary data about past sites and operations that typically create environmental concerns, but may not show up in current government records searches.

Date of Government Version: N/A
Date Data Arrived at EDR: N/A
Date Made Active in Reports: N/A
Number of Days to Update: N/A

Source: EDR, Inc.
Telephone: N/A
Last EDR Contact: N/A
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

EDR RECOVERED GOVERNMENT ARCHIVES

Exclusive Recovered Govt. Archives

RGA HWS: Recovered Government Archive State Hazardous Waste Facilities List

The EDR Recovered Government Archive State Hazardous Waste database provides a list of SHWS incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Health in Hawaii.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/08/2014
Number of Days to Update: 191

Source: Department of Health
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LF: Recovered Government Archive Solid Waste Facilities List

The EDR Recovered Government Archive Landfill database provides a list of landfills derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Health in Hawaii.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/17/2014
Number of Days to Update: 200

Source: Department of Health
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

RGA LUST: Recovered Government Archive Leaking Underground Storage Tank

The EDR Recovered Government Archive Leaking Underground Storage Tank database provides a list of LUST incidents derived from historical databases and includes many records that no longer appear in current government lists. Compiled from Records formerly available from the Department of Health in Hawaii.

Date of Government Version: N/A
Date Data Arrived at EDR: 07/01/2013
Date Made Active in Reports: 01/03/2014
Number of Days to Update: 186

Source: Department of Health
Telephone: N/A
Last EDR Contact: 06/01/2012
Next Scheduled EDR Contact: N/A
Data Release Frequency: Varies

OTHER DATABASE(S)

Depending on the geographic area covered by this report, the data provided in these specialty databases may or may not be complete. For example, the existence of wetlands information data in a specific report does not mean that all wetlands in the area covered by the report are included. Moreover, the absence of any reported wetlands information does not necessarily mean that wetlands do not exist in the area covered by the report.

Oil/Gas Pipelines

Source: PennWell Corporation

Petroleum Bundle (Crude Oil, Refined Products, Petrochemicals, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)) N = Natural Gas Bundle (Natural Gas, Gas Liquids (LPG/NGL), and Specialty Gases (Miscellaneous)). This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Electric Power Transmission Line Data

Source: PennWell Corporation

This map includes information copyrighted by PennWell Corporation. This information is provided on a best effort basis and PennWell Corporation does not guarantee its accuracy nor warrant its fitness for any particular purpose. Such information has been reprinted with the permission of PennWell.

Sensitive Receptors: There are individuals deemed sensitive receptors due to their fragile immune systems and special sensitivity to environmental discharges. These sensitive receptors typically include the elderly, the sick, and children. While the location of all sensitive receptors cannot be determined, EDR indicates those buildings and facilities - schools, daycares, hospitals, medical centers, and nursing homes - where individuals who are sensitive receptors are likely to be located.

AHA Hospitals:
Source: American Hospital Association, Inc.
Telephone: 312-280-5991
The database includes a listing of hospitals based on the American Hospital Association's annual survey of hospitals.

Medical Centers: Provider of Services Listing
Source: Centers for Medicare & Medicaid Services
Telephone: 410-786-3000
A listing of hospitals with Medicare provider number, produced by Centers of Medicare & Medicaid Services, a federal agency within the U.S. Department of Health and Human Services.

Nursing Homes
Source: National Institutes of Health
Telephone: 301-594-6248
Information on Medicare and Medicaid certified nursing homes in the United States.

Public Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on elementary and secondary public education in the United States. It is a comprehensive, annual, national statistical database of all public elementary and secondary schools and school districts, which contains data that are comparable across all states.

Private Schools
Source: National Center for Education Statistics
Telephone: 202-502-7300
The National Center for Education Statistics' primary database on private school locations in the United States.

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory
Source: Office of Planning
Telephone: 808-587-2895

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

STREET AND ADDRESS INFORMATION

GEOCHECK ®- PHYSICAL SETTING SOURCE ADDENDUM

TARGET PROPERTY ADDRESS

CALTECH SUBMILLIMETER OBSERVATORY
MAUNA KEA ACCESS ROAD
PAAUILO, HI 96776

TARGET PROPERTY COORDINATES

Latitude (North):	19.8225 - 19˚ 49’ 21.00’’
Longitude (West):	155.4754 - 155˚ 28’ 31.44’’
Universal Tranverse Mercator:	Zone 5
UTM X (Meters):	240704.7
UTM Y (Meters):	2193609.0
Elevation:	13343 ft. above sea level

USGS TOPOGRAPHIC MAP

Target Property Map:	5949268 MAUNA KEA, HI
Version Date:	2013

EDR’s GeoCheck Physical Setting Source Addendum is provided to assist the environmental professional in forming an opinion about the impact of potential contaminant migration.

Assessment of the impact of contaminant migration generally has two principal investigative components:

1. Groundwater flow direction, and
2. Groundwater flow velocity.

Groundwater flow direction may be impacted by surface topography, hydrology, hydrogeology, characteristics of the soil, and nearby wells. Groundwater flow velocity is generally impacted by the nature of the geologic strata.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW DIRECTION INFORMATION

Groundwater flow direction for a particular site is best determined by a qualified environmental professional using site-specific well data. If such data is not reasonably ascertainable, it may be necessary to rely on other sources of information, such as surface topographic information, hydrologic information, hydrogeologic data collected on nearby properties, and regional groundwater flow information (from deep aquifers).

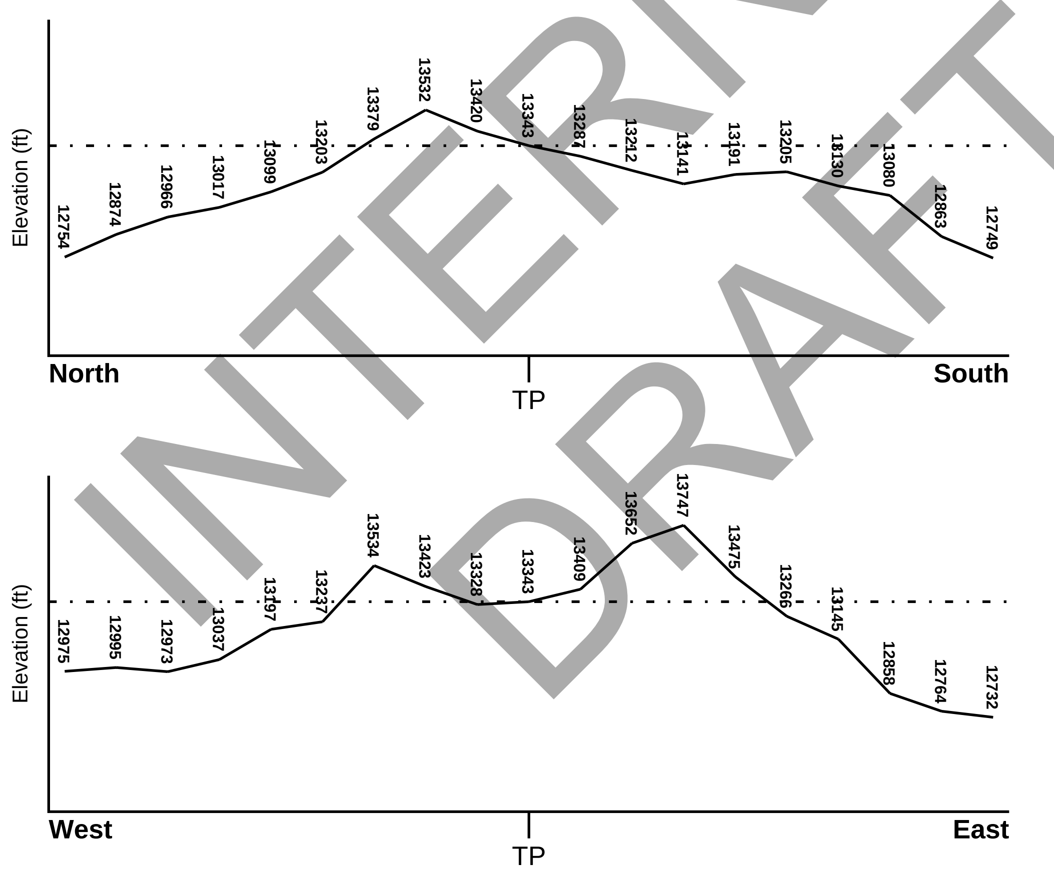
TOPOGRAPHIC INFORMATION

Surface topography may be indicative of the direction of surficial groundwater flow. This information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

TARGET PROPERTY TOPOGRAPHY

General Topographic Gradient: General SSW

SURROUNDING TOPOGRAPHY: ELEVATION PROFILES



Target Property Elevation: 13343 ft. 0 1/2 1 Miles

Source: Topography has been determined from the USGS 7.5' Digital Elevation Model and should be evaluated on a relative (not an absolute) basis. Relative elevation information between sites of close proximity should be field verified.

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

HYDROLOGIC INFORMATION

Surface water can act as a hydrologic barrier to groundwater flow. Such hydrologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

Refer to the Physical Setting Source Map following this summary for hydrologic information (major waterways and bodies of water).

FEMA FLOOD ZONE

Target Property County	FEMA Flood Electronic Data
HAWAII, HI	YES - refer to the Overview Map and Detail Map

Flood Plain Panel at Target Property: 1551660600C - FEMA Q3 Flood data

Additional Panels in search area: Not Reported

NATIONAL WETLAND INVENTORY

NWI Quad at Target Property	NWI Electronic Data Coverage
MAUNA KEA	YES - refer to the Overview Map and Detail Map

HYDROGEOLOGIC INFORMATION

Hydrogeologic information obtained by installation of wells on a specific site can often be an indicator of groundwater flow direction in the immediate area. Such hydrogeologic information can be used to assist the environmental professional in forming an opinion about the impact of nearby contaminated properties or, should contamination exist on the target property, what downgradient sites might be impacted.

AQUIFLOW®

Search Radius: 1.000 Mile.

EDR has developed the AQUIFLOW Information System to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted by environmental professionals to regulatory authorities at select sites and has extracted the date of the report, groundwater flow direction as determined hydrogeologically, and the depth to water table.

MAP ID	LOCATION FROM TP	GENERAL DIRECTION GROUNDWATER FLOW
Not Reported		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

GROUNDWATER FLOW VELOCITY INFORMATION

Groundwater flow velocity information for a particular site is best determined by a qualified environmental professional using site specific geologic and soil strata data. If such data are not reasonably ascertainable, it may be necessary to rely on other sources of information, including geologic age identification, rock stratigraphic unit and soil characteristics data collected on nearby properties and regional soil information. In general, contaminant plumes move more quickly through sandy-gravelly types of soils than silty-clayey types of soils.

GEOLOGIC INFORMATION IN GENERAL AREA OF TARGET PROPERTY

Geologic information can be used by the environmental professional in forming an opinion about the relative speed at which contaminant migration may be occurring.

ROCK STRATIGRAPHIC UNIT

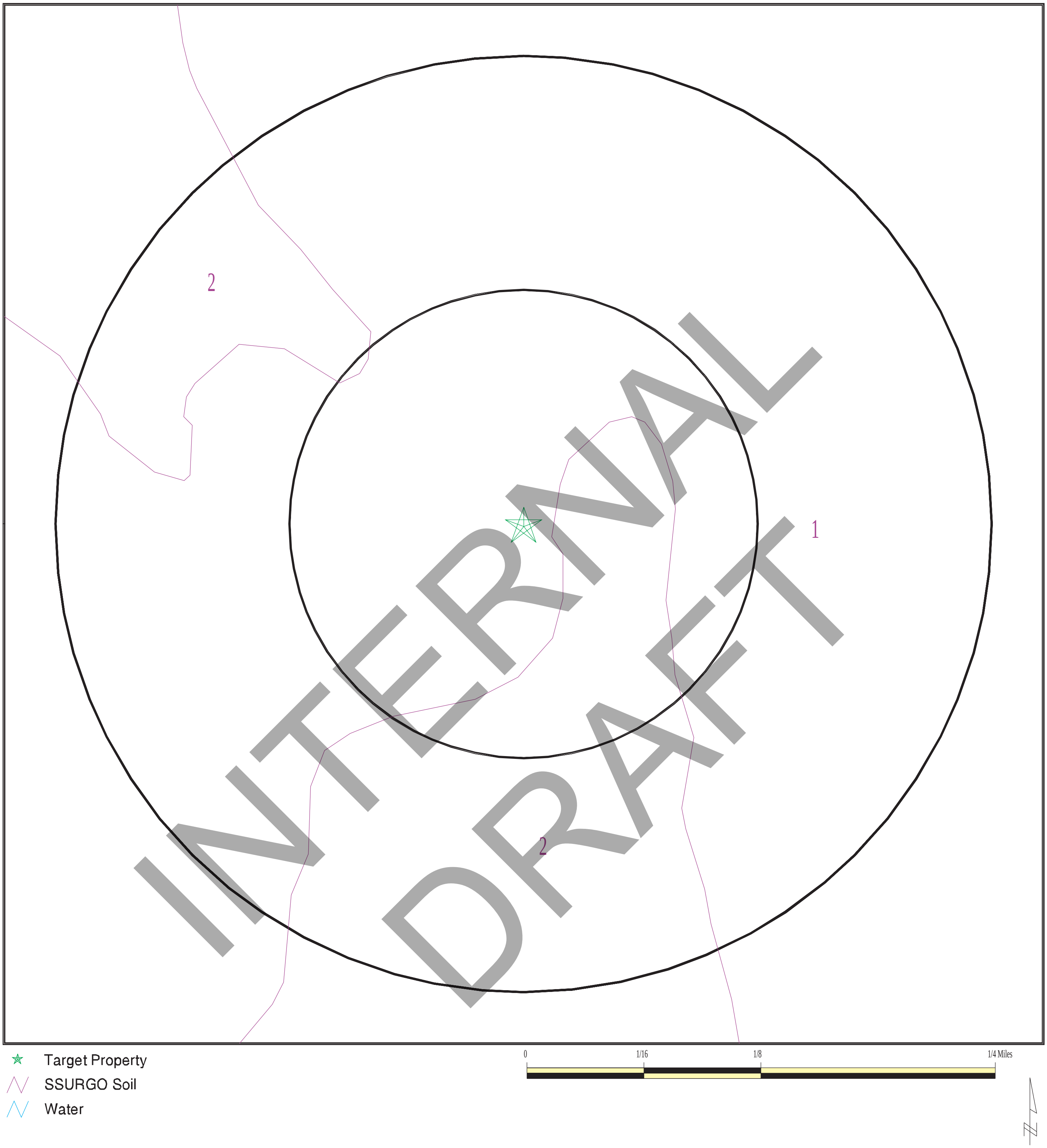
Era:	-
System:	-
Series:	-
Code:	N/A *(decoded above as Era, System & Series)*

GEOLOGIC AGE IDENTIFICATION

Category: -

Geologic Age and Rock Stratigraphic Unit Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - a digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

SSURGO SOIL MAP - 4502574.2s



SITE NAME: Caltech Submillimeter Observatory	CLIENT: ENPRO, Env. Professionals
ADDRESS: Mauna Kea Access Road Paauilo HI 96776	CONTACT: Heather Schauer INQUIRY #: 4502574.2s
LAT/LONG: 19.8225 / 155.4754	DATE: December 30, 2015 1:35 pm

DOMINANT SOIL COMPOSITION IN GENERAL AREA OF TARGET PROPERTY

The U.S. Department of Agriculture's (USDA) Soil Conservation Service (SCS) leads the National Cooperative Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. The following information is based on Soil Conservation Service SSURGO data.

Soil Map ID: 1

Soil Component Name: Cinder land

Soil Surface Texture: paragravelly material

Hydrologic Group: Class A - High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.

Soil Drainage Class: Excessively drained

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Low

Depth to Bedrock Min: > 0 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		Soil Reaction (pH)
1	0 inches	59 inches	paragravelly material	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 141 Min: 42	Max: 7.3 Min: 6.1

Soil Map ID: 2

Soil Component Name: Very stony land

Soil Surface Texture: extremely stony fine sandy loam

Hydrologic Group: Class A - High infiltration rates. Soils are deep, well drained to excessively drained sands and gravels.

Soil Drainage Class: Well drained

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

Hydric Status: Not hydric

Corrosion Potential - Uncoated Steel: Moderate

Depth to Bedrock Min: > 152 inches

Depth to Watertable Min: > 0 inches

Soil Layer Information							
	Boundary			Classification		Saturated hydraulic conductivity micro m/sec	Soil Reaction (pH)
Layer	Upper	Lower	Soil Texture Class	AASHTO Group	Unified Soil		
1	0 inches	9 inches	extremely stony fine sandy loam	Silt-Clay Materials (more than 35 pct. passing No. 200), Clayey Soils.	COARSE-GRAINED SOILS, Sands, Sands with fines, Silty Sand.	Max: 141 Min: 42	Max: 7.8 Min: 5.6
2	9 inches	59 inches	extremely cobbly material	Granular materials (35 pct. or less passing No. 200), Stone Fragments, Gravel and Sand.	COARSE-GRAINED SOILS, Gravels, Clean gravels, Poorly Graded Gravel. COARSE-GRAINED SOILS, Gravels, Gravels with fines, Silty Gravel.	Max: 141 Min: 42	Max: 7.8 Min: 5.6

LOCAL / REGIONAL WATER AGENCY RECORDS

EDR Local/Regional Water Agency records provide water well information to assist the environmental professional in assessing sources that may impact ground water flow direction, and in forming an opinion about the impact of contaminant migration on nearby drinking water wells.

WELL SEARCH DISTANCE INFORMATION

DATABASE	SEARCH DISTANCE (miles)
Federal USGS	1.000
Federal FRDS PWS	Nearest PWS within 1 mile
State Database	1.000

FEDERAL USGS WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

GEOCHECK® - PHYSICAL SETTING SOURCE SUMMARY

FEDERAL FRDS PUBLIC WATER SUPPLY SYSTEM INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No PWS System Found		

Note: PWS System location is not always the same as well location.

STATE DATABASE WELL INFORMATION

MAP ID	WELL ID	LOCATION FROM TP
No Wells Found		

PHYSICAL SETTING SOURCE MAP - 4502574.2s

- County Boundary
- Major Roads
- Contour Lines
- Earthquake epicenter, Richter 5 or greater
- Water Wells
- Public Water Supply Wells
- Cluster of Multiple Icons
- Groundwater Flow Direction
- GI Indeterminate Groundwater Flow at Location
- GV Groundwater Flow Varies at Location

SITE NAME:	Caltech Submillimeter Observatory	CLIENT:	ENPRO, Env. Professionals
ADDRESS:	Mauna Kea Access Road	CONTACT:	Heather Schauer
	Paauilo HI 96776	INQUIRY #:	4502574.2s
LAT/LONG:	19.8225 / 155.4754	DATE:	December 30, 2015 1:35 pm

GEOCHECK® - PHYSICAL SETTING SOURCE MAP FINDINGS
RADON

AREA RADON INFORMATION

Federal EPA Radon Zone for HAWAII County: 3

Note: Zone 1 indoor average level > 4 pCi/L.
: Zone 2 indoor average level >= 2 pCi/L and <= 4 pCi/L.
: Zone 3 indoor average level < 2 pCi/L.

Federal Area Radon Information for HAWAII COUNTY, HI

Number of sites tested: 97

Area	Average Activity	% <4 pCi/L	% 4-20 pCi/L	% >20 pCi/L
Living Area - 1st Floor	0.054 pCi/L	99%	1%	0%
Living Area - 2nd Floor	1.100 pCi/L	100%	0%	0%
Basement	-0.247 pCi/L	100%	0%	0%

PHYSICAL SETTING SOURCE RECORDS SEARCHED

TOPOGRAPHIC INFORMATION

USGS 7.5' Digital Elevation Model (DEM)
Source: United States Geologic Survey
EDR acquired the USGS 7.5' Digital Elevation Model in 2002 and updated it in 2006. The 7.5 minute DEM corresponds to the USGS 1:24,000- and 1:25,000-scale topographic quadrangle maps. The DEM provides elevation data with consistent elevation units and projection.

Current USGS 7.5 Minute Topographic Map
Source: U.S. Geological Survey

HYDROLOGIC INFORMATION

Flood Zone Data: This data, available in select counties across the country, was obtained by EDR in 2003 & 2011 from the Federal Emergency Management Agency (FEMA). Data depicts 100-year and 500-year flood zones as defined by FEMA.

NWI: National Wetlands Inventory. This data, available in select counties across the country, was obtained by EDR in 2002, 2005 and 2010 from the U.S. Fish and Wildlife Service.

State Wetlands Data: Wetlands Inventory
Source: Office of Planning
Telephone: 808-587-2895

HYDROGEOLOGIC INFORMATION

AQUIFLOW R Information System
Source: EDR proprietary database of groundwater flow information
EDR has developed the AQUIFLOW Information System (AIS) to provide data on the general direction of groundwater flow at specific points. EDR has reviewed reports submitted to regulatory authorities at select sites and has extracted the date of the report, hydrogeologically determined groundwater flow direction and depth to water table information.

GEOLOGIC INFORMATION

Geologic Age and Rock Stratigraphic Unit
Source: P.G. Schruben, R.E. Arndt and W.J. Bawiec, Geology of the Conterminous U.S. at 1:2,500,000 Scale - A digital representation of the 1974 P.B. King and H.M. Beikman Map, USGS Digital Data Series DDS - 11 (1994).

STATSGO: State Soil Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
The U.S. Department of Agriculture's (USDA) Natural Resources Conservation Service (NRCS) leads the national Conservation Soil Survey (NCSS) and is responsible for collecting, storing, maintaining and distributing soil survey information for privately owned lands in the United States. A soil map in a soil survey is a representation of soil patterns in a landscape. Soil maps for STATSGO are compiled by generalizing more detailed (SSURGO) soil survey maps.

SSURGO: Soil Survey Geographic Database
Source: Department of Agriculture, Natural Resources Conservation Service (NRCS)
Telephone: 800-672-5559
SSURGO is the most detailed level of mapping done by the Natural Resources Conservation Service, mapping scales generally range from 1:12,000 to 1:63,360. Field mapping methods using national standards are used to construct the soil maps in the Soil Survey Geographic (SSURGO) database. SSURGO digitizing duplicates the original soil survey maps. This level of mapping is designed for use by landowners, townships and county natural resource planning and management.

PHYSICAL SETTING SOURCE RECORDS SEARCHED

LOCAL / REGIONAL WATER AGENCY RECORDS

FEDERAL WATER WELLS

PWS: Public Water Systems
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Public Water System data from the Federal Reporting Data System. A PWS is any water system which provides water to at least 25 people for at least 60 days annually. PWSs provide water from wells, rivers and other sources.

PWS ENF: Public Water Systems Violation and Enforcement Data
Source: EPA/Office of Drinking Water
Telephone: 202-564-3750
Violation and Enforcement data for Public Water Systems from the Safe Drinking Water Information System (SDWIS) after August 1995. Prior to August 1995, the data came from the Federal Reporting Data System (FRDS).

USGS Water Wells: USGS National Water Inventory System (NWIS)
This database contains descriptive information on sites where the USGS collects or has collected data on surface water and/or groundwater. The groundwater data includes information on wells, springs, and other sources of groundwater.

STATE RECORDS

Well Index Database
Source: Commission on Water Resource Management
Telephone: 808-587-0214
CWRM maintains a Well Index Database to track specific information pertaining to the construction and installation of production wells in Hawaii

OTHER STATE DATABASE INFORMATION

RADON

Area Radon Information
Source: USGS
Telephone: 703-356-4020
The National Radon Database has been developed by the U.S. Environmental Protection Agency (USEPA) and is a compilation of the EPA/State Residential Radon Survey and the National Residential Radon Survey. The study covers the years 1986 - 1992. Where necessary data has been supplemented by information collected at private sources such as universities and research institutions.

EPA Radon Zones
Source: EPA
Telephone: 703-356-4020
Sections 307 & 309 of IRAA directed EPA to list and identify areas of U.S. with the potential for elevated indoor radon levels.

OTHER

Airport Landing Facilities: Private and public use landing facilities
Source: Federal Aviation Administration, 800-457-6656

Epicenters: World earthquake epicenters, Richter 5 or greater
Source: Department of Commerce, National Oceanic and Atmospheric Administration

Earthquake Fault Lines: The fault lines displayed on EDR’s Topographic map are digitized quaternary faultlines, prepared in 1975 by the United State Geological Survey

PHYSICAL SETTING SOURCE RECORDS SEARCHED

STREET AND ADDRESS INFORMATION

Caltech Submillimeter Observatory
Mauna Kea Access Road
Paauilo, HI 96776

Inquiry Number: 4502574.9
December 31, 2015

The EDR Aerial Photo Decade Package

EDR®

6 Armstrong Road, 4th Floor
Shelton, Connecticut 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Aerial Photo Decade Package

Environmental Data Resources, Inc. (EDR) Aerial Photo Decade Package is a screening tool designed to assist environmental professionals in evaluating potential liability on a target property resulting from past activities. EDR's professional researchers provide digitally reproduced historical aerial photographs, and when available, provide one photo per decade.

When delivered electronically by EDR, the aerial photo images included with this report are for ONE TIME USE ONLY. Further reproduction of these aerial photo images is prohibited without permission from EDR. For more information contact your EDR Account Executive.

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

Date EDR Searched Historical Sources:

Aerial Photography December 31, 2015

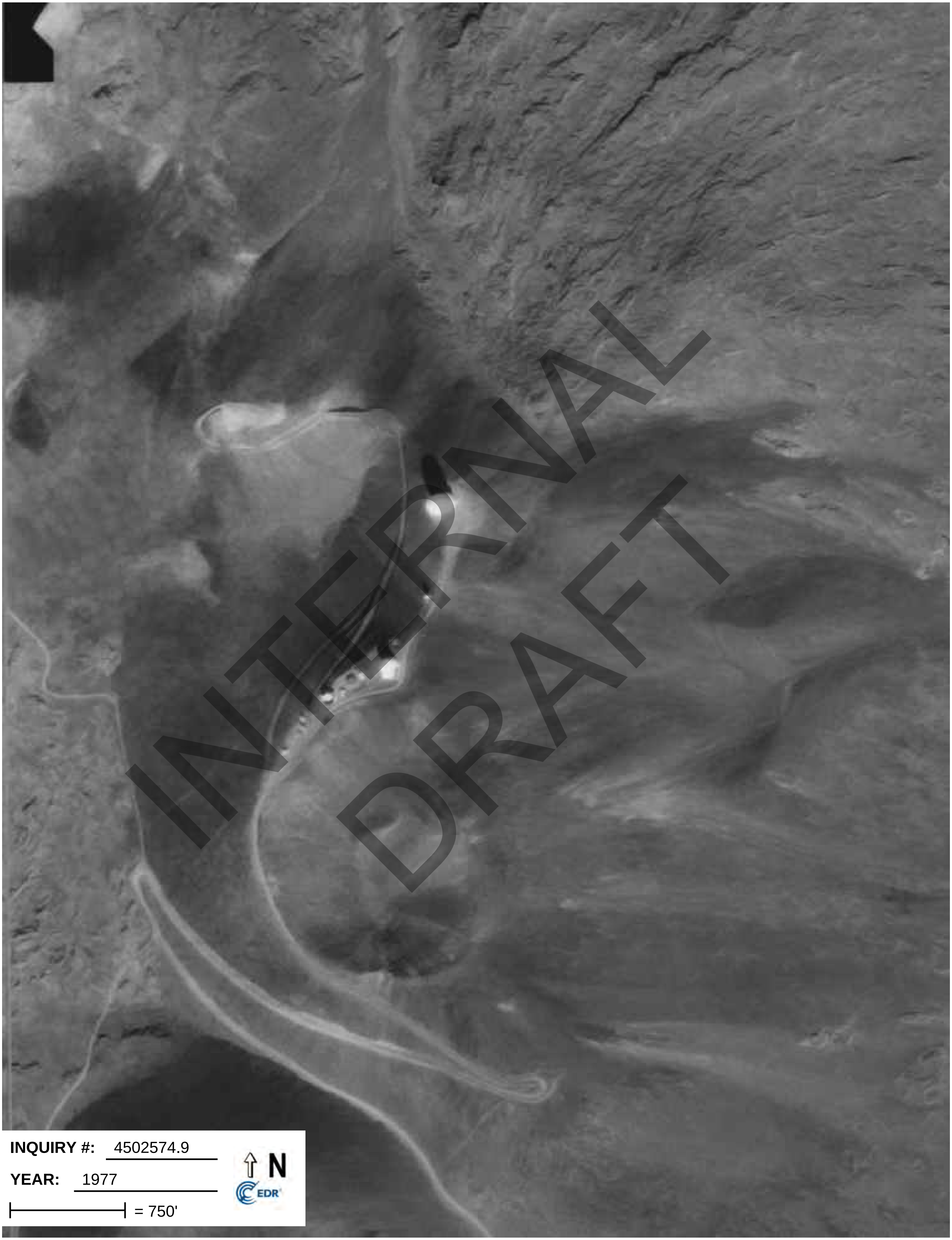
Target Property:

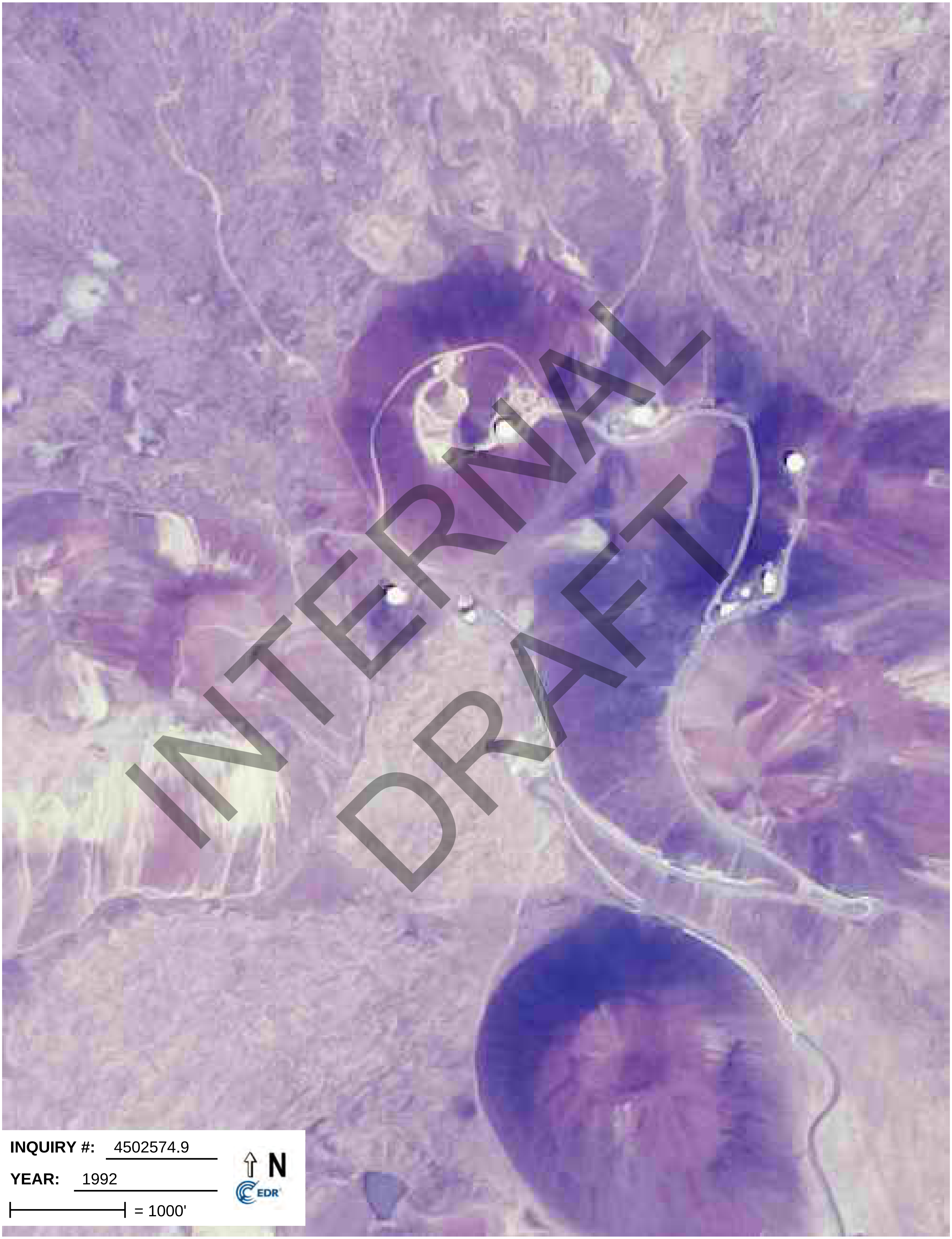
Mauna Kea Access Road

Paauilo, HI 96776

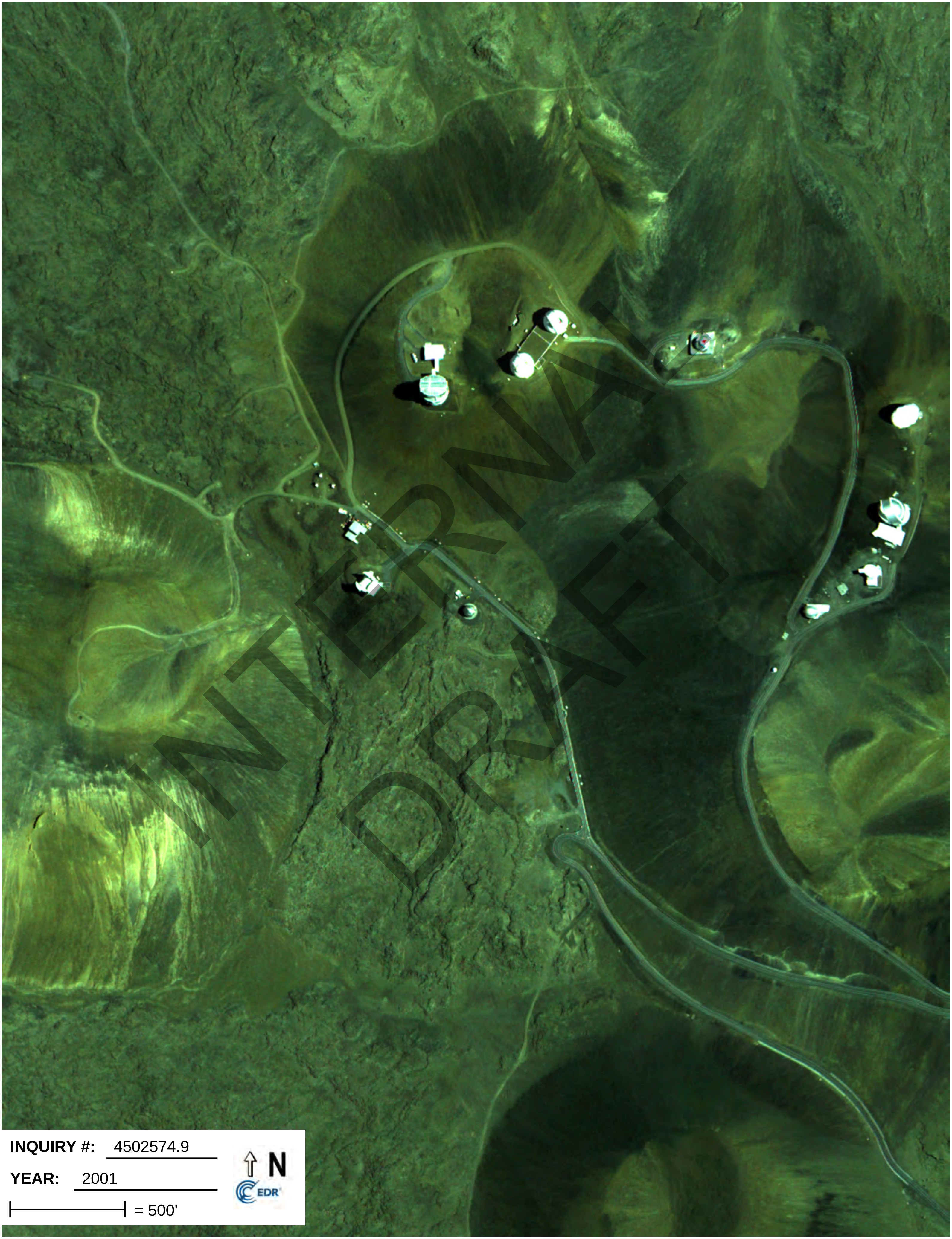
Year	***Scale***	***Details***	***Source***
1954	Aerial Photograph. Scale: 1"=750'	Flight Date: October 19, 1954	EDR
1977	Aerial Photograph. Scale: 1"=750'	Flight Date: January 01, 1977	EDR
1992	Aerial Photograph. Scale: 1"=1000'	Flight Date: September 30, 1992	EDR
1995	Aerial Photograph. Scale: 1"=1000'	Flight Date: September 09, 1995	EDR
2001	Aerial Photograph. Scale: 1"=500'	DOQQ - acquisition dates: April 28, 2001	USGS/DOQQ


INQUIRY #: 4502574.9
YEAR: 1954
= 750'
N
EDR


INQUIRY #: 4502574.9
YEAR: 1977
= 750'
N
EDR


INTERNAL
DRAFT
INQUIRY #: 4502574.9
YEAR: 1992
= 1000'
N
EDR


INQUIRY #: 4502574.9
YEAR: 1995
= 1000'
N
EDR


INTERNAL DRAFT
INQUIRY #: 4502574.9
YEAR: 2001
= 500'
N
EDR

Caltech Submillimeter Observatory

Mauna Kea Access Road

Paauilo, HI 96776

Inquiry Number: 4502574.4

December 30, 2015

EDR Historical Topo Map Report

with QuadMatch™

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

EDR Historical Topo Map Report

12/30/15

Site Name:	Client Name:
Caltech Submillimeter Observa	ENPRO, Env. Professionals
Mauna Kea Access Road	151 Hekili Street Suite 210
Paauilo, HI 96776	Kailua, HI 96734
EDR Inquiry # 4502574.4	Contact: Heather Schauer

EDR Topographic Map Library has been searched by EDR and maps covering the target property location as provided by ENPRO, Env. Professionals were identified for the years listed below. EDR's Historical Topo Map Report is designed to assist professionals in evaluating potential liability on a target property resulting from past activities. EDRs Historical Topo Map Report includes a search of a collection of public and private color historical topographic maps, dating back to the late 1800s.

Search Results:		***Coordinates:***	
Site Name:	Caltech Submillimeter Observa	**Latitude:**	19.8225 19° 49' 21" North
Address:	Mauna Kea Access Road	**Longitude:**	-155.4754 -155° 28' 31" West
City,State,Zip:	Paauilo, HI 96776	**UTM Zone:**	Zone 5 North
P.O.#	NA	**UTM X Meters:**	240708.67
Project:	1512-00532-PH1	**UTM Y Meters:**	2193739.59
		Elevation:	13342.64' above sea level

Maps Provided:

2013
1993
1982
1956

Topo Sheet Thumbnails

This EDR Topo Map Report is based upon the following USGS topographic map sheets.

2013 Source Sheets

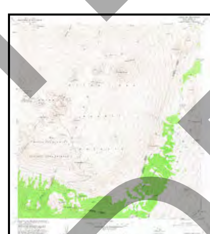
Mauna Kea
2013
7.5-minute, 24000

1993 Source Sheets

Mauna Kea
1993
7.5-minute, 24000
Aerial Photo Revised 1993

1982 Source Sheets

Ahumoa
1982
7.5-minute, 24000
Aerial Photo Revised 1977
Edited 1982



Mauna Kea
1982
7.5-minute, 24000
Aerial Photo Revised 1978
Edited 1982

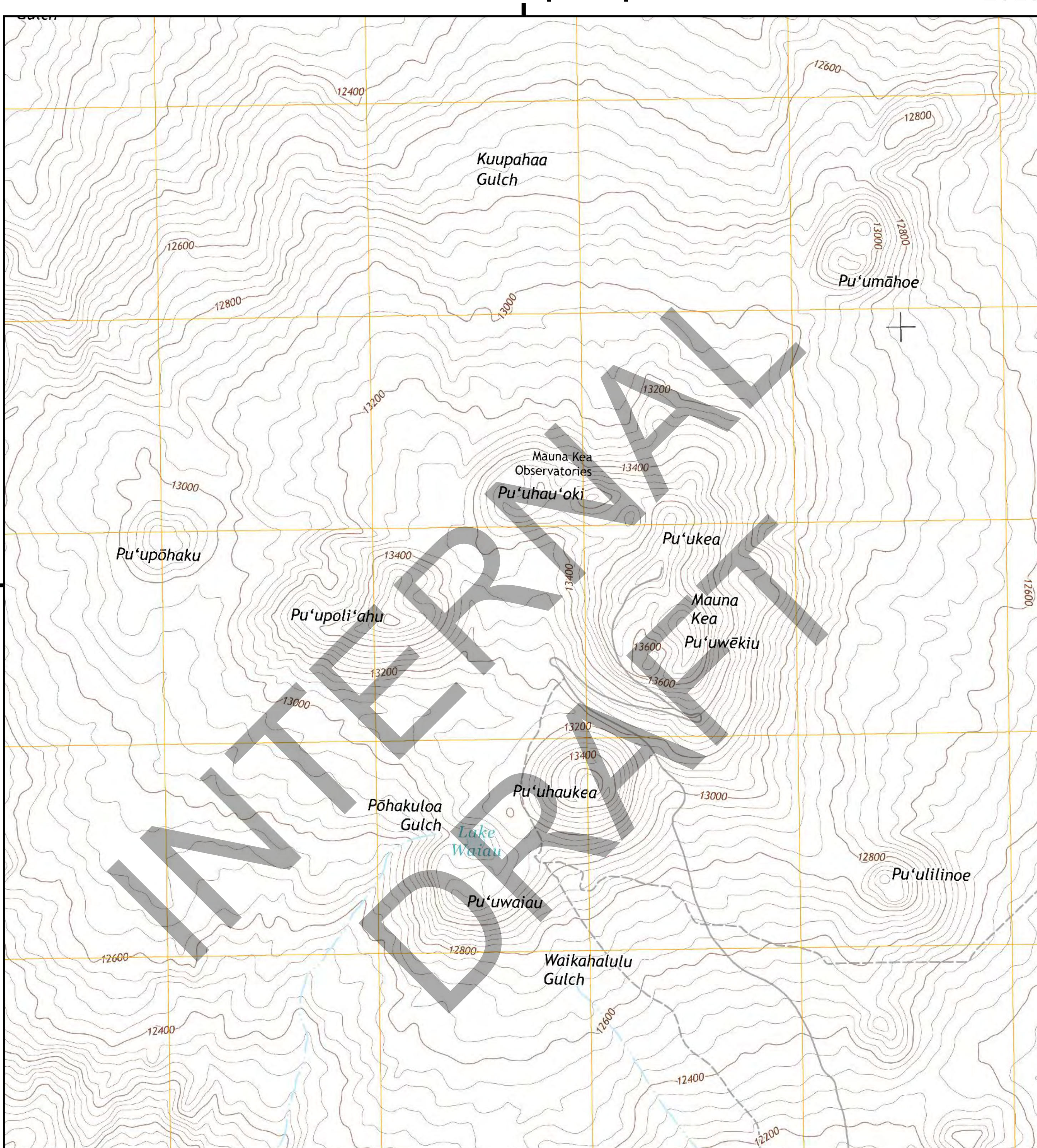
1956 Source Sheets

Mauna Kea
1956
7.5-minute, 24000
Aerial Photo Revised 1954

Ahumoa
1956
7.5-minute, 24000
Aerial Photo Revised 1954

Historical Topo Map

2013



This report includes information from the following map sheet(s).

Miles 0.25 0.5 1 1.5

NW N NE
W E
SW S SE

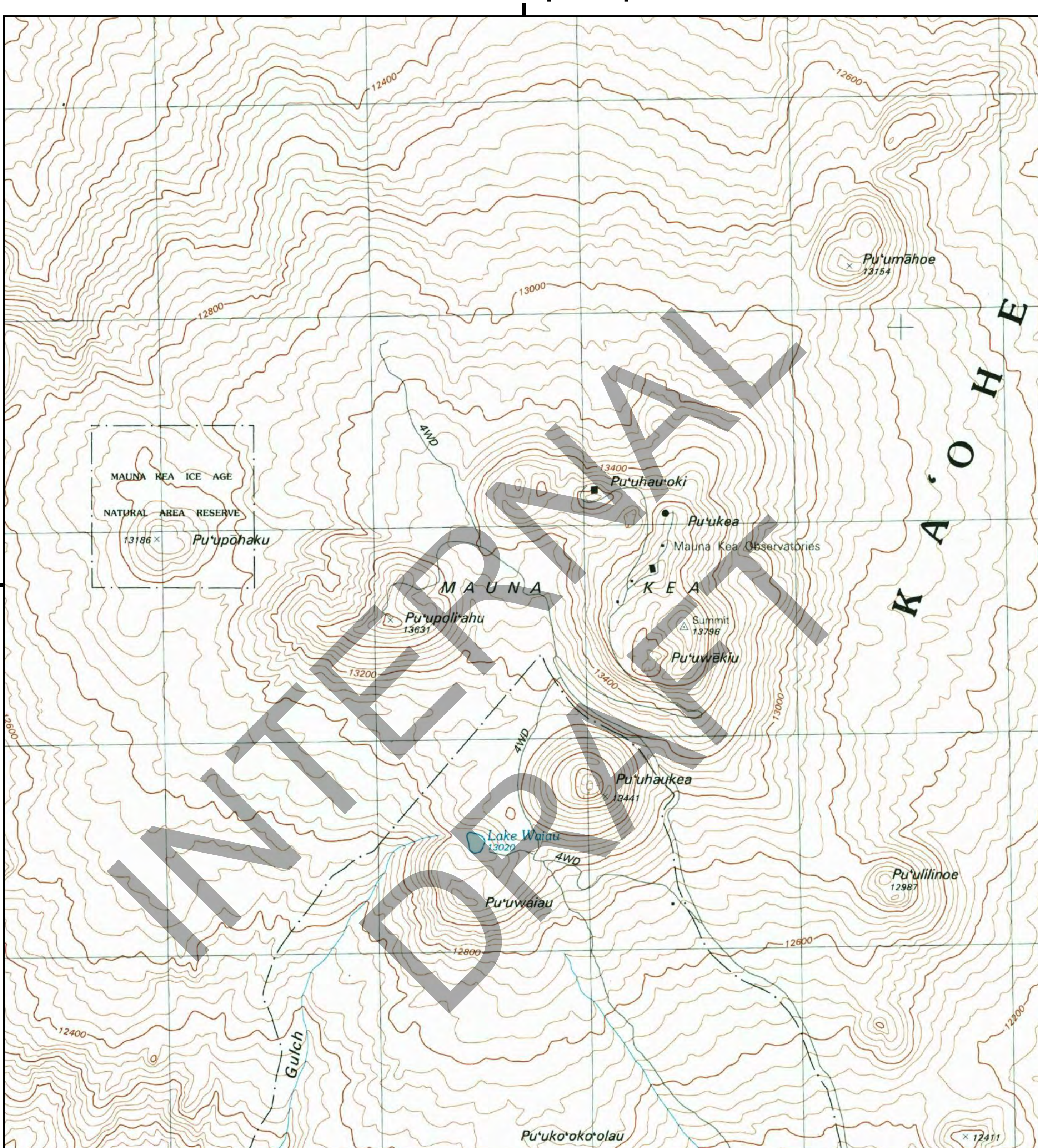
TP, Mauna Kea, 2013, 7.5-minute

SITE NAME: Caltech Submillimeter Observatory
ADDRESS: Mauna Kea Access Road
Paauilo, HI 96776
CLIENT: ENPRO, Env. Professionals

N

Historical Topo Map

1993



This report includes information from the following map sheet(s).

Miles 0.25 0.5 1 1.5

NW N NE

W E

SW S SE

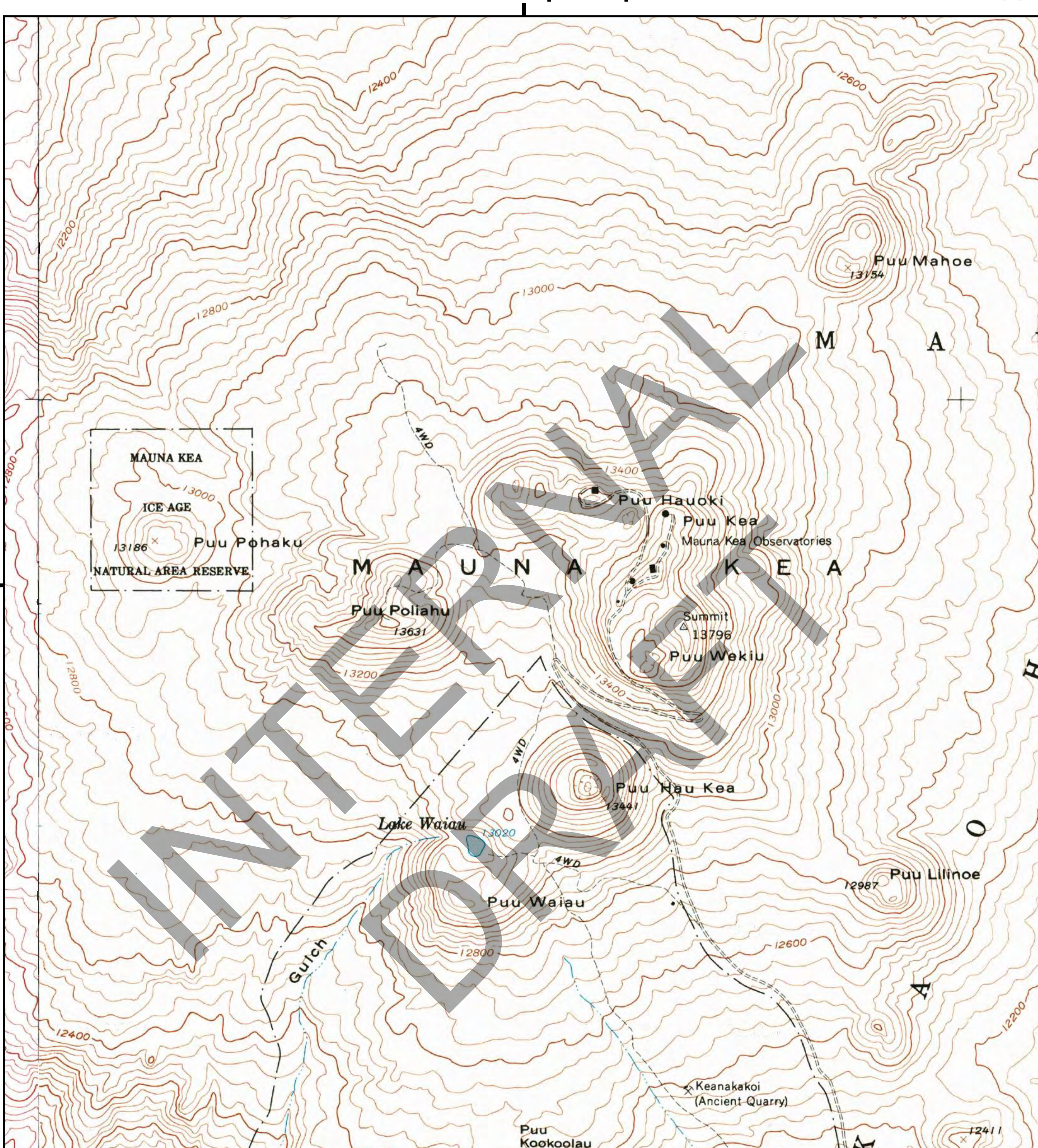
TP, Mauna Kea, 1993, 7.5-minute

SITE NAME: Caltech Submillimeter Observatory
ADDRESS: Mauna Kea Access Road
Paauilo, HI 96776
CLIENT: ENPRO, Env. Professionals

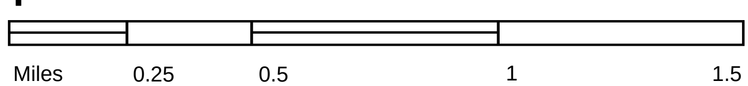
N

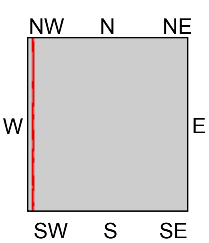
Historical Topo Map

1982



This report includes information from the following map sheet(s).





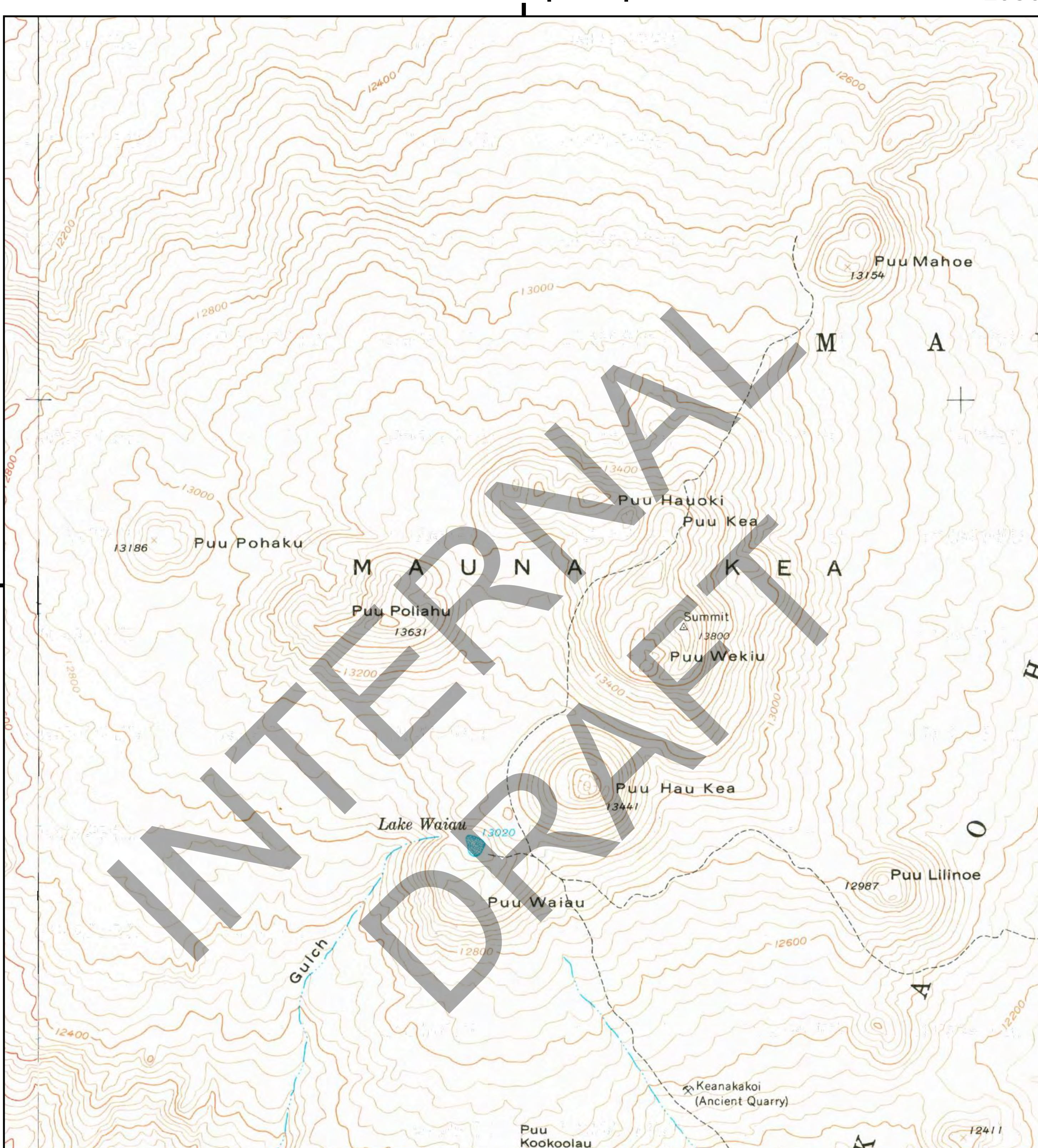
TP, Mauna Kea, 1982, 7.5-minute

W, Ahumoa, 1982, 7.5-minute

SITE NAME: Caltech Submillimeter Observatory
ADDRESS: Mauna Kea Access Road
Paauilo, HI 96776
CLIENT: ENPRO, Env. Professionals

Historical Topo Map

1956



This report includes information from the following map sheet(s).

Miles 0.25 0.5 1 1.5

NW N NE W E SW S SE

TP, Mauna Kea, 1956, 7.5-minute

W, Ahumoa, 1956, 7.5-minute

SITE NAME: Caltech Submillimeter Observatory
ADDRESS: Mauna Kea Access Road
Paauilo, HI 96776
CLIENT: ENPRO, Env. Professionals

N

REGULATORY RECORDS DOCUMENTATION

DEPARTMENTAL
FORM P-26

RESIDENTIAL APPRAISAL CARD

CARD ___ OF ___ CARDS			
ZONE	SEC.	PLAT	PARCEL
4	4	015	009

1. TOPOGRAPHY	2. ST. IMPVTS	3. UTILITIES	4. USE	5. ADD'L L. IMPVTS
LEVEL ☐	GRAVEL ☐	WATER ☐	RES. ☐	PAVED AREAS ☐
SLOPING FT.	PAVED ☐	ELEC. ☐	COM'L ☐	RET. WALLS ☐ TERR/PATIOS ___ SQ. FT.
GRADE "	CURB ☐	GAS ☐	IND. ☐	LAWN-LDSC. ☐ FENCES ___ LIN. FT.
H ☐ L ☐	GUTTER ☐	SEWER ☐	AGR. ☐	WALK WAYS ☐
	SIDE WK ☐	UNDERG'D ☐	INST. ☐	SPRINKLERS ☐ BARBEC. ___ CU. FT.
				SWIM. POOL ___ SQ. FT.
				SHAPE ___

6.
7. ___
8. ADDR ZONING ___
9. MOD. FACTOR ___
ST. DEPTH ___ CORNER ___
OTHER ___

DESCRIPTION S. H. Mauna Kea Science Reserve Hamakua, Hawaii
G/L#S-4191

OWNER	TITLE HISTORY	NET AREA
State of Hawaii	For 1969: 13,321.054 ac fr por par-001 same owner	13,321.054ac
(University of Hawaii) Le	G/L#S-4191 for 65yrs bg 6/21/68 to 6/20/2033 Cons:Gratis	
MAUNA KEA SCIENCE RESERVE		
	For 1982: R/S: To 4415-10(new) 1962.0 Ac.	
	-11(new) 143.5 Ac. TMB M-452'81;	11,215.55 Ac.
(Science and Engineering Research	Sublease 2/10/84 fr University of Hawaii until 12/31/2033 $1 per yr	
Council) Sub-le	R 4/13/84 Liber 17801/631 TMB 4430'84	

On Adj. $1313296.59
Date: 1/31/86

YEAR		1979	1985							YEAR
AREA		1980 1981								AREA
LAND	/	/	/ ~~136848~~							LAND
IMP.	—	—	~~15293895~~							IMP.
TOT.	/	/	/ ~~15424743~~							TOT.
EX.	/	/	/ -							EX.
NET	—	—	- ~~15424743~~							NET
TAX										TAX

REQUEST TO ACCESS A GOVERNMENT RECORD

DATE: December 30, 2015

TO: **Hazard Evaluation & Emergency Response Office (Fax: 586-7537)**

FROM: Heather Schauer ENPRO Environmental

Name or Alias

151 Hekili Street, Suite 210 (808) 748-2108 phone

Contact Information

Kailua, Hawaii 96734 (808) 262-4449 fax

Although you are not required to provide any personal information, you should provide enough information to allow the agency to contact you about this request. The processing of this request may be stopped if the agency is unable to contact you. Therefore, please provide any information that will allow the agency to contact you (name or alias, telephone or fax number, mailing address, e-mail address, etc.).

I WOULD LIKE THE FOLLOWING GOVERNMENT RECORD:

Describe the government record as specifically as possible so that it can be located. Try to provide a record name, subject matter, date, location, purpose, or names of persons to whom the record refers, or other information that could help the agency identify the record. A complete and accurate description of the government record you request will prevent delays in locating the record. Attach a second page if needed.

Aloha,

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- TMK: (3) 4-4-015: 009

My report is due January 15, 2016. In light of my timeline, I would greatly appreciate any assistance you can provide in expediting access to the files. Mahalo for you time and assistance,

Heather Schauer

I WOULD LIKE: (please check one or more of the options below)

☐ **To inspect the government record.**

☐ **A copy of the government record:** (Please check one of the options below.) See the back of this page for information about fees that you may be required to pay for agency services to process your record request. Note: Copying and transmission charges may also apply to certain options.

- ☐ Pick up at agency (**date and time**): ____________________
- ☐ Mail
- ☐ Fax (toll free and only if available)
- ☐ Other, if available (please specify): ____________________

☐ If the agency maintains the records in a form other than paper, please advise in which format you would prefer to have the record.

☐ Electronic ☐ Audio ☐ Other (please specify): ____________________

☐ Check this box if you are attaching a request for waiver of fees in the public interest (see waiver information on back).

OFFICIAL USE ONLY: **SEE BACK FOR IMPORTANT INFORMATION**

Office Manager: ____________________ Date: __________

OIP (rev. 07/29/99)

Release Notification *15-Jan-16* **Case No:** **20090527-1500**

Release Name: Hydraulic fluid release NRC 905897

Filing Information:

Section:	Central
Island:	Hawaii
Areawide Name:	
Type:	Private
File Under:	California Institute of Technology
Facility/Site Name:	Caltech Submillimeter Observatory

	Facility/Site	Reported
Line One:	111 Nowelo St	Mauna Kea
Line Two:		Inside dome of Caltech Submillimeter Observatory
City:	Hilo	Mauna Kea
Zip Code:	96720	
Supplemental:	Summit	Lat 19 49' 21" N Long 155 28' 33 W
Island:	Hawaii	Hawaii

Substances Involved

Hydraulic Oil	22.7 Gallons

Media: Concrete **Uniform Hazardous Waste Manifest Number:** **Associated NRC #:** 905897

Notification

Does this release exceed the RQ and qualify as a release to the environment? Yes

Is this fugitive dumping or can a PRP be identified for purposes of followup? RP

Is the reporter calling for the RP? Yes

Was initial notification given immediately following discovery of the incident? Yes

Date of the Written Followup: 5/27/2009

Will this require follow up for notification? Initial: **Written:**

Reported By

Reporter's Name: Evan Pfaff

Reporter's Affiliation:

Release Date: **Release Time:** **Duration:** **ER:** None

Activity History *Notices*

Response	5/27/2009	Liz Galvez	10/6/2009	Pending further action

Release Comments

8/26/2009	Liz Galvez	Spoke with Evan Pfaff. Excavation and removal of contaminated soil has been completed. There is remaining impacted soil under concrete believed to be from previous releases and they would like to leave in place until decommisioning of facility in about seven years. I requested that lat and long positions of the impacted soil be taken and included in the report; also requested that the documented disposal of the soil be included in the report. A supplement report will be provided.

		SOSC to discuss with DLNR prior to giving a NFA for the release.
10/6/2009	Liz Galvez	Received letter from Richard Chamberlin of Caltech Submillimeter Observatory, dated September 29, 2009 regarding disposal documentation and site location information for the 22.7 gallons of hydraulic spill that occurred at the Caltech Submillimeter Observatory. 3,500 pounds of potentially contaminated soil was excavated and disposed of at West Hawaii Sanitary Landfill. A map indicating where the spill occurred is documented. At this time, it is known that additional contamination from previous releases is still present and will remain in place until such time that the CSO is being decommissioned.
10/7/2009	Liz Galvez	Completion of the removal actions for the hydraulic spill that occurred on or about May 27, 2009 has been completed. A "No Further Action" is pending upon completion of additional investigation and/or cleanup actions that will be undertaken when the CSO will be decommissioned.
6/3/2009	Liz Galvez	

REQUEST TO ACCESS A GOVERNMENT RECORD

DATE: December 30, 2015

TO: **DOH/EMD/Solid & Hazardous Waste Branch (Fax: 808-586-7509)**

FROM: Heather Schauer ENPRO Environmental

Name or Alias

151 Hekili Street, Suite 210 (808) 748-2108 phone

Contact Information

Kailua, Hawaii 96734 (808) 262-4449 fax

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☐ Electronic ☐ Audio ☐ Other (please specify): ____

☐ Check this box if you are attaching a request for waiver of fees in the public interest (see waiver information on back).

SEE BACK FOR IMPORTANT INFORMATION

OFFICIAL USE ONLY:

Office Manager: ____ Date: ____ OIP (rev. 07/29/99)

NOTICE TO REQUESTER

(Use multiple forms if necessary)

TO: Heather Schauer, ENPRO / Fax No. 262-4449 UST Section
FROM: Hawaii Dept. of Health, Solid & Hazardous Waste Branch, 586-4226
(Agency/name & telephone number of contact person at agency)

DATE REQUEST RECEIVED: 12/30/15
DATE OF THIS NOTICE: 1/11/16

GOVERNMENT RECORDS YOU REQUESTED (attach copy of request or provide brief description below):

1.
2.
3. See attachment
4.

There are no UST records.

NOTICE IS PROVIDED TO YOU THAT YOUR REQUEST:

☐ **Will be granted in its entirety.**
☒ **Cannot be granted because**

- ☒ Agency does not maintain the records. Agency believed to maintain records:
- ☐ Agency needs a further description or clarification of the records requested. Please contact the agency and provide the following information:
- ☐ Request requires agency to create a summary or compilation from records not readily retrievable.

☐ **Is denied in its entirety** ☐ **Will be granted only as to certain parts**
based upon the following exemption provided in HRS § 92F-13 and/or § 92F-22 and other laws cited below (portions of records that agency will not disclose should be described in general terms).

RECORDS OR INFORMATION WITHHELD	APPLICABLE STATUTES	AGENCY JUSTIFICATION

REQUESTER'S RESPONSIBILITIES:

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Method of Disclosure:

☒ Inspection at the following location: 919 Ala Moana Blvd, Rm 212, Honolulu.

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- ☐ Available for pick-up at the following location: _____.
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- ☐ Will be transmitted to you by other means requested: _____.

Timing of Disclosure: All records, or first increment where applicable, will be made available or provided to you:

☒ On please call for appointment.

☐ After prepayment of fees and costs of $ _____ (50% of fees +100% of costs, as estimated below).
Payment may be made by cash or: ☐ personal check ☐ other ___________.

For incremental disclosures, each subsequent increment will be disclosed within 20 business days after:

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- ☐ Receipt of each incremental prepayment required.

Disclosure is being made in increments because the records are voluminous and the following extenuating circumstances exist:

- ☐ Agency must consult with another person to determine whether the record is exempt from disclosure under HRS chapter 92F.
- ☐ Request requires extensive agency efforts to search, review, or segregate the records or otherwise prepare the records for inspection or copying.
- ☐ Agency requires additional time to respond to the request in order to avoid an unreasonable interference with its other statutory duties and functions.
- ☐ A natural disaster or other situation beyond agency's control prevents agency from responding to the request within 10 business days.

ESTIMATED FEES & COSTS:

The agency is authorized to charge you certain fees and costs to process your request (even if no record is subsequently found to exist), but must waive the first $30 in fees assessed for general requesters and the first $60 in fees when the agency finds that the request made is in the public interest. See HAR §§ 2-71-19, -31 and -32. The agency may require prepayment of 50% of the total estimated fees and 100% of the total estimated costs prior to processing your request. The following is the estimate of the fees and costs that the agency will charge you, with the applicable waiver amount deducted:

Fees:	Search	Estimate of time to be spent: 15 ($2.50 for each 15-minute period)	$2.50
	Review & segregation	Estimate of time to be spent: _____ ($5.00 for each 15-minute period)	$
	Fees waived	☒ general ($30) ☐ public interest ($60)	<$30.00>
	Other	_____ (Pursuant to HAR §§ 2-71-19 & 2-71-31)	$
	Total Estimated Fees:		$0
Costs:	Copying	Estimate of # of pages to be copied: _____ (@ $_____ per page.)	$
	Other	_____	$
	Total Estimated Costs:		$

For questions about this notice, please contact the person named above. Questions regarding compliance with the UIPA may be directed to the Office of Information Practices at 808-586-1400 or oip@hawaii.gov.

DEC 30 2015 (1)

REQUEST TO ACCESS A GOVERNMENT RECORD

UG: 0
HW: ____
SW: ____

DATE: December 30, 2015

TO: **DOH/EMD/Solid & Hazardous Waste Branch (Fax: 808-586-7509)**

FROM: Heather Schauer ENPRO Environmental
Name or Alias
Contact Information 151 Hekili Street, Suite 210 (808) 748-2108 phone
Kailua, Hawaii 96734 (808) 262-4449 fax

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SEE BACK FOR IMPORTANT INFORMATION

OFFICIAL USE ONLY:

Office Manager: ____________________ Date: __________ OIP (rev. 07/29/99)

12/31

NOTICE TO REQUESTER

(Use multiple forms if necessary)

TO: Heather Schauer, ENPRO / Fax No. 262-4449 HW Section
FROM: Hawaii Dept. of Health, Solid & Hazardous Waste Branch, 586-4226
(Agency/name & telephone number of contact person at agency)

DATE REQUEST RECEIVED: 12/30/15
DATE OF THIS NOTICE: 1/11/16

GOVERNMENT RECORDS YOU REQUESTED (attach copy of request or provide brief description below):
1.
2.
3. See attachment
4.

NOTICE IS PROVIDED TO YOU THAT YOUR REQUEST: There are no HW records.

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RECORDS OR INFORMATION WITHHELD	APPLICABLE STATUTES	AGENCY JUSTIFICATION

INTERNAL DRAFT

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	Total Estimated Fees:		**$** 0
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	Other	_____	$
	Total Estimated Costs:		**$**

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DEC 30 2015 (1)

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SW:

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OFFICIAL USE ONLY:

Office Manager: ____ Date: ____ OIP (rev. 07/29/99)

12/31

NOTICE TO REQUESTER

(Use multiple forms if necessary)

TO: Heather Schauer, ENPRO / Fax No. 262-4449 SW Section
FROM: Hawaii Dept. of Health, Solid & Hazardous Waste Branch, 586-4226
(Agency/name & telephone number of contact person at agency)

DATE REQUEST RECEIVED: 12/30/15
DATE OF THIS NOTICE: 1/11/16

GOVERNMENT RECORDS YOU REQUESTED (attach copy of request or provide brief description below):

1.
2.
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4.

NOTICE IS PROVIDED TO YOU THAT YOUR REQUEST: There are no SW records.

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- ☐ The prior increment (if one prepayment of fees is required and received).
- ☐ Receipt of each incremental prepayment required.

Disclosure is being made in increments because the records are voluminous and the following extenuating circumstances exist:

- ☐ Agency must consult with another person to determine whether the record is exempt from disclosure under HRS chapter 92F.
- ☐ Request requires extensive agency efforts to search, review, or segregate the records or otherwise prepare the records for inspection or copying.
- ☐ Agency requires additional time to respond to the request in order to avoid an unreasonable interference with its other statutory duties and functions.
- ☐ A natural disaster or other situation beyond agency's control prevents agency from responding to the request within 10 business days.

ESTIMATED FEES & COSTS:

The agency is authorized to charge you certain fees and costs to process your request (even if no record is subsequently found to exist), but must waive the first $30 in fees assessed for general requesters and the first $60 in fees when the agency finds that the request made is in the public interest. See HAR §§ 2-71-19, -31 and -32. The agency may require prepayment of 50% of the total estimated fees and 100% of the total estimated costs prior to processing your request. The following is the estimate of the fees and costs that the agency will charge you, with the applicable waiver amount deducted:

Fees:	Search	Estimate of time to be spent: 15 ($2.50 for each 15-minute period)	$ 2.50
	Review & segregation	Estimate of time to be spent: _____ ($5.00 for each 15-minute period)	$
	Fees waived	☒ general ($30) ☐ public interest ($60)	<$ 30.00 >
	Other	______ (Pursuant to HAR §§ 2-71-19 & 2-71-31)	$
	Total Estimated Fees:		**$** 0
Costs:	Copying	Estimate of # of pages to be copied: _____ (@ $ ____ per page.)	$
	Other	______	$
	Total Estimated Costs:		**$**

For questions about this notice, please contact the person named above. Questions regarding compliance with the UIPA may be directed to the Office of Information Practices at 808-586-1400 or oip@hawaii.gov.

DEC 30 2015 (1)

REQUEST TO ACCESS A GOVERNMENT RECORD

UG: ______

HW: ______

SW: NONE

DATE: December 30, 2015

TO: DOH/EMD/Solid & Hazardous Waste Branch (Fax: 808-586-7509)

FROM: Heather Schauer ENPRO Environmental

Name or Alias

Contact Information 151 Hekili Street, Suite 210 (808) 748-2108 phone

Kailua, Hawaii 96734 (808) 262-4449 fax

Although you are not required to provide any personal information, you should provide enough information to allow the agency to contact you about this request. The processing of this request may be stopped if the agency is unable to contact you. Therefore, please provide any information that will allow the agency to contact you (name or alias, telephone or fax number, mailing address, e-mail address, etc.).

I WOULD LIKE THE FOLLOWING GOVERNMENT RECORD:

Describe the government record as specifically as possible so that it can be located. Try to provide a record name, subject matter, date, location, purpose, or names of persons to whom the record refers, or other information that could help the agency identify the record. A complete and accurate description of the government record you request will prevent delays in locating the record. Attach a second page if needed.

Aloha,

I am currently working on an Environmental Site Assessment for the Caltech Submillimeter Observatory located within a large TMK on the summit of Mauna Kea on the island of Hawaii, Hawaii. I would like to review the regulatory records for the following TMK:

- TMK: (3) 4-4-015: 009

My report is due January 15, 2016. In light of my timeline, I would greatly appreciate any assistance you can provide in expediting access to the files. Mahalo for you time and assistance,

Heather Schauer

I WOULD LIKE: (please check one or more of the options below)

☐ **To inspect the government record.**

☐ **A copy of the government record:** (Please check one of the options below.) See the back of this page for information about fees that you may be required to pay for agency services to process your record request. Note: Copying and transmission charges may also apply to certain options.

- ☐ Pick up at agency (**date and time**): ______
- ☐ Mail
- ☐ Fax (toll free and only if available)
- ☐ Other, if available (please specify): ______

☐ If the agency maintains the records in a form other than paper, please advise in which format you would prefer to have the record.

☐ Electronic ☐ Audio ☐ Other (please specify): ______

☐ Check this box if you are attaching a request for walver of fees in the public interest (see walver information on back).

SEE BACK FOR IMPORTANT INFORMATION

OFFICIAL USE ONLY:

Office Manager: ______ Date: ______ OIP (rev. 07/29/99)

12/31

REQUEST TO ACCESS A GOVERNMENT RECORD

DATE: December 30, 2015

TO: **Hawaii Fire Prevention Bureau (Fax: 808-932-2927)**

FROM: Heather Schauer ENPRO Environmental

Name or Alias

Contact Information

151 Hekili Street, Suite 210 (808) 748-2108 phone

Kailua, Hawaii 96734 (808) 262-4449 fax

Although you are not required to provide any personal information, you should provide enough information to allow the agency to contact you about this request. The processing of this request may be stopped if the agency is unable to contact you. Therefore, please provide any information that will allow the agency to contact you (name or alias, telephone or fax number, mailing address, e-mail address, etc.).

I WOULD LIKE THE FOLLOWING GOVERNMENT RECORD:

Describe the government record as specifically as possible so that it can be located. Try to provide a record name, subject matter, date, location, purpose, or names of persons to whom the record refers, or other information that could help the agency identify the record. A complete and accurate description of the government record you request will prevent delays in locating the record. Attach a second page if needed.

Aloha,

I am currently working on an Environmental Site Assessment for the Caltech Submillimeter Observatory located within a large TMK on the summit of Mauna Kea on the island of Hawaii, Hawaii. I would like to review the regulatory records for the following TMK:

- TMK: (3) 4-4-015: 009

I wanted to know if your office had any information regarding any fires, complaints, permits, violations involving hazardous materials use, USTs or ASTs on record for the subject properties and/or adjoining properties.

My report is due January 15, 2015. In light of my timeline, I would greatly appreciate any assistance you can provide in expediting access to the files. Mahalo

Heather Schauer

I WOULD LIKE: (please check one or more of the options below)

☐ **To inspect the government record.**

☐ **A copy of the government record:** **(Please** check one of the options below.) See the back of this page for information about fees that you may be required to pay for agency services to process your record request. Note: Copying and transmission charges may also apply to certain options.

- ☐ Pick up at agency (**date and time**): ____________________
- ☐ Mail
- ☐ Fax (toll free and only if available)
- ☐ Other, if available (please specify): ____________________

☐ If the agency maintains the records in a form other than paper, please advise in which format you would prefer to have the record.

☐ Electronic ☐ Audio ☐ Other (please specify): ____________________

☐ Check this box if you are attaching a request for waiver of fees in the public interest (see waiver information on back).

SEE BACK FOR IMPORTANT INFORMATION

OFFICIAL USE ONLY: SEE BACK FOR IMPORTANT INFORMATION

ENVIRONMENTAL LIENS / AUL REPORT

AFX Corp., Inc. TitleSearch.com - EnvironmentalLiens.com

Order Number	79-16929-47	**Effective Date**	1/6/2016		
Last name	STATE OF HAWAII / UNIVERSITY OF HAWAII				
First name		**County**	HAWAII		
Street address		**City**		**State**	HAWAII
Mailing address	101 AUPUNI ST #126, HILO HI 96720-4265				
Parcel Number	(3) 4-4-015:009	**Alternate parcel number**			
Legal Desc.	MAUNA KEA SCIENCE RESERVE				

Federal, state, and local environmental records have been researched, resulting in the following list of recorded environmental liens and AUL's (activity and usage limitations) for the subject property having been found:

ENVIRONMENTAL LIENS, IC s, LUC s, AUL s, & DEUR s

1 NONE FOUND WITH UNITED STATES EPA
2 NONE FOUND WITH HAWAII OFFICE OF ENVIRONMENTAL QUALITY CONTROL
3 NONE FOUND IN THE HAWAII COUNTY OFFICIAL LAND RECORDS
4

JUDGMENTS, LIENS

1 NONE FOUND WITH HAWAII OFFICE OF ENVIRONMENTAL QUALITY CONTROL
2 NO PENDING ENFORCEMENT ACTION LOCATED
3
4

OTHER INFORMATION:

This search is subject to the terms and conditions at TitleSearch.com.

RECORDS OF COMMUNICATION/INTERVIEW

Phase I Environmental Site Assessment Property Questionnaire

Circle all that apply: User ● Owner ● Key Site Manager

Please complete **ALL** sections of this questionnaire and return a **signed and dated** copy to ENPRO Environmental via FAX at **808-262-4449** or e-mail at **info@enproenvironmental.com** as soon as possible.

Communication with:

Name:	Simon Radford
Company:	California Institute of Technology
Phone Number:	808 935 1909
Date:	2016-01-06
Amount of Time Familiar With Site:	5 ½ years
Relationship to Site:	Operations Manager

PROJECT NO.: **1512-00532-PH1**

PROJECT NAME/ADDRESS: **Caltech Submilimeter Observatory**
Mauna Kea
Hawaii Island, Hawaii

Prior to answering the questions supplied in the table below, please provide ENPRO with the following information:

A. What is your purpose/reason for requesting a Phase I Environmental Site Assessment of the above referenced property? _ Due diligence prior to observatory decommissioning; requirement of MK observatories decommissioning plan. ______________________________

B. Can you supply a floor plan diagram and list of tenants for the structures at the property? If so, please attach copies with your questionnaire responses or send separately prior to the site visit.

DIRECTIONS: Please answer all questions to the best of your knowledge and in good faith. Mark the appropriate response with an "**X**". (Note: **U/NR** indicates "Unknown" or "No Response").
If you not know the answer, please check the **U/NR** box rather than the **No** box.
Please also elaborate on ALL **Yes** responses in the **Comment** box (for example, if the response to "Is the adjoining property used for an industrial use?" is **Yes**, please explain, e.g., "The building next door is used for canning tomatoes"). You may also provide additional information to **U/NR** and **No** responses as necessary. If you have any questions while completing the questionnaire, please contact us.

Question		Response			Comment
		Yes	No	U/NR	
1.	Are you aware of any pending, threatened, or past ***litigation*** relevant to hazardous substances or petroleum products in, on, or from the property?		No		
2.	Are you aware of any pending, threatened, or past ***administrative proceedings*** relevant to hazardous substances or petroleum products in, on, or from the property?		No		
3.	Are you aware of any ***notices from any governmental entity*** regarding any possible violation(s) of environmental laws or possible liability relating to hazardous substances or petroleum products in, on, or from the property?		No		

PROJECT NO.: 1512-00532--PH1

PROJECT NAME/ADDRESS: Caltech Submilimeter Observatory
Mauna Kea
Hawaii Island, Hawaii

Question		Response			Comment
		Yes	No	U/ NR	
4.	Are you aware of any ***environmental cleanup liens*** against the property that are filed or recorded under federal, tribal, state, or local law?		No		
5.	Are you aware of any ***Activity and Use Limitations (AULs)***, including engineering controls, land use restrictions, or institutional controls that are in place at the property and/or have been filed or recorded in a registry under federal, tribal, state, or local law?		No		
6.	Do you have any ***specialized knowledge*** or experience related to possible environmental concerns at the property or nearby properties? (For example, are you involved in the same line of business as the current or former occupants at the property or adjacent/nearby properties such that you would have specialized knowledge of the chemicals and processes used by this type of business?)		No		
7.	Does the purchase price being paid for this property reasonably reflect the fair market value of the property? If you conclude that there is a difference, have you considered whether the ***devalued purchase price*** is because contamination is known or believed to be present at the property? (Please reply in **Comment** section)				Not applicable
8.	Are you aware of ***commonly known or reasonably ascertainable information*** about the property or nearby properties that would help ENPRO to identify conditions indicative of releases or threatened releases? (For example, neighboring property is known to have once been a vehicle junk yard)		No		
9.	Do you know any ***past uses*** of the property which may have contributed to potential contaminant releases?		No		
10.	Do you know of any ***specific chemicals*** that are present or once were present at the property?		No		
11.	Do you know of any ***spills or other chemical releases*** that have taken place at the property?	Yes			Hydraulic oil spill, 2009 May 17
12.	Do you know of any ***environmental cleanups*** that have taken place at the property?	Yes			Hydraulic oil cleanup, 2009 May-Sept.
13.	Based on your knowledge and experience related to the property, are there any ***obvious indicators*** that point to the presence or likely presence of contamination at the property?		No		
14.	a.) Is the ***property*** used for an industrial use?		No		Other: Scientific Obs.
	b.) Are any ***adjacent properties*** used for an industrial use?		No		Not applicable
15.	a.) Has the ***property*** been used for an industrial use ***in the past***?		No		
	b.) Have any of the ***adjacent properties*** been used for an industrial use ***in the past***?		No		Not applicable

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PROJECT NO.: 1512-00532-PH1

PROJECT NAME/ADDRESS: Caltech Submilimeter Observatory
Mauna Kea
Hawaii Island, Hawaii

	Question	Response Yes	No	U/ NR	Comment
16.	a.) Is the ***property*** used as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility?		No		
	b.) Are any of the ***adjacent properties*** used as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility?		No		
17.	a.) Has the ***property*** been used ***in the past*** as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility?		No		
	b.) Have any of the ***adjacent properties*** been used ***in the past*** as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility?		No		
18.	a.) Are there ***currently*** any automotive or industrial **batteries** damaged or discarded, or **pesticides, paints, or other chemicals** in individual containers of greater than five gallons in volume or fifty gallons in the aggregate, stored on, or used at the ***property*** or at the *facility*?		No		
	b.) Have there been ***previously*** any automotive or industrial **batteries** damaged or discarded, or **pesticides, paints, or other chemicals** in individual containers of greater than five gallons in volume or fifty gallons in the aggregate, stored on or used at the ***property*** or at the *facility*?		No		
19.	a.) Are there ***currently*** any industrial **drums** (typically 55-gallon) or **sacks of chemical** located on the ***property?***		No		
	b.) Have there been ***previously*** any industrial **drums** (typically 55-gallon) or **sacks of chemical** located on the ***property?***		No		
20.	a.) Are there ***currently*** any ground water monitoring wells or other **ground water wells** (e.g., drinking water wells) located on the ***property***?		No		
	b.) Have there been ***previously*** any ground water monitoring wells or other **ground water wells** (e.g., drinking water wells) located on the ***property***?		No		
21.	a.) Are there ***currently*** any ground water monitoring wells or other **ground water wells** (e.g., drinking water wells) located on any of the ***adjacent properties?***		No		
	b.) Have there been ***previously*** any ground water monitoring wells or other **ground water wells** (e.g., drinking water wells) located on any of the ***adjacent properties?***		No		

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PROJECT NO.: **1512-00532-PH1**

PROJECT NAME/ADDRESS: **Caltech Submilimeter Observatory**
Mauna Kea
Hawaii Island, Hawaii

Question		Response			Comment
		Yes	No	U/ NR	
22.	a.) Has ***fill dirt*** been brought onto the property which originated from a ***contaminated site?***		No		
	b.) Has ***fill dirt*** been brought onto the property which is of ***unknown origin?***		No		
23.	a.) Are there ***currently*** any ***pits, ponds or lagoons*** on the property in connection with waste treatment or waste disposal?		No		
	b.) Have there been ***previously*** any ***pits, ponds or lagoons*** on the property in connection with waste treatment or waste disposal?		No		
24.	a.) Is there ***currently*** any ***stained soil*** on the property?		No		
	b.) Has there been ***previously*** any ***stained soil*** on the property?		No		
25. .	a.) Are there ***currently*** any registered or unregistered ***storage tanks*** (above ground or underground) located on the property?				Water tank only
	a.) Have there been ***previously*** any registered or unregistered ***storage tanks*** (above ground or underground) located on the property?		No		
26.	a.) Are there ***currently*** any ***vent pipes, fill pipes, or access ways indicating a fill pipe*** protruding from the ground on the property ***or*** adjacent to any structures on the property?				Fill pipe for water tank and for cesspool
	b.) Have there been ***previously*** any ***vent pipes, fill pipes, or access ways indicating a fill pipe*** protruding from the ground on the property ***or*** adjacent to any structures on the property?		No		
27.	a.) Are there ***currently*** any ***flooring, drains, or walls*** located within the structure(s) on the property that are stained by substances other than water ***or*** are emitting foul odors?				Lubrication and hydraulic residues on concrete floor
	b.) Have there been ***previously*** any ***flooring, drains, or walls*** located within the structure(s) on the property that are stained by substances other than water ***or*** are emitting foul odors?		No		
28.	a.) ***If the property is served by a private well*** or non-public water system, ***have contaminants been identified*** in the well or system that exceed guidelines applicable to the water system?				Not applicable
	b.) ***If the property is served by a private well*** or non-public water system, ***has the well been designated as contaminated*** by any government environmental/health agency?				Not applicable
29.	a.) Are there any ***environmental liens or government notifications*** relating to ***current violations*** of environmental laws with respect to the property or any facility located on the property?		No		
	b.) Are you aware of the ***past existence*** of any ***environmental violations*** of environmental laws with respect to the property or any facility located on the property?		No		

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PROJECT NO.: **1512-00532-PH1**

PROJECT NAME/ADDRESS: **Caltech Submilimeter Observatory**
Mauna Kea
Hawaii Island, Hawaii

Question		Response			Comment
		Yes	No	U/ NR	
30.	a.) Have you been informed of the existence of any ***hazardous substances or petroleum products*** which are ***currently*** used or stored on the property?				Small quantities paints, lubricants, hydr. oil, etc.
	b.) Have you been informed of the ***past*** existence of any ***hazardous substances or petroleum products*** used or stored on the property?		No		
31.	a.) Are you aware of any ***previous Environmental Site Assessments*** of the property or facility which indicated the presence of ***hazardous materials or petroleum products?***		No		
	b.) Are you aware of any ***previous Environmental Site Assessments*** which indicated the ***contamination of the property or facility?***		No		
	c.) Are you aware of any ***previous Environmental Site Assessments*** which ***recommended further assessment*** of the property or facility?		No		
32.	a.) Are you aware of any ***pending, threatened, or past litigation*** relevant to hazardous substances or petroleum products involving the property?		No		
	b.) Are you aware of any ***pending, threatened, or past administrative proceedings*** relevant to hazardous substances or petroleum products involving the property?		No		
	c.) Are you aware of any notices from any government entity regarding any ***possible violations*** of environmental laws or ***possible liability*** relevant to hazardous substances or petroleum products involving the property?		No		
33. .	a.) Does the property ***discharge waste water*** on or adjacent to the property, other than storm water, into a ***storm water sewer system?***		No		
	b.) Does the property ***discharge waste water*** on or adjacent to the property, other than storm water, into a ***sanitary sewer system?***	Yes			Cesspool on site.
34.	Have any hazardous substances or petroleum products, unidentified waste materials, tires, automotive or industrial batteries, or any other waste materials been ***dumped above grade, buried, and/or burned on the property?***		No		
35.	Is there any ***transformer, capacitor, or any hydraulic equipment*** on the property for which there are any records of the presence of ***PCBs?***		No		Helco Xformer; hydraulic sys; no record of PCBs
36.	a.) Is there now, or have there ever been any ***asbestos-containing materials (ACM)*** in any application on the property?			U	
	b.) Has there ever been any ***testing for ACM*** conducted on the property?		No		

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PROJECT NO.: **1512-00532-PH1**
PROJECT NAME/ADDRESS: **Caltech Submilimeter Observatory**
Mauna Kea
Hawaii Island, Hawaii

Question		Response			Comment
		Yes	No	U/ NR	
36.	c.) Is there an ***asbestos Operations and Maintenance*** (O & M) program in place at the property?		No		
37.	a.) Is there now, or have there ever been any ***Lead-Based Paint (LBP)*** in any application on the property?			U	
	b.) Has there ever been any ***testing for LBP*** conducted on the property?		No		
	c.) Is there a ***LBP O & M*** program in place at the property?		No		
38.	Has the ***water*** at the property ever been tested for ***lead?***			U	
39.	Has ***radon testing*** ever been conducted at the property?			U	
40.	Is the property, or any portion of the property, located or involved in any ***Ecologically Sensitive Areas*** (i.e., wetlands, coastal barrier resource areas, coastal barrier improvement act areas, flood plain, endangered species, etc.)?	Yes			Conservation District
41.	a.) Is the property, ***or*** any property within 1.0 mile of the property, listed on the Federal ***National Priorities List (NPL)?***		No		
	b.) Is the property, ***or*** any property within 0.5 miles of the property, listed on the Federal ***CERCLIS List?***		No		
	c.) Is the property, ***or*** any property within 1.0 mile of the property, listed by the Federal government as a ***RCRA TSD Facility?***		No		
42.	a.) Is the property, ***or*** any property within 1.0 mile of the property, listed by the State government as a ***Hazardous Waste site?***		No		
	b.) Is the property, ***or*** any property within 0.5 miles of the property, listed by the State government as a ***CERCLIS-equivalent site?***		No		
	c.) Is the property, ***or*** any property within 0.5 miles of the property, listed by the State as a ***Leaking Underground Storage Tank (LUST) site?***		No		
	c.) Is the property, ***or*** any property within 0.5 miles of the property, listed by the State as a ***Solid Waste/Landfill facility?***		No		

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PROJECT NO.: 1512-00532-PH1

PROJECT NAME/ADDRESS: Caltech Submillimeter Observatory
Mauna Kea
Hawaii Island, Hawaii

Respondent Affirmation:

Respondent represents that to the best of the respondent's knowledge the above statements and facts are true and correct and to the best of the respondent's actual knowledge, no material facts have been suppressed or misstated.

Signature ________________________ Date 2016-01-06 ___________
(For oral communications, the word "Affirmed" appears on the signature line)

or

Answers to this questionnaire have been orally communicated to a representative of Environmental Professionals, completed by:

Name ______________ Signature ____________________ Date_________

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Phase I Environmental Site Assessment Property Questionnaire

Circle all that apply: User ● Owner ● Key Site Manager

Please complete **ALL** sections of this questionnaire and return a **signed and dated** copy to ENPRO Environmental via FAX at **808-262-4449** or e-mail at **hschauer@enproenvironmental.com** as soon as possible.

Communication with:	Name:	Stephanie Nagata
	Company:	Office of Maunakea Management
	Phone Number:	808-933-0734
	Date:	January 28, 2016
	Amount of Time Familiar With Site:	15.5 years
	Relationship to Site:	OMMK has oversight of observatory activities that impact the external environment.

PROJECT NO.: **1512-00532-PH1**

PROJECT NAME/ADDRESS: **Caltech Submilimeter Observatory**
Mauna Kea
Hawaii Island, Hawaii

Prior to answering the questions supplied in the table below, please provide ENPRO with the following information:

A. What is your purpose/reason for requesting a Phase I Environmental Site Assessment of the above referenced property? ____________________

B. Can you supply a floor plan diagram and list of tenants for the structures at the property? If so, please attach copies with your questionnaire responses or send separately prior to the site visit.

DIRECTIONS: Please answer all questions to the best of your knowledge and in good faith. Mark the appropriate response with an "**X**". (Note: **U/NR** indicates "Unknown" or "No Response").
If you not know the answer, please check the **U/NR** box rather than the **No** box.
Please also elaborate on ALL **Yes** responses in the **Comment** box (for example, if the response to "Is the adjoining property used for an industrial use?" is **Yes**, please explain, e.g., "The building next door is used for canning tomatoes"). You may also provide additional information to **U/NR** and **No** responses as necessary. If you have any questions while completing the questionnaire, please contact us.

	Question	**Response**			**Comment**
		Yes	**No**	**U/NR**	
1.	Are you aware of any pending, threatened, or past ***litigation*** relevant to hazardous substances or petroleum products in, on, or from the property?		X		
2.	Are you aware of any pending, threatened, or past ***administrative proceedings*** relevant to hazardous substances or petroleum products in, on, or from the property?		X		
3.	Are you aware of any ***notices from any governmental entity*** regarding any possible violation(s) of environmental laws or possible liability relating to hazardous substances or petroleum products in, on, or from the property?		X		

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PROJECT NO.: **1512-00532--PH1**
PROJECT NAME/ADDRESS: **Caltech Submilimeter Observatory**
Mauna Kea
Hawaii Island, Hawaii

Question		Response Yes	Response No	Response U/NR	Comment
4.	Are you aware of any ***environmental cleanup liens*** against the property that are filed or recorded under federal, tribal, state, or local law?		X		
5.	Are you aware of any ***Activity and Use Limitations (AULs)***, including engineering controls, land use restrictions, or institutional controls that are in place at the property and/or have been filed or recorded in a registry under federal, tribal, state, or local law?	X			Any land use defined under Conservation District rules are subject to review and a permit from DLNR
6.	Do you have any ***specialized knowledge*** or experience related to possible environmental concerns at the property or nearby properties? (For example, are you involved in the same line of business as the current or former occupants at the property or adjacent/nearby properties such that you would have specialized knowledge of the chemicals and processes used by this type of business?)	X			Possible. In May 2009, there was a hydraulic leak that spilled onto the floor of the telescope facility. An estimated 7 gallons may have been released into the cinder through a drain hole. The majority of nearly 23 gallons were recovered. Also see page 6-9 of the 2009 Maunakea CMP for additional information on other facilities.
7.	Does the purchase price being paid for this property reasonably reflect the fair market value of the property? If you conclude that there is a difference, have you considered whether the ***devalued purchase price*** is because contamination is known or believed to be present at the property? (Please reply in **Comment** section)			X	
8.	Are you aware of ***commonly known or reasonably ascertainable information*** about the property or nearby properties that would help ENPRO to identify conditions indicative of releases or threatened releases? (For example, neighboring property is known to have once been a vehicle junk yard)		X		
9.	Do you know any ***past uses*** of the property which may have contributed to potential contaminant releases?	X			See no. 5 above
10.	Do you know of any ***specific chemicals*** that are present or once were present at the property?	X			Only the hydraulic fluid mentioned in no. 6 above
11.	Do you know of any ***spills or other chemical releases*** that have taken place at the property?	X			See No. 6 above
12.	Do you know of any ***environmental cleanups*** that have taken place at the property?	X			See No. 6 above.

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13.	Based on your knowledge and experience related to the property, are there any ***obvious indicators*** that point to the presence or likely presence of contamination at the property?		X		
14.	a.) Is the ***property*** used for an industrial use?		X		
	b.) Are any ***adjacent properties*** used for an industrial use?		X		
15.	a.) Has the ***property*** been used for an industrial use ***in the past***?		X		
	b.) Have any of the ***adjacent properties*** been used for an industrial use ***in the past***?		X		
	Question	**Response**			**Comment**
		Yes		**U/ NR**	
16.	a.) Is the ***property*** used as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility?		X		
	b.) Are any of the ***adjacent properties*** used as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility?		X		
17.	a.) Has the ***property*** been used ***in the past*** as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility?		X		
	b.) Have any of the ***adjacent properties*** been used ***in the past*** as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility?		X		
18.	a.) Are there ***currently*** any automotive or industrial **batteries** damaged or discarded, or **pesticides, paints, or other chemicals** in individual containers of greater than five gallons in volume or fifty gallons in the aggregate, stored on, or used at the ***property*** or at the *facility*?		X		
	b.) Have there been ***previously*** any automotive or industrial **batteries** damaged or discarded, or **pesticides, paints, or other chemicals** in individual containers of greater than five gallons in volume or fifty gallons in the aggregate, stored on or used at the ***property*** or at the *facility*?		X		
19.	a.) Are there ***currently*** any industrial **drums** (typically 55-gallon) or **sacks of chemical** located on the ***property?***		X		
	b.) Have there been ***previously*** any industrial **drums** (typically 55-gallon) or **sacks of chemical** located on the ***property?***		X		
20.	a.) Are there ***currently*** any ground water monitoring wells or other **ground water wells** (e.g., drinking water wells) located on the ***property***?		X		
	b.) Have there been ***previously*** any ground water monitoring wells or other **ground water wells** (e.g., drinking water wells) located on the ***property***?		X		
21.	a.) Are there ***currently*** any ground water monitoring wells or other **ground water wells** (e.g., drinking water wells) located on any of the ***adjacent properties?***		X		
	b.) Have there been ***previously*** any ground water monitoring wells or other **ground water wells** (e.g., drinking water wells) located on any of the ***adjacent properties?***		X		

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PROJECT NAME/ADDRESS: **Caltech Submilimeter Observatory**
Mauna Kea
Hawaii Island, Hawaii

	Question	Response Yes	Response No	Response U/NR	Comment
22.	a.) Has ***fill dirt*** been brought onto the property which originated from a ***contaminated site?***		X		
	b.) Has ***fill dirt*** been brought onto the property which is of ***unknown origin?***		X		
23.	a.) Are there ***currently*** any ***pits, ponds or lagoons*** on the property in connection with waste treatment or waste disposal?		X		
	b.) Have there been ***previously*** any ***pits, ponds or lagoons*** on the property in connection with waste treatment or waste disposal?		X		
24.	a.) Is there ***currently*** any ***stained soil*** on the property?				Possible stained soil below concrete floor due to a hydraulic leak. See comment under No. 6 above
	b.) Has there been ***previously*** any ***stained soil*** on the property?				See No. 6 and 24 above
25. .	a.) Are there ***currently*** any registered or unregistered ***storage tanks*** (above ground or underground) located on the property?		X		
	a.) Have there been ***previously*** any registered or unregistered ***storage tanks*** (above ground or underground) located on the property?		X		
26.	a.) Are there ***currently*** any ***vent pipes, fill pipes, or access ways indicating a fill pipe*** protruding from the ground on the property ***or*** adjacent to any structures on the property?	X			Water and septic (cesspool).
	b.) Have there been ***previously*** any ***vent pipes, fill pipes, or access ways indicating a fill pipe*** protruding from the ground on the property ***or*** adjacent to any structures on the property?		X		
27.	a.) Are there ***currently*** any ***flooring, drains, or walls*** located within the structure(s) on the property that are stained by substances other than water ***or*** are emitting foul odors?		X		
	b.) Have there been ***previously*** any ***flooring, drains, or walls*** located within the structure(s) on the property that are stained by substances other than water ***or*** are emitting foul odors?		X		
28.	a.) ***If the property is served by a private well*** or non-public water system, ***have contaminants been identified*** in the well or system that exceed guidelines applicable to the water system?		X		
	b.) ***If the property is served by a private well*** or non-public water system, ***has the well been designated as contaminated*** by any government environmental/health agency?		X		
29.	a.) Are there any ***environmental liens or government***		X		

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	notifications relating to ***current violations*** of environmental laws with respect to the property or any facility located on the property?				
	b.) Are you aware of the ***past existence*** of any ***environmental violations*** of environmental laws with respect to the property or any facility located on the property?		X		See 2009 Maunakea CMP

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Hawaii Island, Hawaii

	Question	Response			Comment
		Yes	No	U/ NR	
30.	a.) Have you been informed of the existence of any ***hazardous substances or petroleum products*** which are ***currently*** used or stored on the property?	X			See Maunakea Natural Resources Management Plan pg 3-12.
	b.) Have you been informed of the ***past*** existence of any ***hazardous substances or petroleum products*** used or stored on the property?		X		
31.	a.) Are you aware of any ***previous Environmental Site Assessments*** of the property or facility which indicated the presence of ***hazardous materials or petroleum products?***		X		
	b.) Are you aware of any ***previous Environmental Site Assessments*** which indicated the ***contamination of the property or facility?***				See comment under No. 6 and 24 above
	c.) Are you aware of any ***previous Environmental Site Assessments*** which ***recommended further assessment*** of the property or facility?	X			See comment under No. 6 and 24 above. Also see letter from DLNR
32.	a.) Are you aware of any ***pending, threatened, or past litigation*** relevant to hazardous substances or petroleum products involving the property?		X		
	b.) Are you aware of any ***pending, threatened, or past administrative proceedings*** relevant to hazardous substances or petroleum products involving the property?		X		
	c.) Are you aware of any notices from any government entity regarding any ***possible violations*** of environmental laws or ***possible liability*** relevant to hazardous substances or petroleum products involving the property?		X		
33. .	a.) Does the property ***discharge waste water*** on or adjacent to the property, other than storm water, into a ***storm water sewer system?***		X		
	b.) Does the property ***discharge waste water*** on or adjacent to the property, other than storm water, into a ***sanitary sewer system?***	X			Into cesspool.
34.	Have any hazardous substances or petroleum products, unidentified waste materials, tires, automotive or industrial batteries, or any other waste materials been ***dumped above***		X		

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	grade, buried, and/or burned on the property?				
35.	Is there any ***transformer, capacitor, or any hydraulic equipment*** on the property for which there are any records of the presence of ***PCBs?***		X		
36.	a.) Is there now, or have there ever been any ***asbestos-containing materials (ACM)*** in any application on the property?			X	
	b.) Has there ever been any ***testing for ACM*** conducted on the property?		X		

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	Question	Response			Comment
		Yes	No	U/ NR	
36.	c.) Is there an ***asbestos Operations and Maintenance*** (O & M) program in place at the property?		X		
37.	a.) Is there now, or have there ever been any ***Lead-Based Paint (LBP)*** in any application on the property?		X		
	b.) Has there ever been any ***testing for LBP*** conducted on the property?		X		
	c.) Is there a ***LBP O & M*** program in place at the property?		X		
38.	Has the ***water*** at the property ever been tested for ***lead?***		X		
39.	Has ***radon testing*** ever been conducted at the property?		X		
40.	Is the property, or any portion of the property, located or involved in any ***Ecologically Sensitive Areas*** (i.e., wetlands, coastal barrier resource areas, coastal barrier improvement act areas, flood plain, endangered species, etc.)?	X			Near wekiu bug habitat
41.	a.) Is the property, ***or*** any property within 1.0 mile of the property, listed on the Federal ***National Priorities List (NPL)?***		X		
	b.) Is the property, ***or*** any property within 0.5 miles of the property, listed on the Federal ***CERCLIS List?***		X		
	c.) Is the property, ***or*** any property within 1.0 mile of the property, listed by the Federal government as a ***RCRA TSD Facility?***		X		
42.	a.) Is the property, ***or*** any property within 1.0 mile of the property, listed by the State government as a ***Hazardous Waste site?***		X		
	b.) Is the property, ***or*** any property within 0.5 miles of the property, listed by the State government as a ***CERCLIS-equivalent site?***		X		
	c.) Is the property, ***or*** any property within 0.5 miles of the property, listed by the State as a ***Leaking Underground Storage Tank (LUST) site?***		X		
	c.) Is the property, ***or*** any property within 0.5 miles of the property,		X		

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	listed by the State as a ***Solid Waste/Landfill facility?***					

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Mauna Kea
Hawaii Island, Hawaii

Respondent Affirmation:

Respondent represents that to the best of the respondent's knowledge the above statements and facts are true and correct and to the best of the respondent's actual knowledge, no material facts have been suppressed or misstated.

Signature Stephanie Sagah Date 2/4/16
(For oral communications, the word "Affirmed" appears on the signature line)

or

Answers to this questionnaire have been orally communicated to a representative of Environmental Professionals, completed by:

Name __________ Signature __________ Date __________

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Phase I Environmental Site Assessment Property Questionnaire

Circle all that apply: User ● Owner ● Key Site Manager

Please complete **ALL** sections of this questionnaire and return a **signed and dated** copy to ENPRO Environmental via FAX at **808-262-4449** or e-mail at **hschauer@enproenvironmental.com** as soon as possible.

Communication with:	Name:	Russell Y. Tsuji
	Company:	DLNR Land Division
	Phone Number:	(808) 587-0422
	Date:	March 7, 2016
	Amount of Time Familiar With Site:	Aware of the general leased area since 2015 as an employee of DLNR
	Relationship to Site:	Land Division Administrator

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Prior to answering the questions supplied in the table below, please provide ENPRO with the following information:

A. What is your purpose/reason for requesting a Phase I Environmental Site Assessment of the above referenced property? **We understand that either UH or its sublessee has initiated the request for the Phase I. CAVEAT: please note that UH and its sublessee have had exclusive use of the property since at least the commencement of General Lease No. S-4191 between the Board of Land and Natural Resources (BLNR), as lessor, and UH, as lessee, on June 21, 1968. Our files indicate that the BLNR, as lessor under the aforesaid General Lease never received notice, written or otherwise, of any spills of hazardous materials or other episodes of possible environmental contamination at the property.**

B. Can you supply a floor plan diagram and list of tenants for the structures at the property? If so, please attach copies with your questionnaire responses or send separately prior to the site visit.

DIRECTIONS: Please answer all questions to the best of your knowledge and in good faith. Mark the appropriate response with an "**X**". (Note: **U/NR** indicates "Unknown" or "No Response").
If you not know the answer, please check the **U/NR** box rather than the **No** box.
Please also elaborate on ALL **Yes** responses in the **Comment** box (for example, if the response to "Is the adjoining property used for an industrial use?" is **Yes**, please explain, e.g., "The building next door is used for canning tomatoes"). You may also provide additional information to **U/NR** and **No** responses as necessary. If you have any questions while completing the questionnaire, please contact us.

Question		Response			Comment
		Yes	No	U/NR	
1.	Are you aware of any pending, threatened, or past ***litigation*** relevant to hazardous substances or petroleum products in, on, or from the property?		X		See caveat in item A above.
2.	Are you aware of any pending, threatened, or past ***administrative***		X		See caveat in item A

	proceedings relevant to hazardous substances or petroleum products in, on, or from the property?				above.
3.	Are you aware of any ***notices from any governmental entity*** regarding any possible violation(s) of environmental laws or possible liability relating to hazardous substances or petroleum products in, on, or from the property?		X		See caveat in item A above.

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PROJECT NAME/ADDRESS: **Caltech Submilimeter Observatory**
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Question		Response			Comment
		Yes	No	U/ NR	
4.	Are you aware of any ***environmental cleanup liens*** against the property that are filed or recorded under federal, tribal, state, or local law?		X		See caveat in item A above.
5.	Are you aware of any ***Activity and Use Limitations (AULs)***, including engineering controls, land use restrictions, or institutional controls that are in place at the property and/or have been filed or recorded in a registry under federal, tribal, state, or local law?		X		See caveat in item A above.
6.	Do you have any ***specialized knowledge*** or experience related to possible environmental concerns at the property or nearby properties? (For example, are you involved in the same line of business as the current or former occupants at the property or adjacent/nearby properties such that you would have specialized knowledge of the chemicals and processes used by this type of business?)		X		See caveat in item A above.
7.	Does the purchase price being paid for this property reasonably reflect the fair market value of the property? If you conclude that there is a difference, have you considered whether the ***devalued purchase price*** is because contamination is known or believed to be present at the property? (Please reply in **Comment** section)			X	Probably not applicable. See caveat in item A above.
8.	Are you aware of ***commonly known or reasonably ascertainable information*** about the property or nearby properties that would help ENPRO to identify conditions indicative of releases or threatened releases? (For example, neighboring property is known to have once been a vehicle junk yard)		X		See caveat in item A above.
9.	Do you know any ***past uses*** of the property which may have contributed to potential contaminant releases?		X		See caveat in item A above.
10.	Do you know of any ***specific chemicals*** that are present or once were present at the property?		X		See caveat in item A above.
11.	Do you know of any ***spills or other chemical releases*** that have taken place at the property?		X		See caveat in item A above.
12.	Do you know of any ***environmental cleanups*** that have taken place at the property?		X		See caveat in item A above.
13.	Based on your knowledge and experience related to the property, are there any ***obvious indicators*** that point to the presence or likely presence of contamination at the property?		X		See caveat in item A above.
14.	a.) Is the ***property*** used for an industrial use?			X	See caveat in item A

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		Yes	No	U/NR	Comment
					above.
	b.) Are any ***adjacent properties*** used for an industrial use?			X	See caveat in item A above.
15.	a.) Has the ***property*** been used for an industrial use ***in the past***?			X	See caveat in item A above.
	b.) Have any of the ***adjacent properties*** been used for an industrial use ***in the past***?			X	See caveat in item A above.

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Question		Response			Comment
		Yes	No	U/NR	
16.	a.) Is the ***property*** used as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility?			X	See caveat in item A above.
	b.) Are any of the ***adjacent properties*** used as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility?			X	See caveat in item A above.
17.	a.) Has the ***property*** been used ***in the past*** as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility?			X	See caveat in item A above.
	b.) Have any of the ***adjacent properties*** been used ***in the past*** as a gasoline station, motor repair facility, commercial printing facility, dry cleaners, photo developing laboratory, junkyard or landfill, or as a waste treatment, storage, disposal, processing, or recycling facility?			X	See caveat in item A above.
18.	a.) Are there ***currently*** any automotive or industrial **batteries** damaged or discarded, or **pesticides, paints, or other chemicals** in individual containers of greater than five gallons in volume or fifty gallons in the aggregate, stored on, or used at the ***property*** or at the *facility*?			X	See caveat in item A above.
	b.) Have there been ***previously*** any automotive or industrial **batteries** damaged or discarded, or **pesticides, paints, or other chemicals** in individual containers of greater than five gallons in volume or fifty gallons in the aggregate, stored on or used at the ***property*** or at the *facility*?			X	See caveat in item A above.
19.	a.) Are there ***currently*** any industrial **drums** (typically 55-gallon) or **sacks of chemical** located on the ***property?***			X	See caveat in item A above.
	b.) Have there been ***previously*** any industrial **drums** (typically 55-gallon) or **sacks of chemical** located on the ***property?***			X	See caveat in item A above.
20.	a.) Are there ***currently*** any ground water monitoring wells or other **ground water wells** (e.g., drinking water wells) located on the ***property***?			X	Contact CWRM. See caveat in item A above.
	b.) Have there been ***previously*** any ground water monitoring wells			X	Contact CWRM. See

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	or other **ground water wells** (e.g., drinking water wells) located on the ***property***?				caveat in item A above.
21.	a.) Are there ***currently*** any ground water monitoring wells or other **ground water wells** (e.g., drinking water wells) located on any of the ***adjacent properties?***			X	Contact CWRM. See caveat in item A above.
	b.) Have there been ***previously*** any ground water monitoring wells or other **ground water wells** (e.g., drinking water wells) located on any of the ***adjacent properties?***			X	Contact CWRM. See caveat in item A above.

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Question		Response			Comment
		Yes	No	U/ NR	
22.	a.) Has ***fill dirt*** been brought onto the property which originated from a ***contaminated site?***			X	See caveat in item A above.
	b.) Has ***fill dirt*** been brought onto the property which is of ***unknown origin?***			X	See caveat in item A above.
23.	a.) Are there ***currently*** any ***pits, ponds or lagoons*** on the property in connection with waste treatment or waste disposal?			X	See caveat in item A above.
	b.) Have there been ***previously*** any ***pits, ponds or lagoons*** on the property in connection with waste treatment or waste disposal?			X	See caveat in item A above.
24.	a.) Is there ***currently*** any ***stained soil*** on the property?			X	See caveat in item A above.
	b.) Has there been ***previously*** any ***stained soil*** on the property?			X	See caveat in item A above.
25. .	a.) Are there ***currently*** any registered or unregistered ***storage tanks*** (above ground or underground) located on the property?			X	See caveat in item A above.
	a.) Have there been ***previously*** any registered or unregistered ***storage tanks*** (above ground or underground) located on the property?			X	See caveat in item A above.
26.	a.) Are there ***currently*** any ***vent pipes, fill pipes, or access ways indicating a fill pipe*** protruding from the ground on the property ***or*** adjacent to any structures on the property?			X	See caveat in item A above.
	b.) Have there been ***previously*** any ***vent pipes, fill pipes, or access ways indicating a fill pipe*** protruding from the ground on the property ***or*** adjacent to any structures on the property?			X	See caveat in item A above.
27.	a.) Are there ***currently*** any ***flooring, drains, or walls*** located within the structure(s) on the property that are stained by substances other than water ***or*** are emitting foul odors?			X	See caveat in item A above.
	b.) Have there been ***previously*** any ***flooring, drains, or walls***			X	See caveat in item A

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		Yes	No	U/NR	Comment
	located within the structure(s) on the property that are stained by substances other than water ***or*** are emitting foul odors?				above.
28.	a.) ***If the property is served by a private well*** or non-public water system, ***have contaminants been identified*** in the well or system that exceed guidelines applicable to the water system?			X	See caveat in item A above.
	b.) ***If the property is served by a private well*** or non-public water system, ***has the well been designated as contaminated*** by any government environmental/health agency?			X	See caveat in item A above.
29.	a.) Are there any ***environmental liens or government notifications*** relating to ***current violations*** of environmental laws with respect to the property or any facility located on the property?			X	See caveat in item A above.
	b.) Are you aware of the ***past existence*** of any ***environmental violations*** of environmental laws with respect to the property or any facility located on the property?			X	See caveat in item A above.

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Mauna Kea
Hawaii Island, Hawaii

	Question	Response			Comment
		Yes	No	U/NR	
30.	a.) Have you been informed of the existence of any ***hazardous substances or petroleum products*** which are ***currently*** used or stored on the property?		X		See caveat in item A above.
	b.) Have you been informed of the ***past*** existence of any ***hazardous substances or petroleum products*** used or stored on the property?		X		See caveat in item A above.
31.	a.) Are you aware of any ***previous Environmental Site Assessments*** of the property or facility which indicated the presence of ***hazardous materials or petroleum products?***		X		See caveat in item A above.
	b.) Are you aware of any ***previous Environmental Site Assessments*** which indicated the ***contamination of the property or facility?***		X		See caveat in item A above.
	c.) Are you aware of any ***previous Environmental Site Assessments*** which ***recommended further assessment*** of the property or facility?		X		See caveat in item A above.
32.	a.) Are you aware of any ***pending, threatened, or past litigation*** relevant to hazardous substances or petroleum products involving the property?		X		See caveat in item A above.
	b.) Are you aware of any ***pending, threatened, or past administrative proceedings*** relevant to hazardous substances or petroleum products involving the property?		X		See caveat in item A above.
	c.) Are you aware of any notices from any government entity regarding any ***possible violations*** of environmental laws or ***possible liability*** relevant to hazardous substances or petroleum products involving the property?		X		See caveat in item A above.
33. .	a.) Does the property ***discharge waste water*** on or adjacent to the property, other than storm water, into a ***storm water sewer system?***			X	See caveat in item A above.

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	b.) Does the property ***discharge waste water*** on or adjacent to the property, other than storm water, into a ***sanitary sewer system?***			X	See caveat in item A above.
34.	Have any hazardous substances or petroleum products, unidentified waste materials, tires, automotive or industrial batteries, or any other waste materials been ***dumped above grade, buried, and/or burned on the property?***			X	See caveat in item A above.
35.	Is there any ***transformer, capacitor, or any hydraulic equipment*** on the property for which there are any records of the presence of ***PCBs?***			X	See caveat in item A above.
36.	a.) Is there now, or have there ever been any ***asbestos-containing materials (ACM)*** in any application on the property?			X	See caveat in item A above.
	b.) Has there ever been any ***testing for ACM*** conducted on the property?			X	See caveat in item A above.

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Question		Response			Comment
		Yes	No	U/ NR	
36.	c.) Is there an ***asbestos Operations and Maintenance*** (O & M) program in place at the property?			X	See caveat in item A above.
37.	a.) Is there now, or have there ever been any ***Lead-Based Paint (LBP)*** in any application on the property?			X	See caveat in item A above.
	b.) Has there ever been any ***testing for LBP*** conducted on the property?			X	See caveat in item A above.
	c.) Is there a ***LBP O & M*** program in place at the property?			X	See caveat in item A above.
38.	Has the ***water*** at the property ever been tested for ***lead?***			X	See caveat in item A above.
39.	Has ***radon testing*** ever been conducted at the property?			X	See caveat in item A above.
40.	Is the property, or any portion of the property, located or involved in any ***Ecologically Sensitive Areas*** (i.e., wetlands, coastal barrier resource areas, coastal barrier improvement act areas, flood plain, endangered species, etc.)?	X			Conservation district. Contact OCCL. See caveat in item A above.
41.	a.) Is the property, ***or*** any property within 1.0 mile of the property, listed on the Federal ***National Priorities List (NPL)?***			X	See caveat in item A above.
	b.) Is the property, ***or*** any property within 0.5 miles of the property, listed on the Federal ***CERCLIS List?***			X	See caveat in item A above.
	c.) Is the property, ***or*** any property within 1.0 mile of the property,			X	See caveat in item A

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	listed by the Federal government as a ***RCRA TSD Facility?***				above.
42.	a.) Is the property, ***or*** any property within 1.0 mile of the property, listed by the State government as a ***Hazardous Waste site?***			X	See caveat in item A above.
	b.) Is the property, ***or*** any property within 0.5 miles of the property, listed by the State government as a ***CERCLIS-equivalent site?***			X	See caveat in item A above.
	c.) Is the property, ***or*** any property within 0.5 miles of the property, listed by the State as a ***Leaking Underground Storage Tank (LUST) site?***			X	See caveat in item A above.
	c.) Is the property, ***or*** any property within 0.5 miles of the property, listed by the State as a ***Solid Waste/Landfill facility?***			X	See caveat in item A above.

PROJECT NO.: 1512-00532-PH1

PROJECT NAME/ADDRESS: Caltech Submilitmeter Observatory
Mauna Kea
Hawaii Island, Hawaii

Respondent Affirmation:

Respondent represents that to the best of the respondent's knowledge the above statements and facts are true and correct and to the best of the respondent's actual knowledge, no material facts have been suppressed or misstated.

Signature /s/ Russell Y. Tsuji __________ Date 03-08-16 ___________
(For oral communications, the word "Affirmed" appears on the signature line)

or

Answers to this questionnaire have been orally communicated to a representative of Environmental Professionals, completed by:

Name _______________ Signature ______________________ Date_________

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QUALIFICATIONS OF ENVIRONMENTAL PROFESSIONALS

Kenton Beal
Executive Vice President

CAREER HISTORY More than twenty-five years of professional environmental project development and management. Strong emphasis on risk evaluation, risk ranking and environmental hazard assessment. Experienced in portfolio-wide environmental management and prioritizing resource allocation to address environmental liabilities in a cost effective manner. Has developed thousands of project budgets for planning and implementation purposes. Performed numerous RCRA hazardous waste characterization investigations, Phase I and II environmental investigations, remediation of soil and groundwater and environmental management of large construction projects. Projects have included urban renewal, remediation management at petroleum refineries, best management practices, storm water management, solid waste management, construction-related permitting, indoor air quality evaluations, closure of RCRA Treatment Storage and Disposal (TSD) facilities, remediation management for fungal contamination, evaluation of environmental issues related to lease disputes and commercial property transactions. Has performed and managed thousands of mold and moisture investigations ranging from single-family residential properties to high-rise commercial and resort properties.

PROFESSIONAL AFFILIATIONS

Registered Environmental Assessor (California)
Past President, Hawaii Chapter of the Institute of Hazardous Materials Managers
Registered Geologist (California)
Certified Professional Geologist (American Institute of Professional Geologists)
American Indoor Air Quality Council (Board of Directors, Hawaii Chapter)
Certified Indoor Environmentalist (Indoor Air Quality Association)
Certified in Mold Loss Prevention (Indoor Air Quality Association)
American Industrial Hygiene Association

EDUCATION

MBA, Hawaii Pacific University, 2001
M.S., Geology and Geophysics, University of Hawaii, 1987
B.A., Geology, University of California at Santa Barbara, 1984

GEOGRAPHIC EXPERIENCE Successfully completed projects throughout the major Hawaiian Islands, Guam, Saipan, CNMI, Puerto Rico, Japan, and throughout the United States

ENVIRONMENTAL INVESTIGATION/ REMEDIATION EXPERIENCE Projects have included wood treatment facilities, petroleum refineries, underground storage tank (UST) sites, agricultural facilities, urban renewal projects, petroleum bulk storage terminals impacted with free floating petroleum hydrocarbons, dry cleaners, and a variety of commercial/industrial facilities. Received No Further Action status at multiple sites from the State of Hawaii Department of Health. Successful experience with investigation and remediation projects for real property transfers and redevelopment. Design of corrective measures for indoor air quality complaints. Mold and moisture training, prevention and response planning.

Kenton Beal
Executive Vice President

SPECIALIZED TRAINING

Mold Loss Prevention, Indoor Air Quality Association
Groundwater Flow through Porous and Fractured Media, University of Wisconsin-Madison
Corrective Action for Containing and Controlling Ground Water Contamination, National Water Well Association
Basic Ground Water Modeling, National Water Well Association
Project Management, University of Hawaii
Clean Air Act Amendment 112 ®, U.S. EPA
Management & Supervision of Hazardous Waste Operations, Unitek Environmental Consultants
AHERA Asbestos Management Planner
AHERA Asbestos Inspector
HVAC and the Indoor Environment, American Indoor Air Quality Council
IICRC S520 Mold Remediation Guideline, American Indoor Air Quality Council
Case Studies in Environmental Mold, American Industrial Hygiene Association
Health Effects of Mold, American Indoor Air Quality Council
40-hour Hazwoper Training and Refreshers, Various
Understanding Environmental Sampling and Data Analysis
Managing Uncertainty with Systematic Planning

PROFESSIONAL PRESENTATIONS

Building Operator Certification, Indoor Environmental Quality, University of Hawaii
Environmental Game Changers, Honolulu, Hawaii
Indoor Air Quality in Commercial Buildings, American Society of Heating and Refrigeration Engineers
Environmental Solutions for Real Estate Transactions, Honolulu Board of Realtors
Storm Water Monitoring, Law Seminars International, Honolulu
Mold Remediation Boot Camp, Las Vegas
Mold University™, Honolulu and Houston
Indoor Air Quality for Property Managers, San Francisco, Honolulu, Las Vegas, Los Angeles
Mold Report™, San Francisco, Honolulu, Las Vegas, Los Angeles
Mold Awareness, International Executive Housekeepers Association
Advanced Conference on Real Estate, Law Seminars International
Hot Topics in the Mold Industry, American Indoor Air Quality Council, Hawaii
Mold Investigation Training, Pensacola, Fort Lauderdale, Orlando, Tampa, Florida
Environmental Investigation for Emergency Services, Burbank and Long Beach California
Multi-Family Residential Development, Lohrman Education Services, Honolulu
Environmental Law Seminar A to Z, NBI, Inc., Honolulu
Real Estate Development From Beginning to End, Lorman Educations Services, Honolulu

Heather Schauer

Environmental Technician

CAREER HISTORY

Experienced in conducting ASTM Standard Phase I Environmental Site Assessments (ESA)'s and site assessment work addressing PCBs, petroleum-related contaminants, pesticides, asbestos, metals, underground storage tanks (USTs), and non-point source contaminants and review of federal, state and county databases and regulatory files.

Experienced in conducting hazardous materials surveys and environmental site assessments for asbestos containing building materials, and lead containing paint

Experienced in conducting surveys for moisture intrusion, visible suspect mold and indoor air quality investigations.

Experienced in conducting post remediation verification (PRV) for mold and moisture intrusion remediation and hygienic indoor surfaces.

Experienced in environmental research and report preparation.

Experienced in ecological fieldwork.

EDUCATION

B.S. Microbiology – 2015 University of Hawaii, Manoa. Emphasis in virology and bacteriology.

SPECIALIZED TRAINING

AHERA Asbestos Building Inspector Certification No. HIASB-4032

Hawaii State Certified Lead Risk Assessor Certification No. PB-0816

Appendix C. Phase II Sampling and Analysis Plan

Caltech Submillimeter Observatory Soil Sampling and Analysis Plan Draft

Caltech Submillimeter Observatory
Mauna Kea Summit
Mauna Kea, Hawaii

Prepared for:

California Institute of Technology
Pasadena, California

and

State of Hawaii Department of Health
Hazard Evaluation and Emergency Response (HEER) Office
2385 Waimano Home Road
Pearl City, Hawaii 96782

Prepared by:

ENPRO Environmental
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808.262.0909 (t)

ENPRO Project Number 2006-00249-PH2
September 25, 2020

TABLE OF CONTENTS

1.0 INTRODUCTION

The California Institute of Technology (Caltech) retained ENPRO Environmental (ENPRO) to prepare a Draft Sampling and Analysis Plan (SAP) to support the decommissioning of the Caltech Submillimeter Observatory (CSO) and associated pump shed and outbuilding located at the summit of Mauna Kea on Hawaii Island (the "Site," see Figures 1-3).

1.1 PURPOSE

The decommissioning of facilities within the CSO sublease include the observatory, pump house, single-story outbuilding, and cesspool. The project will include removing asphalt paving, slab-on-grade and below-grade foundations, utility demolition, earthwork, and the potential excavation and disposal of any soils with concentrations of target chemicals of potential concern (COPCs) exceeding the State of Hawaii Department of Health (DOH) Hazard Evaluation and Emergency Response (HEER) Office's most restrictive levels: the Tier I Environmental Action Levels (EALs) for unrestricted land use.

The purpose of this SAP is to assess whether COPCs are present in soils at the building footprints or that may have migrated beyond the footprints. The Site shall be evaluated based on a comparison of the analytical results to the DOH EALs for unrestricted land use of sites not within 150 meters of a surface water body and where groundwater is not a current or potential drinking water source (DOH, Fall 2017). Data shall also be used to adequately characterize the soil to meet the disposal acceptance requirements of the County of Hawaii West Hawaii Sanitary Landfill (WHSL) in the event that any COPCs are present at concentrations greater than the applicable EALs.

2.0 Background

2.1 Site Description

The Site is located near the summit of Mauna Kea, in the north central part of the island of Hawaii. The Site is further described by the County of Hawaii Real Property Tax Office as a 0.75-acre portion of Tax Map Key (3) 4-4-015: 009 (see Figure 2). It is located in an area zoned "Conservation."

For the purposes of this SAP, the Site is specifically defined as the following (see Figure 4):

- CSO footprint, approximately 6,000 square feet (sf)
- An 850-gallon cesspool, approximately 60 sf

Soil sampling at the Site will encompass an area of approximately 6,060 sf.

2.2 Climate

The summit of Mauna Kea is approximately 14,000 feet above sea level and has its own climate. Snow can occur year-round, with temperatures varying up to 30 ºF between noon and midnight. Daytime temperatures range from 60ºF in the summer to just above freezing in winter. Nighttime temperatures are usually 32ºF or below, regardless of the time of year. (Na Maka o ka Aina, 2020). The mean annual rainfall is approximately 8 inches (University of Hawaii, 2011).

The Site area is typically exposed to winds from the west/northwest during the day and from the east/northeast at night. Winds vary from about 10 to 15 miles per hour and can exceed 100 miles per hour during severe winter storms (Na Maka o ka Aina, 2020).

2.3 Soils/Geology

For detailed information regarding Site soils and geology, see the *Hydrogeological and Geological Evaluation: Decommissioning of the California Institute of Technology Submillimeter Observatory* (HGE) prepared by Intera Geoscience & Engineering Solutions (Intera) and dated September 18, 2019 (provided in the appendix).

2.4 SURFACE WATER

The Site region is moderately sloping in all directions. The nearest body of water is Lake Waiau located one mile to the south. Runoff from the Site does not flow into the lake. The Site is not within 150 meters of a surface water body.

2.5 GROUNDWATER

For detailed information regarding groundwater, see Intera's HGE dated September 18, 2019 (provided in the appendix).

2.6 HISTORIC LAND USE

Historical information provided in ENPRO's *Phase 1 Environmental Site Assessment: Caltech Submillimeter Observatory* (ESA) dated March 21, 2016, indicates that the Site was undeveloped land until 1983, since which the Site has been used for the construction and scientific operation of the CSO. CSO assembly was completed in 1987 and observations ceased in 2015.

2.7 CURRENT/FUTURE LAND USE

The Site is occupied by an out-of-use observatory that is in the process of being decommissioned. The surrounding area is conservation land developed with additional observatories. Future plans call for dismantling the CSO and returning the Site to its natural state.

3.0 PREVIOUS ENVIRONMENTAL REPORTS

One report regarding environmental conditions of the Site was provided for our review. A brief summary of each report is provided below:

Phase 1 Environmental Site Assessment: Caltech Submillimeter Observatory written by ENPRO and dated March 21, 2016.

This report noted a release of 22.7 gallons of hydraulic fluid beneath the CSO slab as reported in the Hazard Evaluation and Emergency Response (HEER) Office's Release Notification dated January 15, 2016. The release was reported to have occurred on May 27, 2009. Excavation and removal of contaminated soil was completed though there was remaining impacted soil under the slab, believed to be from previous releases. A no further action (NFA) designation is pending further testing of the soil under the slab to be conducted after the decommissioning of the observatory.

ENPRO recommended conducting multi-increment (MI) sampling of Site soil for COPCs associated with the hydraulic fluid release following dismantling of the CSO.

The following *de minimis* conditions were identified at the Site:

- Minor oil leak within the dome of the observatory
- Oil staining on the concrete slab at the base of the observatory

4.0 Site Investigation Objectives/Data Quality Objectives

4.1 Objectives and Chemicals of Potential Concern (COPCs)

The purpose of this SAP is to assess whether the following COPCs, potentially present in a hydraulic oil release, are present in soils beneath the CSO slab due to the history of the Site :

- Total petroleum hydrocarbons (TPH) as diesel range organics (DRO) and residual range organics (RRO)
- Polychlorinated biphenyls (PCBs)
- Lead

Stakeholders have indicated to Caltech a concern regarding the potential for the CSO cesspool to have adversely impacted the subsurface. Therefore, although the cesspool is not a REC and there is no regulatory requirement to investigate the cesspool, Caltech has incorporated an investigation of it into this SAP. As there is no specific cause for concern, the soil associated with the cesspool shall be sampled for the following wide suite of COPCs, including those to meet disposal requirements and those potentially present at film processing sites per the Client's request:

- Toxicity Characteristic Leaching Procedure (TCLP) cadmium, chromium, and lead (as needed)
- Total cadmium, chromium, silver, and lead
- TPH as gasoline range organics (GRO), DRO, and RRO
- Benzene, toluene, ethylbenzene, xylenes (BTEX)
- Polynuclear aromatic hydrocarbons (PAHs)
- PCBs
- Cyanide
- Halogenated volatile organic compounds (HVOCs)

ENPRO shall provide Caltech with information regarding COPCs at each location and advise Caltech regarding worker protection from exposure to identified contaminants.

Sampling and analysis shall also adequately characterize the soil to meet the disposal acceptance requirements of WHSL if COPCs are present in concentrations greater than the applicable EALs (see Section 4.2).

All soils excavated from the Site that are not determined to be acceptable for re-use on-site or within Tax Map Key (3) 4-4-015: 009 shall be disposed at a permitted on-island landfill.

4.2 DATA INFORMATION NEEDS

Data to be collected for this project shall support the evaluation as to whether the COPCs are present at the Site. The project site shall be evaluated based on a comparison of the analytical results to the EALs. Data shall also be used to adequately characterize the soil to meet the disposal acceptance requirements of WHSL if COPCs are identified in concentrations greater than the EALs.

To meet WHSL's acceptance criteria, the concentration of PCBs in the soil may not exceed 50 parts per million (ppm). WHSL's regulatory levels for TCLP metals are listed below:

Analyte	Regulatory Level (milligrams/liter)
Cadmium	1.0
Chromium	5.0
Lead	5.0
Silver	5.0

4.3 DECISION UNITS

Soil sampling will be conducted following initial asphalt and slab-on-grade foundation removal, but before the removal of foundation stem walls that extend deeper (the removal of which would disturb potentially impacted soil). See Sections 4.5 and 5.2 for details regarding the MI soil sampling approach.

The Site shall be divided into two lateral decision units (DUs), DUs 1 and 2 (Figure 4). The CSO lateral DU1 shall be further separated into two vertical DU layers (Layer A and B). The lateral DUs and corresponding DU layers are as follows:

- DU1: CSO, approximately 6,000 sf
    - Layer A: 0 – 6 inches beneath the below-grade slab, approximately 110 cubic yards (cy)
    - Layer B: 6 – 12 inches beneath the below-grade slab, approximately 110 cy

The cesspool soils shall be divided into the following DUs, as necessary:

- DU2: Soils removed from the exterior of the cesspool during removal and stockpiled on-site

- DU3 (if necessary): Soils beneath the cesspool if staining is observed following removal; soils shall be excavated until staining is no longer visible or until three additional feet of soil is excavated, whichever is less

4.4 DECISION STATEMENT

ENPRO shall provide Caltech with information regarding COPCs at each DU and advise Caltech regarding worker protection from exposure to identified contaminants.

Only material for which all COPCs are below the EALs may be re-used on-site at the contractor's discretion or elsewhere on TMK (3) 4-4-015: 009 at the University of Hawaii's discretion. All excess soils not re-used on-site shall be disposed at an appropriate landfill based on the results of the MI sampling and laboratory analysis.

If COPCs are detected at concentrations greater than the EALs in any DU, ENPRO will immediately consult with Caltech regarding appropriate responses, which may include additional remedial action and consultation with DOH.

If COPCs are detected at concentrations greater than the EALs, but within the WHSL acceptance criteria, the soil from that DU shall be transported to the WHSL. If COPCs detected in an MI soil sample exceed the EALs and do not meet the WHSL acceptance criteria, the soil shall be disposed of at a permitted landfill on the U.S. mainland.

4.5 SCOPE OF WORK

An MI sampling approach shall be employed to collect soil samples from each DU. A triplicate sample will be collected from the DU considered to be the most likely to contain COPCs at significant concentrations and analyzed to allow for calculation of the standard deviation of the analytical data. The triplicate sample shall be collected from DU1A to test field precision in accordance the DOH HEER Office Technical Guidance Manual (TGM), Section 4.2.8.2.

The scope of work for implementing this SAP involves coordinating and attending meetings with the client and the DOH, planning the environmental investigation, field identification of decision units and sampling locations, collection and packaging of soil samples in conformance with the SAP, transporting soil samples to the designated laboratory, evaluating site information and laboratory results, documenting results, and providing recommendations based on these results. See Section 5.0 for additional details.

5.0 Description of Sampling Activities

Caltech shall provide the following prior to the start of sampling activities:

- All appropriate permits
- Utility clearance of sampling areas
- Traffic control (to be continued for duration of sampling)

5.1 Groundwater

Groundwater sampling and disposal is not expected to occur during the project.

5.2 Soil Sampling Activities

To evaluate the presence of COPCs in the soils at the CSO footprint and cesspool location, an MI sampling approach will be employed. The sampling will be conducted prior to excavation of the soil at the Site. Utilities shall be marked prior to sampling commencement if utilities remain in place.

The MI sampling approach will be performed in conformance with the DOH HEER Office Technical Guidance Manual (TGM) (August 2016).

The Site is not a hazardous waste site and significant contamination is not expected to be encountered based on the results of previous sampling and analytical activities (see Section 3.0). Personnel shall use Level D personal protective equipment (PPE) unless contaminants are detected at concentrations greater than the EALs, at which point PPE shall be upgraded to Level C. See https://chemm.nlm.nih.gov/ppe.htm for a description of PPE requirements by level.

In addition, field monitoring will be performed with a photoionization detector (PID) as described in Section 5.3.

Based on the COPCs for each location, lateral DU 1 will be divided into 100 increments, and the cesspool DU(s) into 75 increments in a systematically random fashion representative of an equivalent volume of soil. Increment spacing shall be determined using the square root of the DU area divided by the targeted number of increments as described in TGM Section 4.2.4.1. Approximately 15 grams of soil will be collected approximately every 14.75 feet.

Sample increments for DU1 shall be collected at the depths specified in Section 4.3. For DU1, an excavator shall be used to scrape the top 12 inches of soil at each increment location. Increments from each DU layer will be collected using a stainless-steel sampling spoon and combined to form a single bulk MI sample. Each increment shall consist of approximately 15 grams of soil. Each bulk sample will have a mass of approximately 1.5 kilograms. Sampling spoons shall be decontaminated with Liquinox® and distilled water between DUs.

Stockpiled cesspool soils may be manipulated with an excavator or backhoe to allow for safe access. Soils shall be sampled from the DU2 stockpile in a systematically random fashion with a stainless-steel sampling spoon and combined to form a single bulk MI sample. Each increment shall consist of approximately 20 grams of soil for a bulk sample mass of 1.5 kilograms. Should a sample need to be collected from the bottom of the cesspool excavation (DU3) due to visible staining, 75 increments consisting of approximately 20 grams of soil each shall be collected directly from the excavator bucket using a stainless-steel sampling spoon and combined to form a single bulk sample.

Also, for each increment from cesspool DUs 2 and 3, approximately 5 grams of soil shall be collected with a disposable Terra-core (or similar) sampler and placed into a glass jar containing 25 mL of a methanol preservative (for volatile analysis), for a 1:1 ratio. Multiple jars shall be required for each MI sample as the methanol in each jar must cover the sample in its entirety while also not exceeding the volume which may be shipped in an individual container as allowed by the Department of Transportation (DOT).

All field personnel shall wear clean disposable nitrile gloves when collecting samples to avoid cross-contamination between DUs. Gloves shall be changed between DUs (e.g., if a hole extends from one DU layer to the next, based on depth, the field personnel will don a new pair of gloves prior to sampling each corresponding DU layer).

Samples will be labelled with a unique sample number, recorded on a chain-of-custody form, placed into an insulated sample chest with ice, and shipped overnight to OnSite Environmental, Inc. (OnSite) in Redmond, Washington for analysis.

Replicate samples shall be collected as described above.

5.3 PHOTOIONIZATION DETECTOR (PID) MONITORING

Environmental monitoring using a PID will be carried out to determine the potential presence of contamination in the soil. If the total VOC concentration in the workspace atmosphere exceeds an 8-hour, time weighted average (TWA) of 20 parts per million (ppm) or a 15-minute, short-term exposure limit (STEL) of 100 ppm, PPE requirements shall be upgraded to Level C.

PID monitoring will be conducted at each DU location using a MiniRAE 3000 as follows:

- The PID shall be calibrated in the field each day, prior to the start of monitoring
- Approximately 100 grams of soil from each DU will be placed in a clean bag
- The bag shall be sealed and allowed to equilibrate for approximately 10 minutes

- Following equilibration, the PID tip shall be inserted into the bag to collect a reading
- PID readings shall be logged for comparison to laboratory results

5.4 SOIL SUB-SAMPLING FOR LABORATORY ANALYSIS OF MI SAMPLES

Samples Intended for Non-Volatile Analyses:

The collection of each MI soil sample will result in approximately 1.5 kilograms of soil for analysis (the bulk sample). A sub-sampling technique will be used by the analytical laboratory to reduce the bulk sample to a laboratory analysis quantity (the analytical sample). The sub-sampling process is described below.

The bulk sample shall be dried and then passed through a 2-millimeter (No. 10) sieve to remove larger debris. The total soil sample shall be spread out on a clean flat surface, by slowly pouring the sample out and then spreading it to a thin (approximately ¼-inch) even layer. The spread-out soil shall be incrementally sampled using a stratified-random pattern by collecting approximately thirty small increments to make up a minimum 10-gram subsample for analysis. The goal is to represent the actual distribution of particle sizes in the sample. The minimum 10-gram subsample will then be analyzed.

All samples shall be destroyed and disposed of by the laboratory in accordance with their permit to receive soil (see appendix).

Samples Intended for Volatile Analyses:

Samples for VOC analysis will result in approximately 375 grams of soil preserved in methanol for analysis (the bulk sample). A sub-sampling technique will be used by the analytical laboratory to reduce the bulk sample to a laboratory analysis quantity (the analytical sample). The sub-sampling process is described below.

For samples requiring VOC analysis, sieving is not a viable option as this would lead to the significant loss of VOCs. If multiple jars are used for one MI sample, the weights of each sample will be recorded and equal volumes of methanol shall be extracted from each jar and combined in the laboratory to comprise the analytical sample.

All samples shall be destroyed and disposed of by the laboratory in accordance with their permit to receive soil (see appendix).

5.5 SAMPLE PRESERVATION PROCEDURES

MI soil samples for non-volatile analysis will be preserved in insulated sample chests with ice and/or frozen gel packs upon collection. MI soil samples for volatile analysis will be preserved in pre-weighed jars containing methanol and placed into insulated sample chests with ice and/or frozen gel packs upon collection.

5.6 LABORATORY ANALYTICAL PROCEDURES

The proposed laboratory analytical methods are listed in the following table.

Table 1

Summary of Compounds to be Analyzed, Laboratory Analytical Methods

Laboratory Analytical Group	Laboratory Method	Proposed Laboratory
Total Petroleum Hydrocarbons	EPA 8015M	OnSite
Heavy Metals – Soil	EPA 6010C/7471B	OnSite
Heavy Metals – TCLP	EPA 1311/1610D	OnSite
Benzene, Toluene, Ethylbenzene, and Xylenes	EPA 8260B	OnSite
Polychlorinated Biphenyls	EPA 8082A	OnSite
Polynuclear Aromatic Hydrocarbons	EPA 8270D	OnSite
Polynuclear Aromatic Hydrocarbons – Low Levels	EPA 8270D/SIM	OnSite
Halogenated Volatile Organic Compounds	EPA 8260C	OnSite
Organochlorine Pesticides	EPA 8081A	OnSite

5.7 CHAIN-OF-CUSTODY AND TRANSPORTATION

Chain-of-Custody record forms shall be used to document sample collection and shipment to the laboratory for analysis.

Each sample will be clearly labeled and logged on a chain-of-custody form. The sampler will retain a copy of the chain-of-custody forms. The original chain-of-custody form will be double-bagged in a Ziploc®-type plastic bag and placed into the cooler with the soil samples.

The chain-of-custody forms will include:

- The name, address, and telephone number of the sender
- The project number and name
- The sample identification numbers
- The type and number of sample containers
- The date and time of sampling
- The sample matrix

- The requested analytes and analytical methods
- The requested sample turnaround time
- Special instructions
- The authorized signatures of all persons who retain custody of the samples prior to receipt by the laboratory (Note: shippers such as FedEx typically do not sign off on chain of custody documentation)

5.8 SAMPLE IDENTIFICATION

All samples collected will be labeled in a clear and precise way for proper identification in the field and for tracking in the laboratory. The samples will have pre-assigned, identifiable, and unique numbers as described in Section 4.3.

Replicate samples will be preserved, packaged, and sealed in the same manner as other samples. Separate sample identification will be assigned to each replicate, and replicates will be submitted blind to the laboratory.

5.9 DECONTAMINATION PROCEDURES

Between decision units, the stainless-steel sampling spoon utilized to collect increments, excavator bucket, and the oil/water interface probe (if applicable) shall be decontaminated using a wash with Liquinox® and water followed by a double rinse with potable water. Following the wash and rinse, the stainless-steel sampling spoon shall be air dried prior to re-use.

5.10 INVESTIGATION DERIVED WASTE

In the process of collecting environmental samples the ENPRO sampling team will generate different types of potentially contaminated investigation derived waste (IDW) that may include the following:

- Used personal protective equipment (PPE)
- Disposable sampling equipment and related items
- Decontamination fluids

The EPA's National Contingency Plan (NCP) requires that management of IDW generated during sampling comply with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable. The sampling plan will follow the *Office of Emergency and Remedial Response (OERR) Directive 9345.3-02* (May 1991) and the DOH HEER Office TGM (August 2016), which provides the guidance for the management of IDW. In addition, other legal and practical considerations that may affect the handling of IDW will be considered.

Used PPE and disposable equipment will be double bagged and placed in a municipal refuse dumpster. These wastes are not considered hazardous and can be sent to a municipal landfill.

Decontamination fluids that will be generated in the sampling event will consist of Liquinox® and water. The volume and concentration of the decontamination fluid will be sufficiently low to allow disposal at the site or sampling area. The water (and Liquinox®) will be poured onto a lined/bermed area (10-mil plastic sheeting with a filter sock berm or similar) and evaporated on-site.

5.11 LIST OF EQUIPMENT, CONTAINERS, AND SUPPLIES

The following equipment, containers and supplies may be used for obtaining MI soil samples and to support related activities:

- Stainless steel spoons
- Terra core (or similar) samplers
- Insulated sample chest
- Nitrile gloves
- Plastic bags
- Liquinox®
- Deionized water
- 10-mil plastic sheeting
- Filter sock berms (or equivalent)
- Teflon® sheeting
- Ziploc®-type bags
- Methanol
- Pre-weighed glass jars
- Oil/water interface probe

6.0 QUALITY ASSURANCE/QUALITY CONTROL PLAN

6.1 QUALITY ASSURANCE/QUALITY CONTROL DATA OBJECTIVES

Field and laboratory quality assurance/quality control (QA/QC) procedures will be implemented to ensure that the data gathered during the field investigation will meet the needs of the project objectives. Field activities will be performed as previously described. Analytical data generated will follow EPA methods and laboratory standard operating procedures (SOPs) and QA/QC guidelines for sample analysis. Adequate reporting levels of the chemicals of concern are dependent on the sample matrix, naturally occurring background concentrations, and laboratory instrumentation.

Quality assurance requirements shall be in accordance with the referenced analytical methods and laboratory tracking. The analyst generating the data and an experienced data reviewer will review the analytical data at the laboratory prior to its release. The analyst shall review the data to ensure that:

- Sample preparation information is correct and complete
- Analysis information is correct and complete
- The appropriate standard operating procedures were followed
- Analytical results are correct and complete
- Quality control samples were within established control limits
- Documentation, including the case narrative is complete

The data reviewer shall review the data package to verify that:

- Calibration data are scientifically sound and method compliant
- QC samples were within established guidelines
- Qualitative and quantitative results are correct
- Documentation and the case narrative are complete
- The data package is complete and ready for document archiving

The data for this project shall be collected and documented in such a manner that will allow the generation of data packages that can be used by an external data auditor to reconstruct the analytical process.

6.2 CALIBRATION PROCEDURES AND FREQUENCY

Calibration will be performed regularly on all laboratory instruments. Each piece of equipment will be calibrated according to manufacturer's procedures.

Laboratory instruments are calibrated before use with a 5-point curve. To verify the calibration, continuing calibration verification standards are used to ensure that the calibration curve has not drifted.

6.3 DATA REDUCTION AND VALIDATION

Most analytical data are documented in computer records or on printouts generated by the instrument data-handling computer and transferred to the centralized acquisition server or acquired directly to the centralized acquisition server. Standard logs are maintained to document preparation of standards. The identity and number of the parent material is recorded and each prepared standard is assigned a number that is traceable to the parent material. The analyst verifies instrument data, calculations, transfers, and documentation, and corrects errors, if detected. Technical department managers, quality control specialists, and project managers perform review of reports and supporting documentation.

6.4 FIELD QUALITY CONTROL CHECKS, SOIL SAMPLES

Field triplicate soil samples will be collected from one randomly selected DU. Field triplicate samples will be collected in the same manner as the original samples through the same DU as the original samples.

The triplicate samples allow for statistical calculation of several important values including the standard deviation, the relative standard deviation, and the 95 percent (%) upper confidence level (UCL) of the mean, as described below.

6.4.1 Standard Deviation

Standard deviation is a measure of the variation from the mean among a group of samples, and in this case it can be calculated for triplicate samples collected from a DU. The lower the standard deviation (the closer the replicate data are to the mean) the more precise the site data are as an estimate of average contaminant concentration in the DU under investigation.

Where replicate sampling is used to evaluate the variation from the mean of multiple DUs, the standard deviation of the contaminant(s) in the selected replicate DU is added to the contaminant levels of the other DUs in the batch for comparison to the relevant EALs. When a DU contaminant average concentration is close to the EALs, a lower standard deviation for the replicates provides a better chance to demonstrate that the contaminant concentration may be below the EALs. A low standard deviation for soil sampling data is achieved by reducing variation in sample results due to errors in field sampling/processing, lab sub-sampling/processing, or lab analysis, to the extent feasible.

6.4.2 95 Percent Upper Confidence Level

The 95% UCL is another statistical measure of the precision for a series of measurements. In this case, the normal and triplicate samples are used to calculate a mean (or average) value and a standard deviation. The mean and standard deviation are used to calculate, with 95% confidence, the mean value for the individual decision unit.

6.4.3 Relative Standard Deviation

The field replicate data collected for DUs are also used to demonstrate that the investigation error for each contaminant is within a reasonable range that supports a conclusion that average contaminant concentrations (e.g., mean plus standard deviation or 95% UCL of the mean) is below or above the relevant EALs. Typically, the relative standard deviation (RSD) of the field replicates (triplicates) is used for this evaluation. The RSD is expressed as a percentage and is calculated using the following formula:

$$\text{RSD\%} = \frac{100 \text{ X Standard Deviation}}{\text{Average}}$$

The lower the RSD% of the replicate data the better. Generally, an RSD% of approximately 35% or less indicates the amount of estimated total error is within a reasonable range for decision making. However, this evaluation will also depend on the data quality objective (DQO) established for the site investigation, as well as how close the contaminant concentrations are to the relevant EALs. In general, the closer the contaminant level is to the EAL, the more impact this statistical measure will have on site decisions. The higher the RSD%, the less confidence there is that the averages approximate a normal distribution, and that the average contaminant concentrations are adequately representative of the DU(s). As the RSD exceeds 50%, and if the average DU concentrations are near the EALs, there is increasing uncertainty that the data are adequately representative. As the RSD% approaches 100% there is very little confidence that the sampling data is useful for decision-making.

6.5 LABORATORY QUALITY CONTROL CHECKS, SOIL SAMPLES

Sample batch sizes will not exceed 20 samples. Batch QC will include method blanks, matrix spikes, matrix spike duplicates (laboratory control standard duplicate, if matrix spikes/matrix spike duplicates cannot be performed), surrogate analysis for organics, and second source reference standard analysis for metals. One method blank sample will be analyzed for every 20 samples (minimum of one per day, one per matrix).

6.5.1 Method Blank

Method blanks will be analyzed for each analytical batch submitted to the laboratory. An aliquot (extraction blank) equal in weight to the sample is used for the method blank analysis. The method blank is taken through the whole analytical process. The analytical results of the method blank are then reported to show that the blank is free of analytical interference.

6.5.2 Matrix Spike/Matrix Spike Duplicate

Matrix spike (MS) and matrix spike duplicate (MSD) are samples, to which known concentrations of analytes are added prior to sample preparation. The MS and MSD are taken through the whole analytical process. Following the analytical process, the recoveries of the spike analytes are calculated and reported for assessment of accuracy. When an MS duplicate is analyzed, the relative percent differences between the MS and the MSD results will also be calculated and reported. The percent recoveries and the relative percent difference are used to evaluate the effect of the sample matrix on the accuracy and precision of the analysis.

6.5.3 Surrogate Spike

Surrogate spike is a known concentration of a non-target analyte added prior to sample preparation. The surrogate is chemically similar to the target analyte and behaves similarly during extraction and analysis. The surrogate spike recovery must meet the established acceptance criteria, and measures the efficiency of the steps of the analytical method in recovering the non-target analytes.

6.5.4 Preventative Maintenance

To ensure that instruments are properly maintained and continue to operate properly, preventative maintenance activities are undertaken on a routine basis. An experienced analyst or a manufacturer's service representative performs maintenance. The types of preventative maintenance actions are dependent on the instrument. Any unusual conditions are investigated and resolved prior to beginning analysis of samples. Instrument maintenance records are maintained, and all non-routine maintenance activities are documented and stored in the department. A separate file is maintained for each instrument.

6.6 DATA QUALITY ASSESSMENT

The laboratory QA manual is designed to maintain the quality of its principal product, reliable and defensible analytical results. Staff members are trained in appropriate QA procedures to support the laboratory's QA plan. The laboratory applies acceptance criteria to all quality control data. When a sample analysis is complete, the quality control data are reviewed and evaluated by using acceptance criteria based on standard operating procedures or client specific data quality objectives. This evaluation is used to validate the corresponding data set. Evaluation is based on:

- Continuing Calibration Verification Standard

- Method Blank Evaluation
- Laboratory Control Evaluation
- MS and MSD Evaluation
- Surrogate Standard Evaluation

6.6.1 Accuracy

Accuracy will be calculated from analysis of matrix spike samples as follows:

$$\text{Accuracy} = \frac{(A - B) \times 100}{C}$$

Where “A” is the analyte determined experimentally from the spike sample; “B” is the background level by separate analysis of the unspiked sample; and “C” is the amount of spike added.

6.6.2 Precision

Precision is the degree of mutual agreement between individual measurements of the same material under similar conditions.

Precision will be determined through evaluation of percent difference in duplicate analysis of samples and by evaluating the standard deviation of multi-point calibrations.

Precision, as determined through percent difference in duplicate analysis of samples, standards and surrogates, is calculated as:

$$\text{Precision} = \frac{(A - B) \times 100}{(A + B)/2}$$

Where “A” is the larger value and “B” is the smaller value of duplicate analyses.

6.6.3 Completeness

Completeness will be evaluated by the percentage of valid analytical results compared to the total number of requested sample analytical results. The completeness objective for this project will be 90 percent or greater.

Percent completeness is calculated using the following equation:

$$\text{Completeness (\%C)} = \frac{(T - R) \times 100}{T}$$

Where “T” is the total number of sample results and “R” is the total number of rejected sample results.

6.7 CORRECTIVE ACTION

When a quality control problem is noted, the following steps will be taken to identify and correct the problem:

- The hard copies of the data will be re-examined.
- The analyst will re-analyze the standard or sample, as appropriate to meet criteria.
- If the problem is not resolved by standard re-analysis, the QA Manager or the Laboratory Director will be consulted to provide additional information about rectifying the problem.
- If the problem cannot be solved in-house, equipment repair contractors, manufacturer’s representatives, or outside consultants will be contacted as necessary to correct the problem.

7.0 Documentation and Reporting

7.1 Field Documentation

Field data will be entered into data entry sheets. All documentation in the data entry sheets shall be written in indelible ink. Changes made to the data entered in the data entry sheets will be crossed out with a single line and the change will be initialed by the person changing the data entry. All field documentation will become part of the project files. At a minimum, the following information will be provided in the field data entry sheets:

- ENPRO personnel conducting field activities
- Subcontractor personnel conducting field activities
- Brief description of project and planned field activities
- Date and time of all field activities (time will be recorded in 24-hour format)
- Weather information at the start of the field day, at the end of the field day, and during significant weather events
- Sample identification and time of sample collection
- Deviations from the proposed or approved sampling procedure
- Field conditions such as petroleum or chemical odor or soil staining

7.2 Investigation Report

Upon completion of the proposed scope of work, ENPRO will prepare and submit an Investigation Report that will contain all results obtained from soil sample analysis. The report will present a description of field procedures, observations and findings, photographic documentation, results of laboratory analyses, conclusions, and recommendations.

7.3 Schedule

Scheduling of soil investigation at the Site for the areas of concern will begin immediately following the authorization to proceed with this SAP by the client and the DOH. Soil sampling is estimated to require approximately one week to complete. Analytical laboratory turn-around-time will be approximately two weeks for all analytes. A report outlining the laboratory analytical results and the comparison to the regulatory limits is expected to require two weeks from the receipt of the final analytical results.

8.0 REFERENCES

Publications:

Name of Publication:	Aquifer Identification and Classification for Oahu: Groundwater Protection Strategy For Hawaii
Author of Publication:	Mink, J.F. and L.S. Lau
Published by:	Water Resources Research Center, University of Hawaii at Manoa, Honolulu, Hawaii
Date of Publication:	1990
Name of Publication:	Soil Survey for the Islands of Oahu, State of Hawaii
Author of Publication:	Foote, Donald E. et al.
Published by:	U.S. Department of Agriculture, Soil Conservation Service, in cooperation with the University of Hawaii Agricultural Experiment Station. Also available at http://websoilsurvey.nrcs.usda.gov/app/
Date of Publication:	1972
Name of Publication:	Hawaii *Department of Health (HDOH), Office of Hazard Evaluation and Emergency Response (*HEER*), Technical Guidance Manual (*TGM*), Interim Final, June 2009*
Author of Publication:	DOH, HEER
Published by:	DOH, HEER
Date of Publication:	2009
Name of Publication:	Tier 1 EAL Surfer
Author of Publication:	DOH HEER Office
Date of Publication:	2017
Name of Publication:	Geotechnical Investigation Report
Author of Publication:	Yogi Kwong Engineers, LLC
Date of Publication:	October 2017