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BOARD OF LAND AND NATURAL RESOURCES
COMMISSION ON WATER RESOURCE MANAGEMENT

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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

Hm-16-118

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

December 30, 2015

Mr. Samuel Lemmo, Administrator
Office of Conservation and Coastal Lands
Department of Land and Natural Resources
P. O. Box 621
Honolulu, Hawaii 96809

Dear Mr. Lemmo:

SUBJECT: Request for Review of 'Notice of Intent' to Decommission

Pursuant to the Decommissioning Plan for Maunakea Observatories (2010) the Office of Maunakea Management (OMKM) is forwarding to you the Notices of Intent to decommission the California Institute for Technology Submillimeter Observatory (CSO) and UH Hilo Hoku Kea Telescope (aka UH Hilo 24"). OMKM reviewed the two notices for compliance with Section 4.2.1, Notice of Intent, of the Decommissioning Plan and are submitting them to OCCL for review and action (see item III below). If your review raises questions or concerns OMKM will work with the observatories to address them.

I. NOTICE OF INTENT: PURPOSE AND CONTENT

Following is a summary of Section 4.2.1 of the Decommissioning Plan:

> "The purpose of an NOI 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 NOI. The NOI should be submitted to UH and DLNR-OCCL at least five years prior to either the termination date or a sublease, or a sublessee's decision to cease operations, or as soon as is feasible if decommissioning is to take place less than five years after a decision is made to cease operations, whichever occurs first. DLNR-OCCL reserves the right to require a CDUP pending a review of the proposed decommissioning activities described in the NOI."

Both the NOIs for the CSO and Hoku Kea telescopes include the required site description, site drawings, presentation of available historic information, and a description of the preconstruction condition.

In your review, you will notice that the two NOIs include somewhat different levels of detail. This is due to Hoku Kea having completed an Environmental Assessment in 2006 that addressed many of the NOI content requirements. The UH Hilo document contains a reference to the Environmental Assessment. CSO, however, had no similar pre-existing publications and thus included this detail directly in the NOI with results of an engineering survey to be submitted as an addendum when completed. Additional considerations identified by OMKM in our reviews to date include:

- OMKM anticipates that the community consultation process will discuss the merits and details of site restoration to natural conditions along with recommendations for *limited* continued land use of one or both observatory sites. This land use could include use of the area for vehicle parking (for visitors), retention of outbuildings. or *partial* site reuse for non-astronomy environmental monitoring. Such possible amendments, if any, will be summarized in the Maunakea Management Board (MKMB)

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
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.

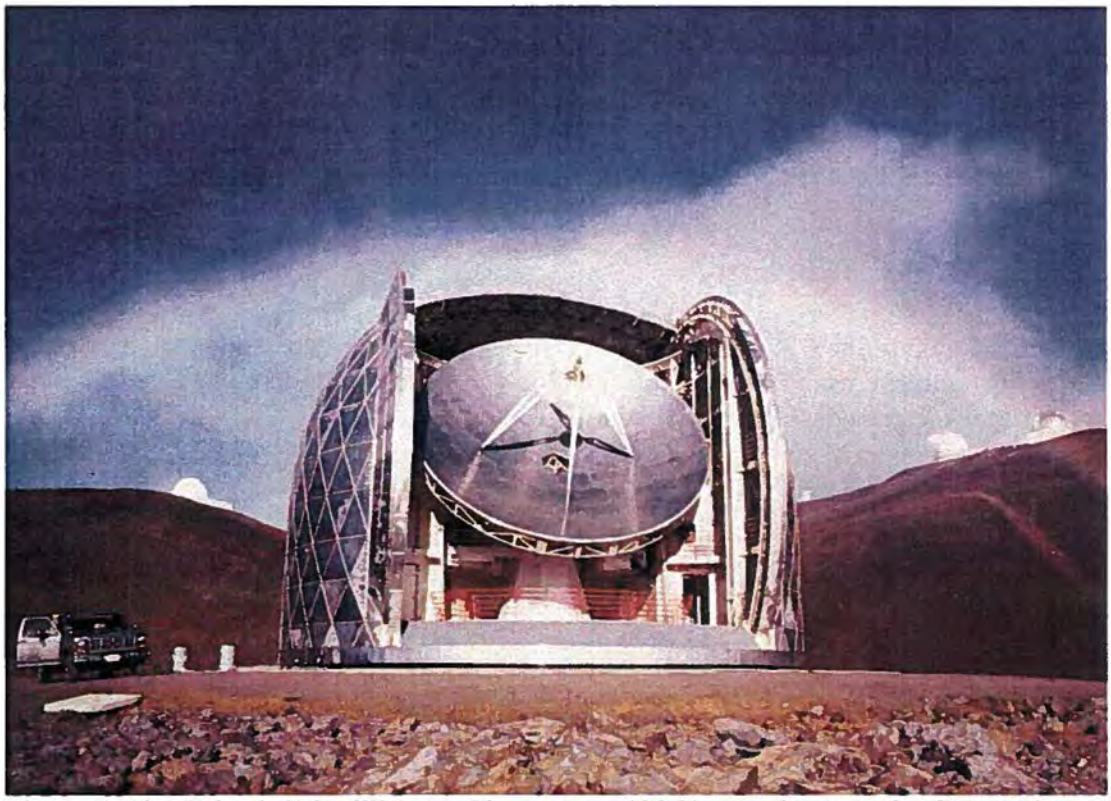


Figure 1. The Caltech Submillimeter Observatory (CSO) near the summit of Maunakea, Hawaii.

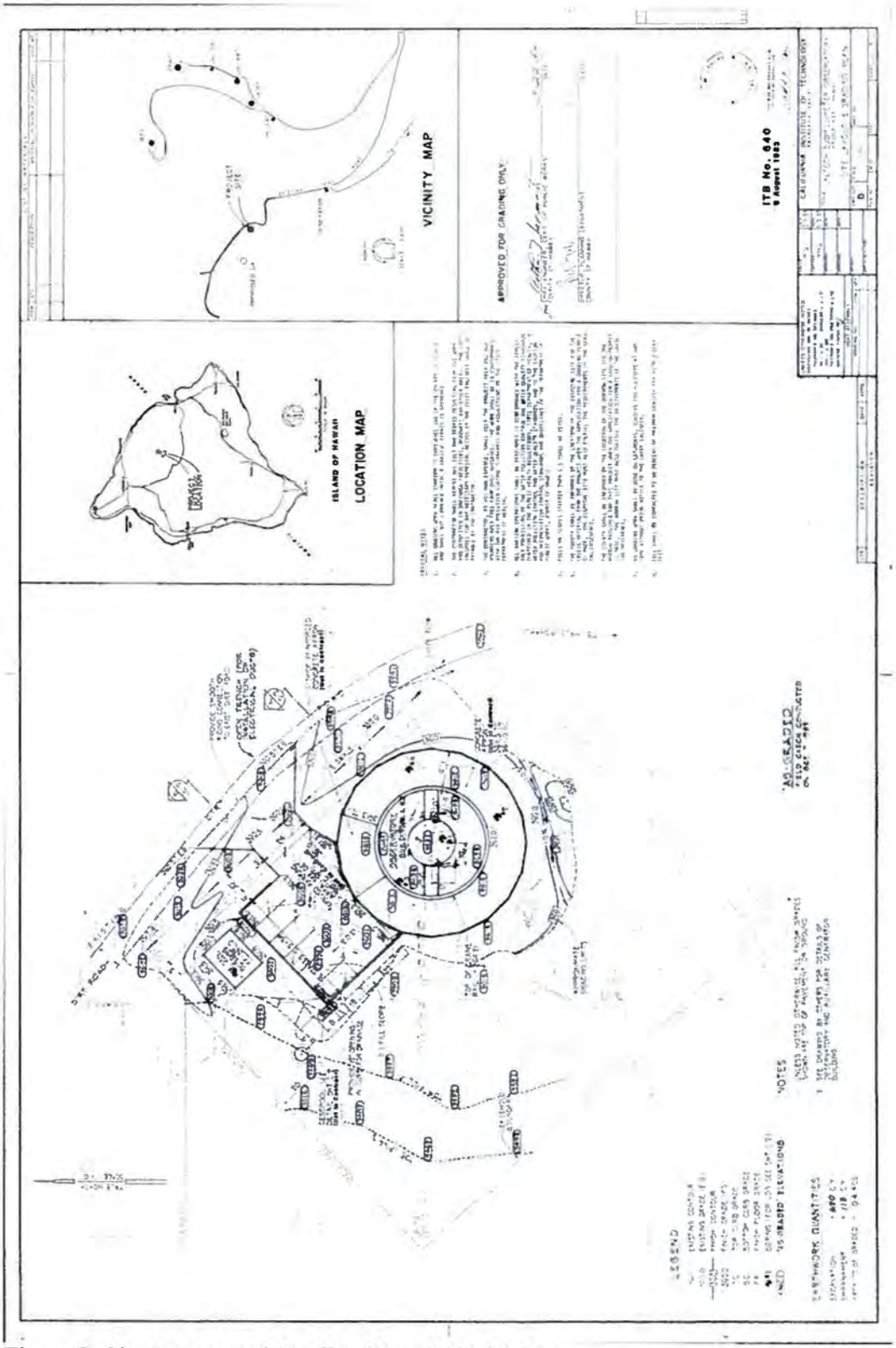


Figure 2: Site Layout and Grading Plan, 1983-02-07.

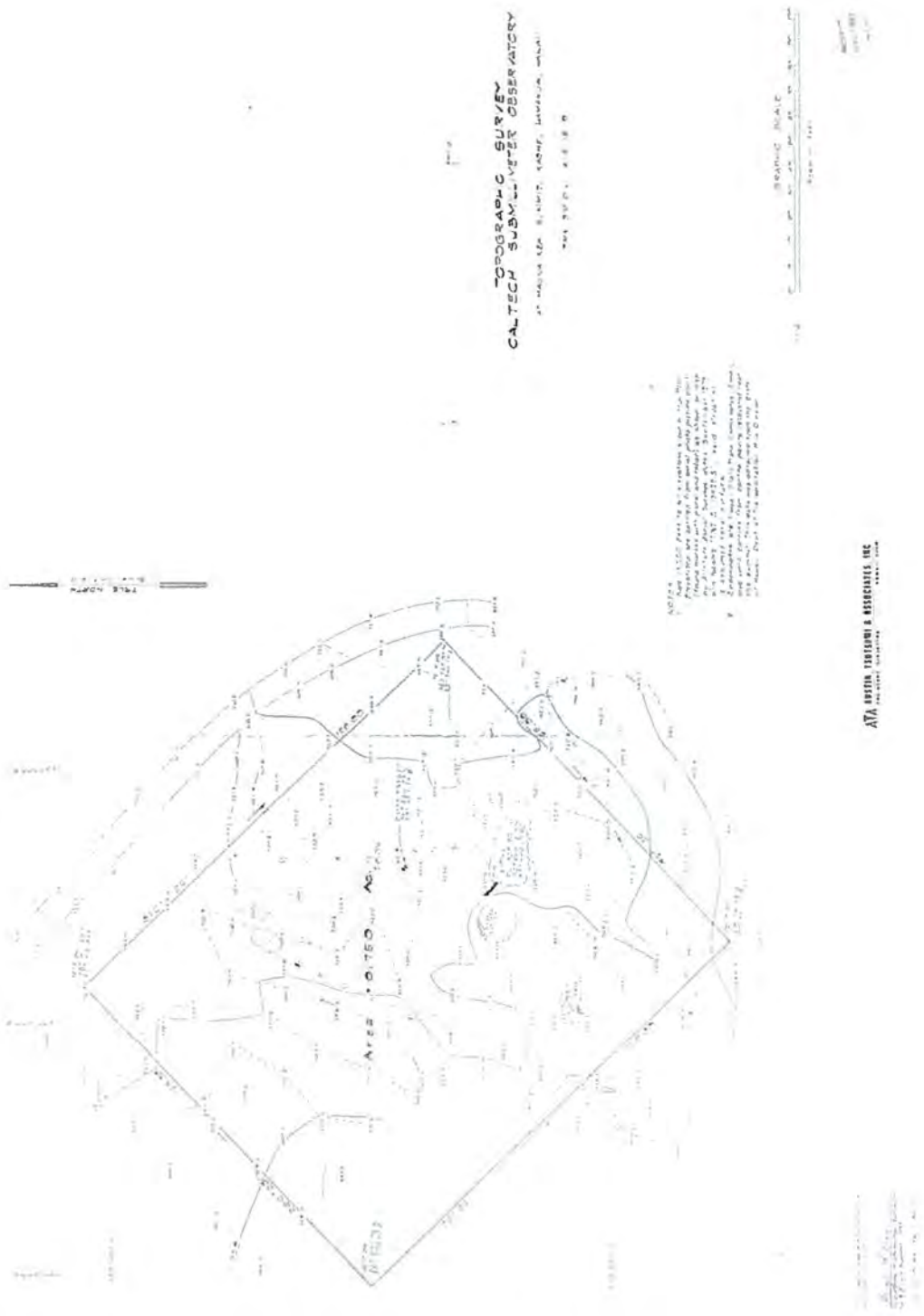


Figure 3: Pre-construction Topographic Survey, 1983-01-21.

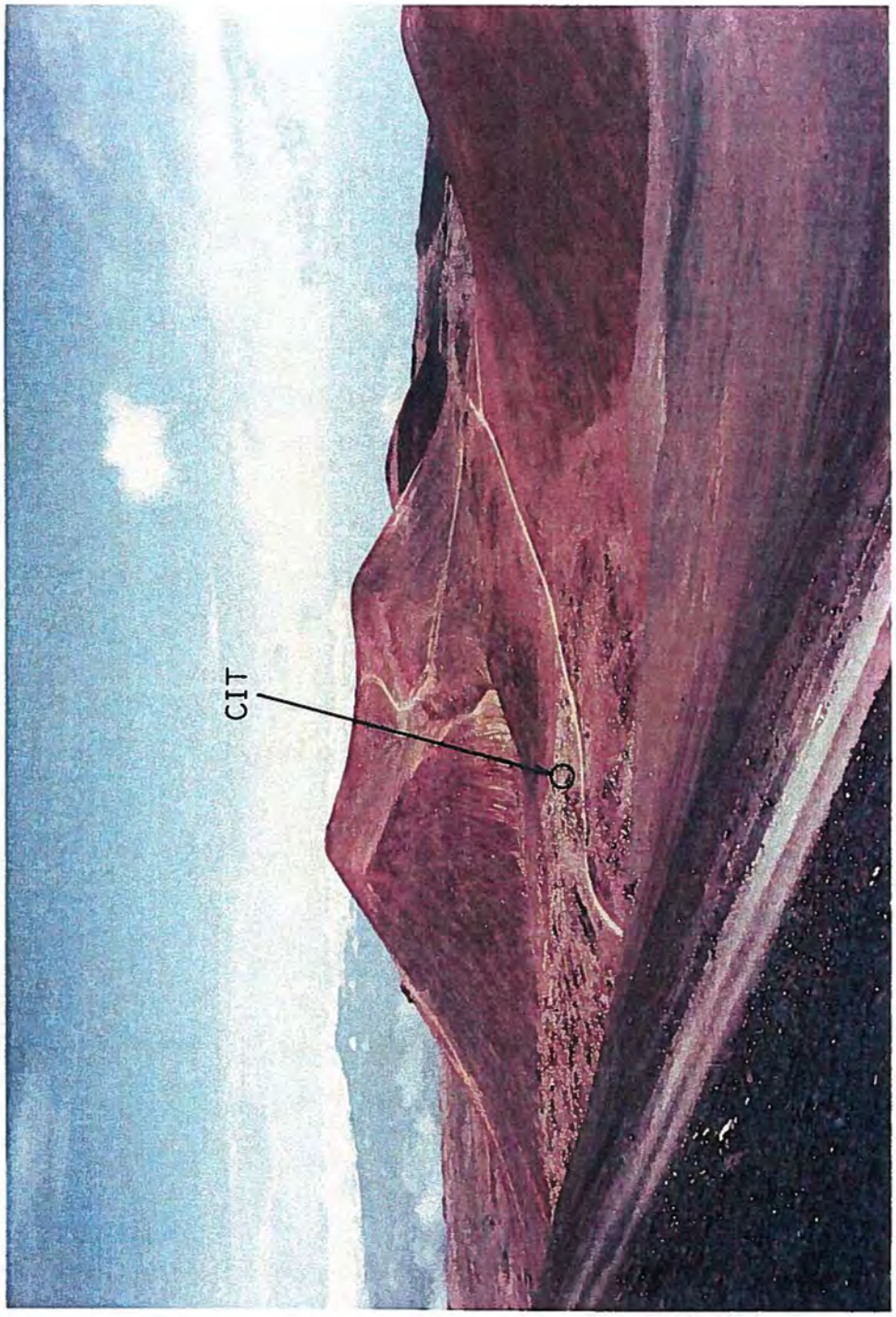


Figure 4: Pre-construction photograph of CSO site.

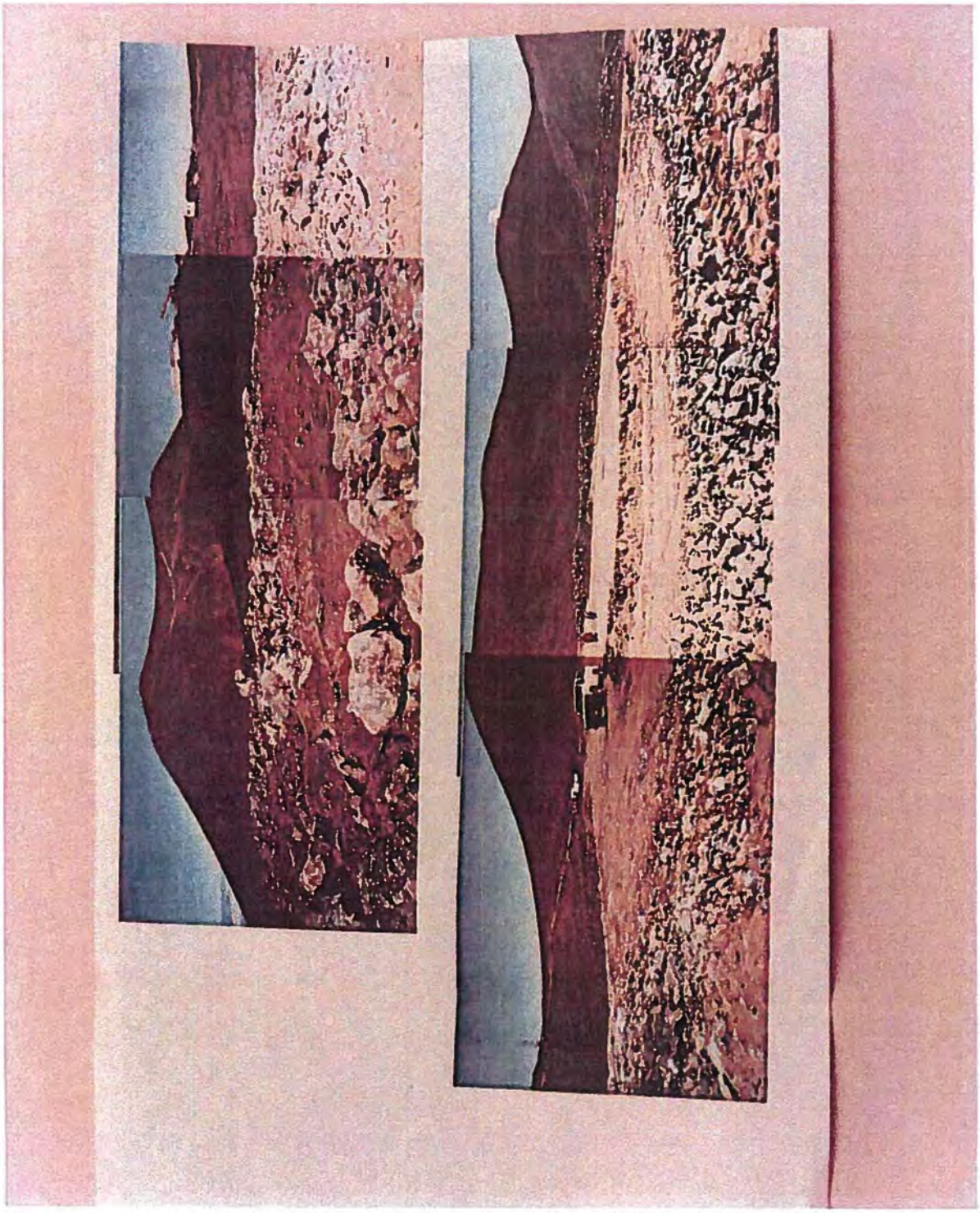


Figure 5: Panoramic photographs of CSO site before (left) and after (right) grading and construction of foundations for the dome and telescope.

Figure 6: Prof. Robert Leighton hammering in the Bench Mark noted in Figure 3.

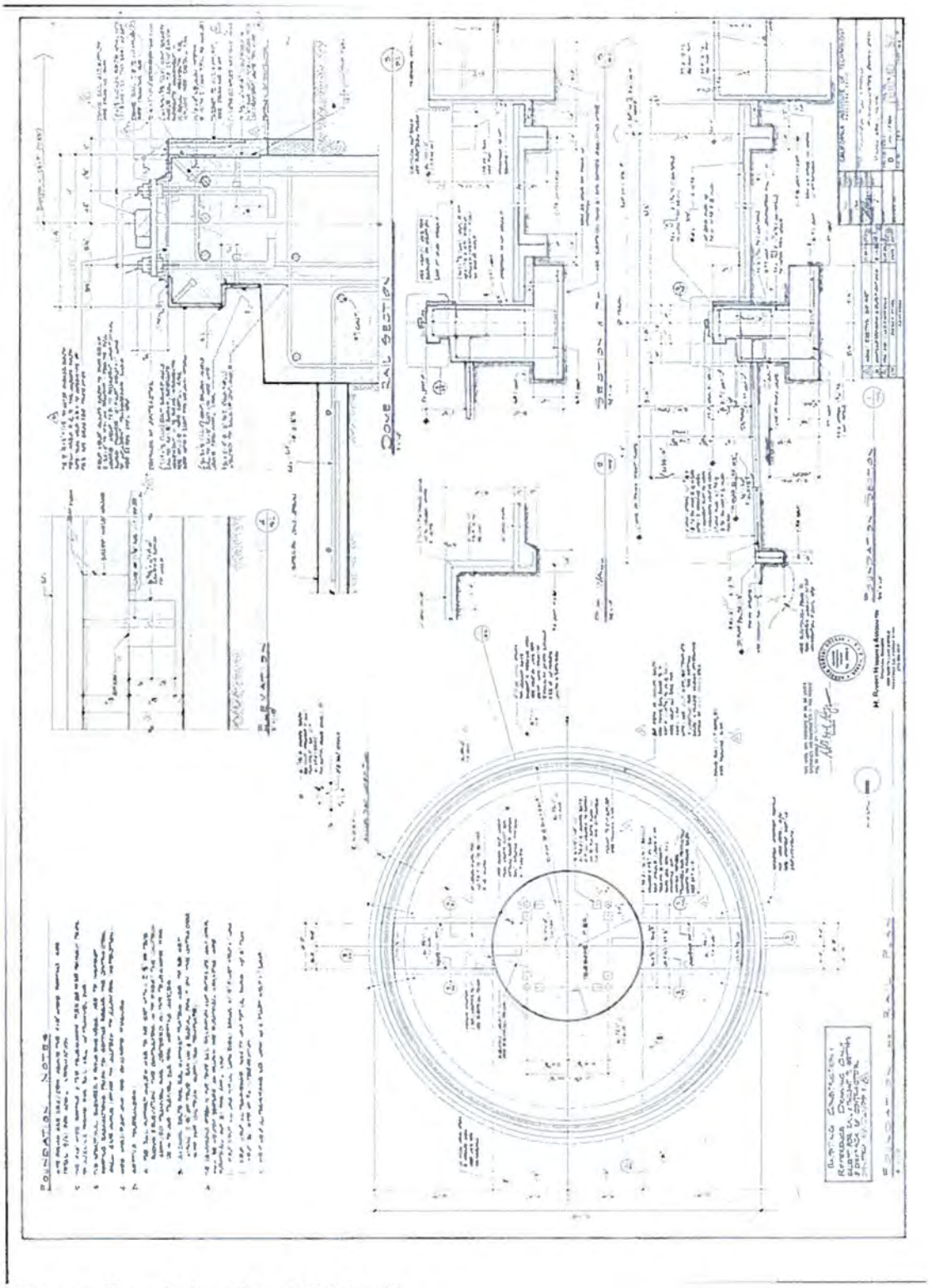


Figure 7. Foundation Plan, 1984-12-20.

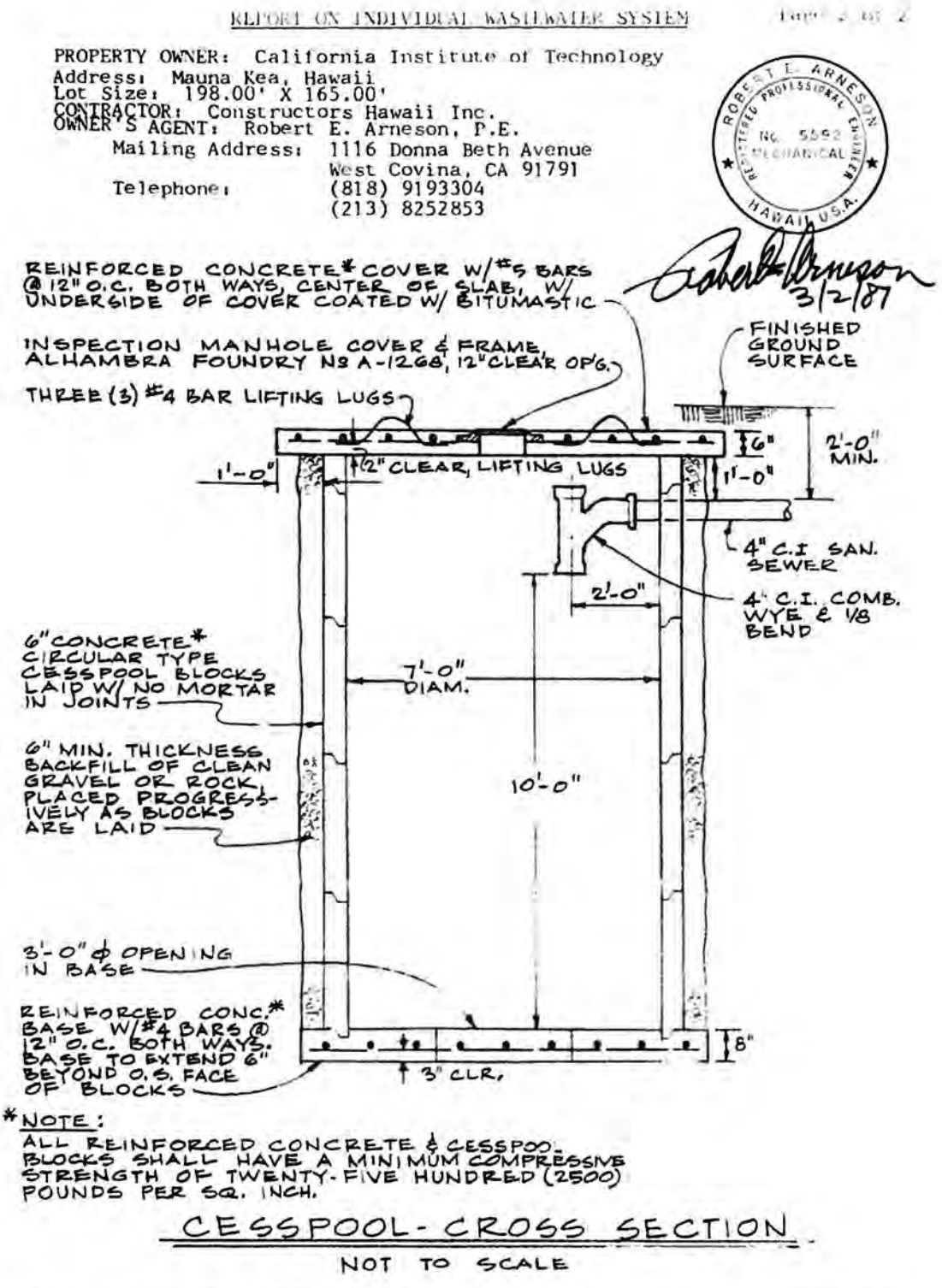


Figure 8: Cesspool report, 1987-03-02.

CALIFORNIA INSTITUTE OF TECHNOLOGY

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 telescope facility to be constructed and operated by and at the expense of Sublessee through a contractual arrangement set forth in a separate Operating and Site Development Agreement.

The facility shall include a parabolic reflecting telescope having an approximate diameter of 10.4 meters and housed in an astrodome, data communication terminals, and associated equipment required to support the operations of the telescope, hereinafter referred to as "the Telescope."

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 facilities, and (3) this Sublease is terminated as provided for in Section IV.G.5., Sublessee shall have such unsuitable damaged property or debris removed within ONE (1) year, after written notice to remove, and shall restore the land to its original condition. In the event Sublessee shall fail to remove such damaged property or debris and restore the land 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.

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 insurance for personal injury or death in the minimum amounts of $300,000 per person, $1,000,000 per occurrence, and $50,000 property damage, subject to revision, every FIVE (5) years, in writing. Said policies shall name Lessor and Sublessor as additional insureds, and a copy shall be deposited with the Director of Procurement and Property Management.

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:

A. Right of Entry

Sublessee will allow Sublessor or its agent(s) known to the Sublessee or carrying suitable identification, at all reasonable times, free access to the demised premises for the purpose of examining the same and determining whether the covenants herein are being full observed and performed.

B. Janitorial and Other Services

Sublessee shall provide janitorial, custodial and security services to the demised premises, including sewerage and sanitation facilities and services.

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 premises hereby demised, in whole or in part.

G. Use of Demise

Sublessee shall use the demised premises exclusively for astronomical facilities to be constructed and managed by and at the expense of Sublessee in cooperation with Sublessor through separate agreements. Sublessee shall not permit or make any waste or strip, or make any unlawful, improper or abusive use of the demised premises or any part thereof, and Sublessee shall be liable to Sublessor for all damages beyond reasonable wear and tear. As used in this Sublease, the term

"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

Sublessee shall designate a representative within the State of Hawaii duly authorized to accept service of process on its behalf. In the event that Sublessee fails to so designate such a representative or such designated representative is unavailable, Sublessee consents that service of any notice or process issued against it may be served upon it by filing the same with the Director of Commerce and Consumer Affairs, State of Hawaii, or in his absence with the Deputy Director. Sublessor shall forward by certified mail to Sublessee a copy of any such notice or process served on the Director of Commerce and Consumer Affairs.

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:

If to Sublessee: Vice President for Business and Finance
California Institute of Technology
Pasadena, CA 91125

If to Sublessor: Vice President for Administration
University of Hawaii
2444 Dole Street
Bachman Hall 201
Honolulu, Hawaii 96822

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 intention to restore the improvements to their prior condition within a reasonable time.

6. Mutual agreement of Sublessor and Sublessee.

7. This Sublease may be terminated by Sublessee upon SIX (6) month's notice in writing, in the event Sublessee's contemplated sources of funding become unavailable and after diligent effort Sublessee is unable to procure alternate sources of funding which in Sublessee's good faith judgment are adequate; or if Sublessor or Lessor do not comply with the terms of this Sublease; or if Sublessee gives Sublessor 2 years' notice.

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 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.

If none of the first three options is satisfactorily completed within TWELVE (12) months, then Option (4) above must be exercised.

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 General Date

FOR THE CALIFORNIA INSTITUTE OF TECHNOLOGY

BY _____, 11/15/83
Marvin L. Goldberger Date
President

By _____, 11/15/83
David W. Morrisroe Date
Vice-President for
Business and Finance

FOR THE DEPARTMENT OF LAND AND NATURAL RESOURCES

By _____ / 12.20.83
Susumu Ono
Chairman
Date

By _____ / 12/16/83
Member
Date

APPROVED AS TO FORM:

By _____ / September 27, 1983
Its Deputy
Attorney General
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.

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.

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 Teijio Matsuda and Harold D. 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 Teijio Matsuda and Harold D. Masumoto acknowledged the instrument to be the free act and deed of said corporation.

Ruth M. Chang
Notary Public, First Circuit
State of Hawaii

My commission expires: 9/30/86

CALIFORNIA INSTITUTE OF TECHNOLOGY

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 discharging its fish and game or state parks responsibilities; provided, however, that such hunting and recreation activities shall be coordinated with the activities of the Lessee on the demised lands; and provided, further, that such hunting and recreation activities shall be limited to day-light hours only.

4. Right to use Demised Lands. The right for itself, and its successors, lessees, grantees and permittees, to use any 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 the 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 surrender 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, sanitary and orderly condition.

3. Waste. The Lessee shall not make, permit or suffer, any waste, strip, spoil, nuisance or unlawful, improper or offensive use of the demised premises.

4. Specified Use. The land hereby leased shall be used by the Lessee as a scientific complex, including without limitation thereof an observatory, and as a scientific reserve being more specifically a buffer zone to prevent the intrusion of activities inimical to said scientific complex.

Activities inimical to said scientific complex shall include light and dust interference to observatory operation

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, sublet, 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 Lessee.

9. Non-Discrimination. The Lessee covenants that the use and enjoyment of the premises shall not be in support of any

policy which discriminates against anyone based upon race, creed, color or national origin.

10. General Liability. The Lessee shall at all times, 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 arising out of any injury, death or damage on the demised premises caused by or resulting from any negligent activities, operations or omissions of the Lessee on or in connection with the demised premises, subject to the laws of the State of Hawaii governing 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 plants in the leased area except those approved for such planting by the Chairman.

IN WITNESS WHEREOF, the STATE OF HAWAII, by its Board of Land and Natural Resources, has caused the seal of the Department of Land and Natural Resources to be hereunto affixed and these presents to be duly executed this 21st

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 distance being: 135° 00' 18,667.62 feet;

2. 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: 225° 00' 18,667.62 feet;

3. 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: 281° 18' 04.6" 5173.56 feet;

4. 207° 49' 06.5" 841.83 feet along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;

5. Thence along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909, on a curve to the right with a radius of 1200.00 feet, the chord azimuth and distance being: 297° 49' 06.5" 2400.00 feet;

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° 31' 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;

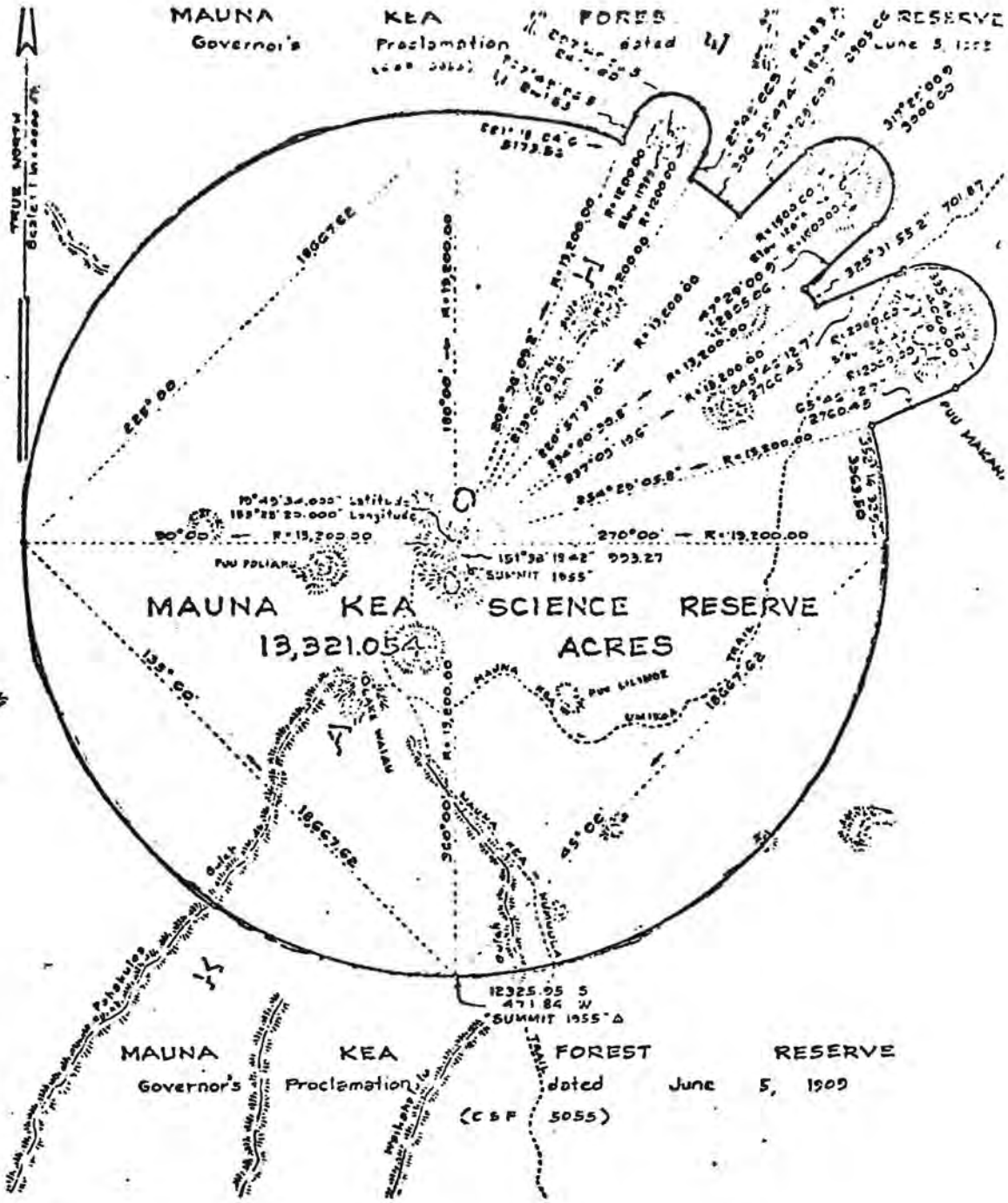
14. 65° 46' 12.7" 2760.45 feet along Mauna Kea Forest Reserve, Governor's Proclamation dated June 5, 1909;

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' 32.9" 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 # 3978

C. BK 1961 - Hana - Folder 1

TAX MAP 4-4-15

SURVEY DIVISION
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
STATE OF HAWAII

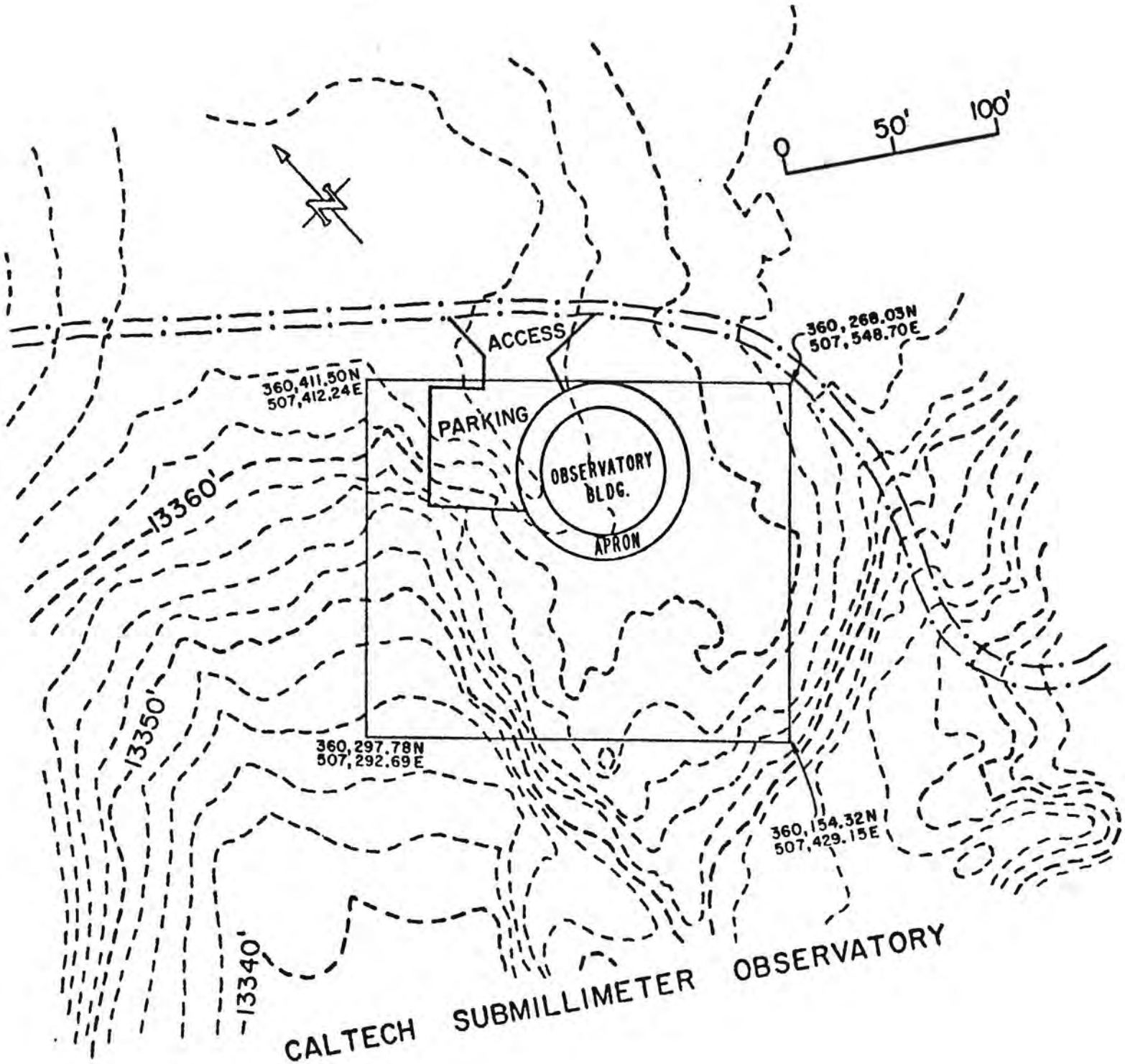
CALIFORNIA INSTITUTE OF TECHNOLOGY

Attachment A, Exhibit B

Caltech Telescope Site

EXHIBIT B

CALTECH TELESCOPE SITE


0
50'
100'
ACCESS
360,411.50N
507,412.24E
360,268.03N
507,548.70E
PARKING
OBSERVATORY
BLDG.
APRON
13360'
13350'
13340'
360,297.78N
507,292.69E
360,154.32N
507,429.15E
CALTECH 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 altitude of 13,360 feet over an area of about 100 × 140 feet. The concrete foundation for the telescope and dome will be approximately 50 feet in diameter and will extend about two feet above the level of the ground. A 6-inch-thick reinforced concrete apron will extend for sixteen feet outside the foundation. The access road and small parking area will be paved with asphalt.

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.

TIME SCHEDULE

Site work will commence in the summer of 1983 with completion of major dome structural work by the end of the summer of 1984. The telescope will be installed in the dome during 1985 with preliminary operation commencing by the end of 1985.

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:

The Telescope is a parabolic reflecting telescope, having a diameter of approximately 10.4 meters. Its principal use will be at far-infrared, submillimeter, and millimeter wavelengths.

"Facilities" include the Telescope, its housing, instruments and associated installations for the Telescope;

"Instruments" include receivers, detectors, test equipment, and tools required to equip the Telescope.

"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, Hilo and West Oahu campuses, and seven Community Colleges. The Manoa campus of UH is responsible for graduate education in the UH system. The governing body of UH is a Board of Regents, which has ultimate authority for the conduct of UH affairs.

B. Parties by Reference

1. Institute for Astronomy

The Institute for Astronomy (IFA) is an organized research unit within the Manoa campus of UH which has responsibility within UH for the conduct of a research program in astronomy and

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 subleased property over the existing road, extended as necessary to reach the property, and shall ensure Caltech's right to have access to a handhole for the permanent power described in IV.B.7. under the conditions described therein, and to the proposed power line described in IV.B.8. UH shall submit on behalf of Caltech such applications as are required and have been prepared by Caltech or its agent for construction and operation of the Facilities, and shall grant to or obtain for Caltech (at no cost to UH) such other rights-of-access as may be necessary for utilities and cableways.

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 immediately preceding section. Such statement shall describe separately the services rendered exclusively for the benefit of Caltech and the cost thereof and the services rendered for the common benefit of all of the astronomical facilities in the Science Reserve and the cost thereof. Caltech shall reimburse UH for its actual cost of all such services rendered for the exclusive benefit of Caltech and shall reimburse UH for a share of the services rendered for the common benefit of all of the astronomical facilities in the Science Reserve, which share shall not exceed a fraction, the numerator of which is one, and

the 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.

UH shall also provide a road to within approximately 20 feet of the subleased property.

8. Infrastructure Improvements

In an effort to provide a more reliable, economical and environmentally acceptable source of power at Hale Pohaku and to the telescopes in the Science Reserve, UH intends to construct a power line for the benefit of existing and future users and intends to improve and to pave the road in whole or in part from

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 additional User's fees until the total amounts indicated in c. above have been paid, or to pay the balance of such amounts in a lump sum. Caltech shall have the right to transfer this obligation to any party to whom the Sublease is reassigned according to its terms. If this Agreement is terminated before Caltech has obtained the funds necessary to construct and install the Facilities, then Caltech shall not be obligated to pay any additional User's fees.

V. OTHER UTILITIES AND SERVICES

If the principal parties mutually agree that UH should construct other improvements necessary or desirable for the

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 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, Caltech shall, during the period of this Agreement, at its own cost and expense, maintain liability insurance for personal injury or death in the minimum amounts of $300,000 per person, $1,000,000 per occurrence, and $50,000 property damage, subject to revision, every FIVE (5) years, in writing. Said policies shall name UH and the State of Hawaii as additional insureds, and a copy shall be deposited with the Director of Procurement and Property Management, UH.

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 _____ OCT 24 1983
Fujio Matsuda Date
President

by _____ OCT 24 1983
Its Date

APPROVED AS TO FORM:

_____ 8/3/83
Its Deputy Attorney General Date

FOR THE CALIFORNIA INSTITUTE OF TECHNOLOGY:

by _____ 11/15/83
Marvin L. Goldberger Date
President

by _____ 11/15/83
David W. Morrisroe Date
Vice-President for
Business and Finance

CALIFORNIA INSTITUTE OF TECHNOLOGY

Attachment C

Conservation District Use Permit

HA-1492

approved 1982-12-17

Caltech con Hawaii 6-24

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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

DIRECTOR
INSTITUTE FOR ASTRONOMY

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. Jeffers/G. Pieri
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

Jeffries / Plesset

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.

2444 Dole Street · Room 202 · Honolulu, Hawaii 96822

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
Vice President for Administration

Enclosures
cc Group 70
Dr. T. G. Phillips, CIT
Dr. John Jefferies/G. Plasch
Mrs. Mae Nishioka/W. Muraoka

LNR-PO
Ev. 1981

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
P. O. BOX 621
HONOLULU, HAWAII 96809

CONSERVATION DISTRICT USE APPLICATION

Print or Type)

FOR DLNR USE ONLY

Reviewed by _____
Date _____
Accepted by _____
Date _____
File No. _____
EIS Required _____
PH Required _____

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 awaii

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.

: The Environmental Assessment may be submitted in lieu of the information required above.

INFORMATION REQUIRED FOR CONDITIONAL USE ONLY

1. 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.

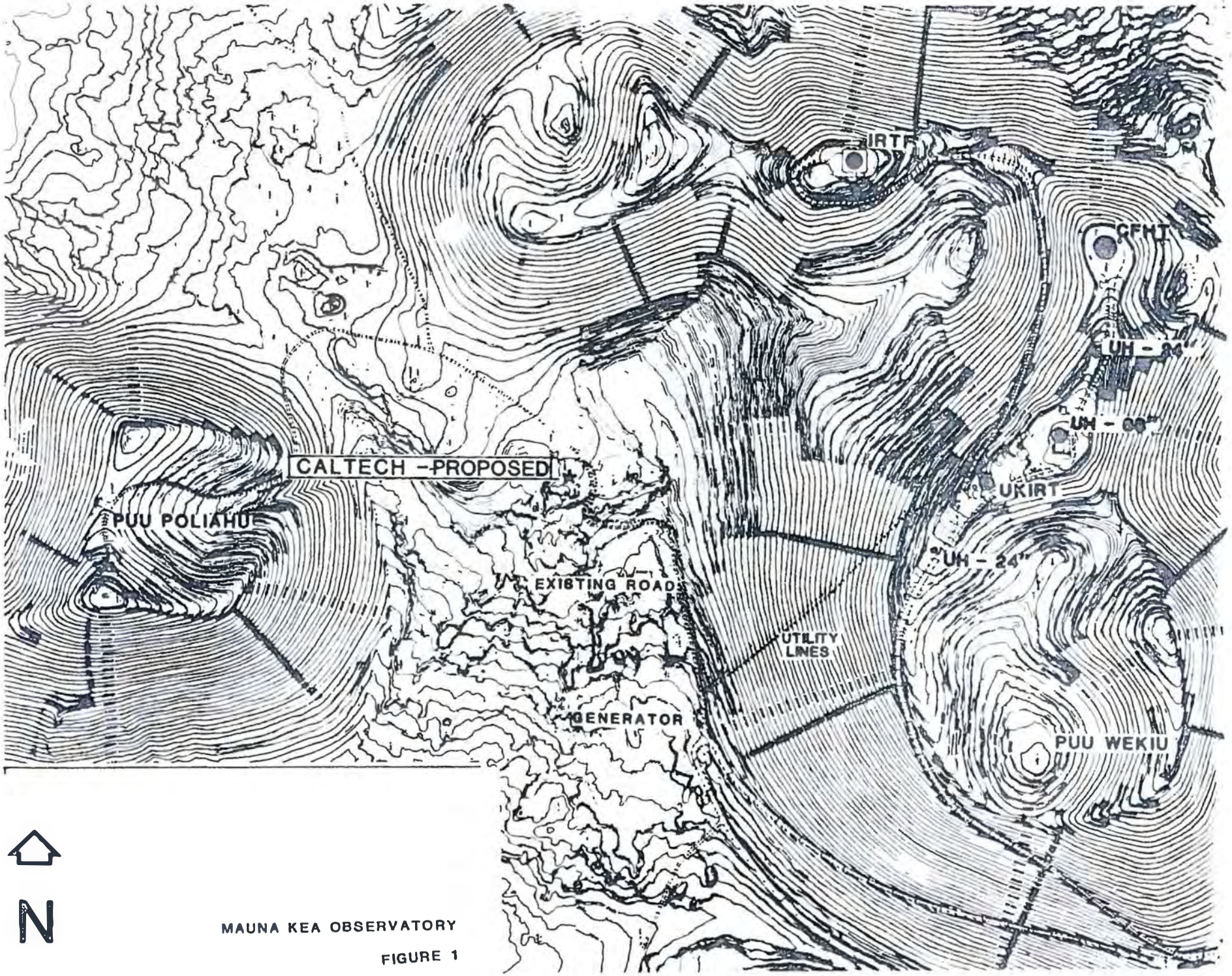
Operations: It is estimated that when the telescope becomes operational an average of five to seven persons will be present on the mountain at one time, operating in two shifts per day at the telescope site. The additional personnel are expected to generate an additional 1,100 - 1,500 gallons per month 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

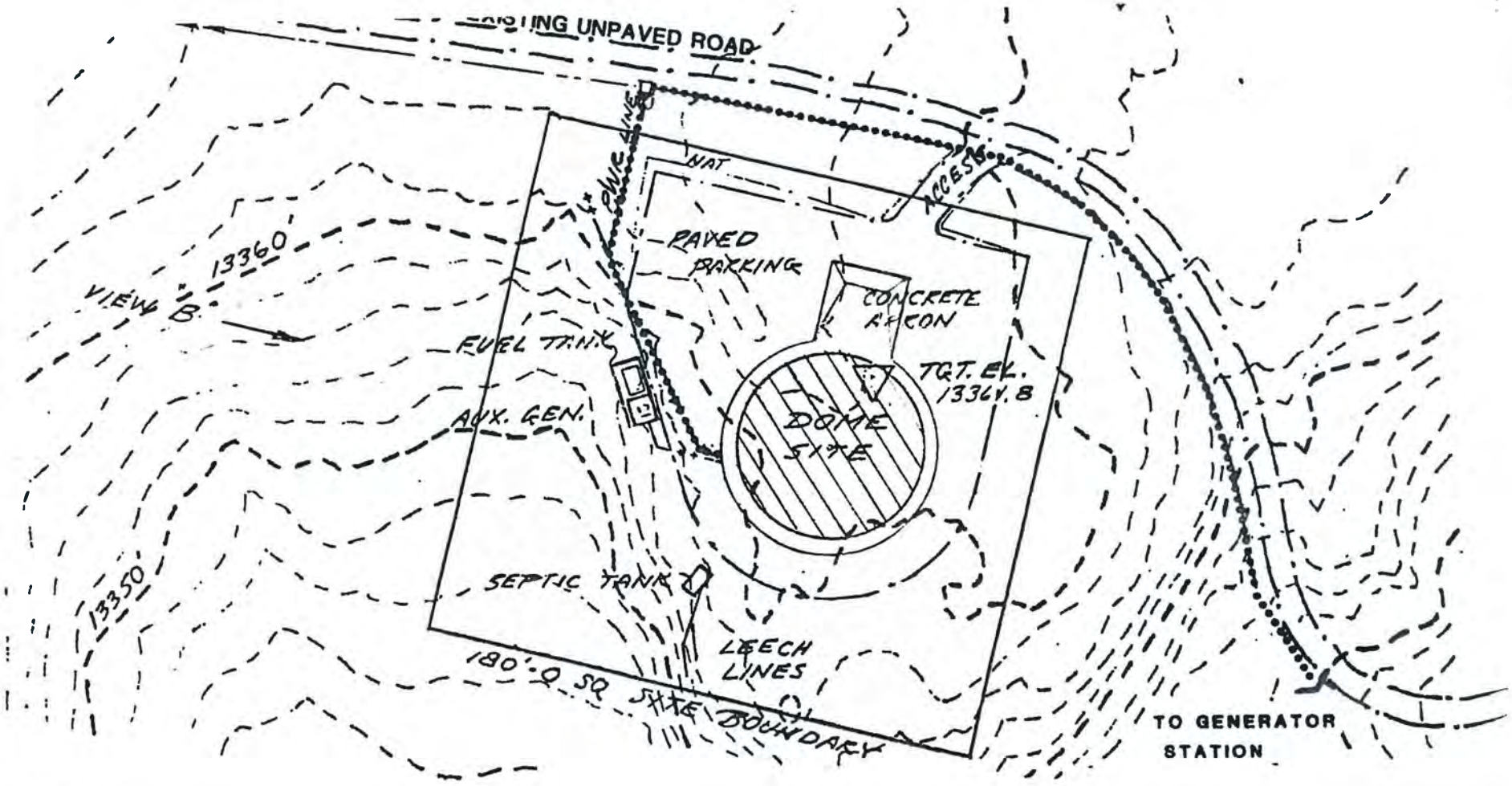


FIGURE 2

LEGEND

..... UTILITY LINES

Source: Survey Office & Tax Maps Bureau
By DK & PD May 1955