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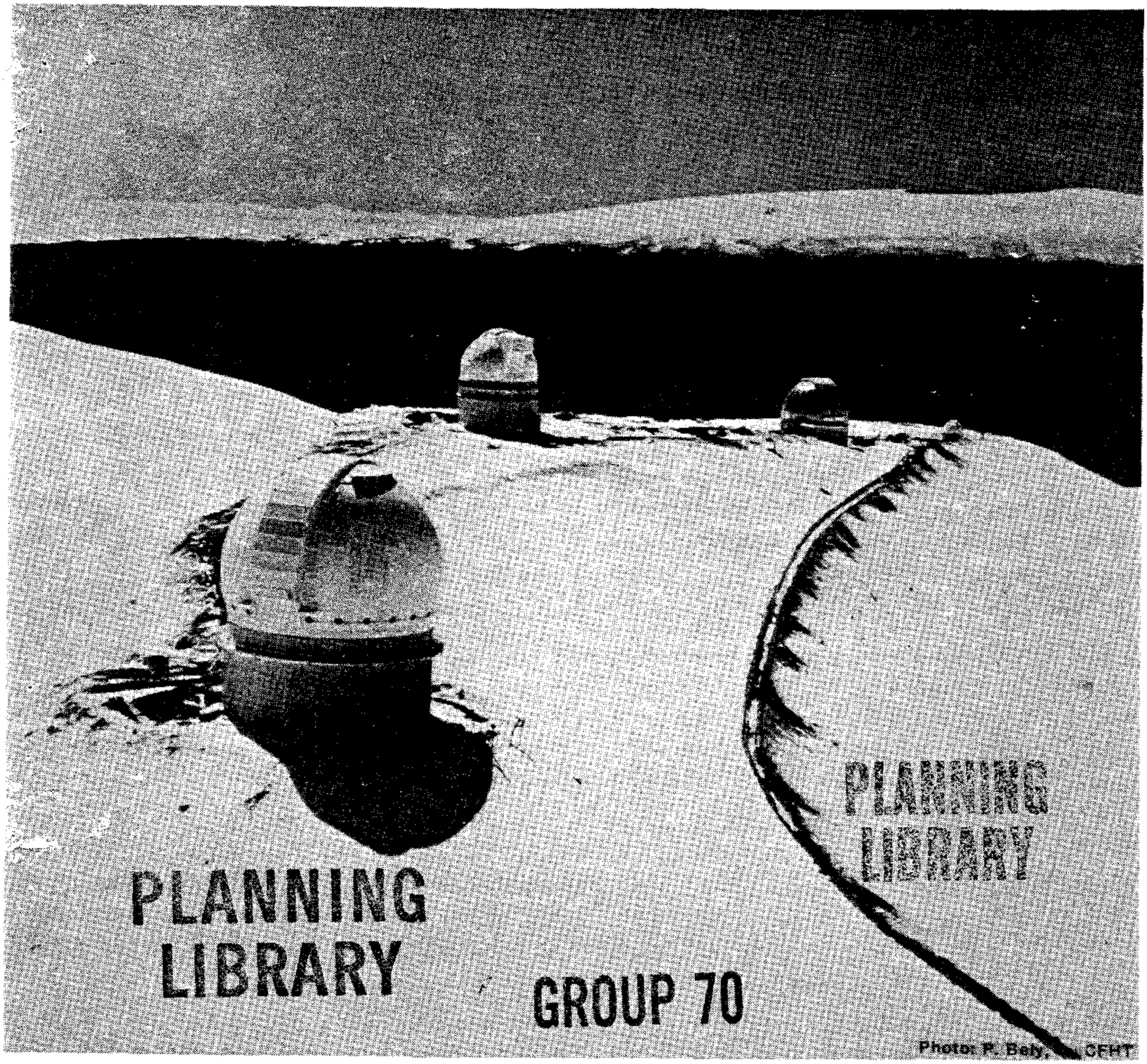


Photo: P. Bely, CFHT

MAUNA KEA SCIENCE RESERVE: COMPLEX DEVELOPMENT PLAN

FINAL ENVIRONMENTAL IMPACT STATEMENT

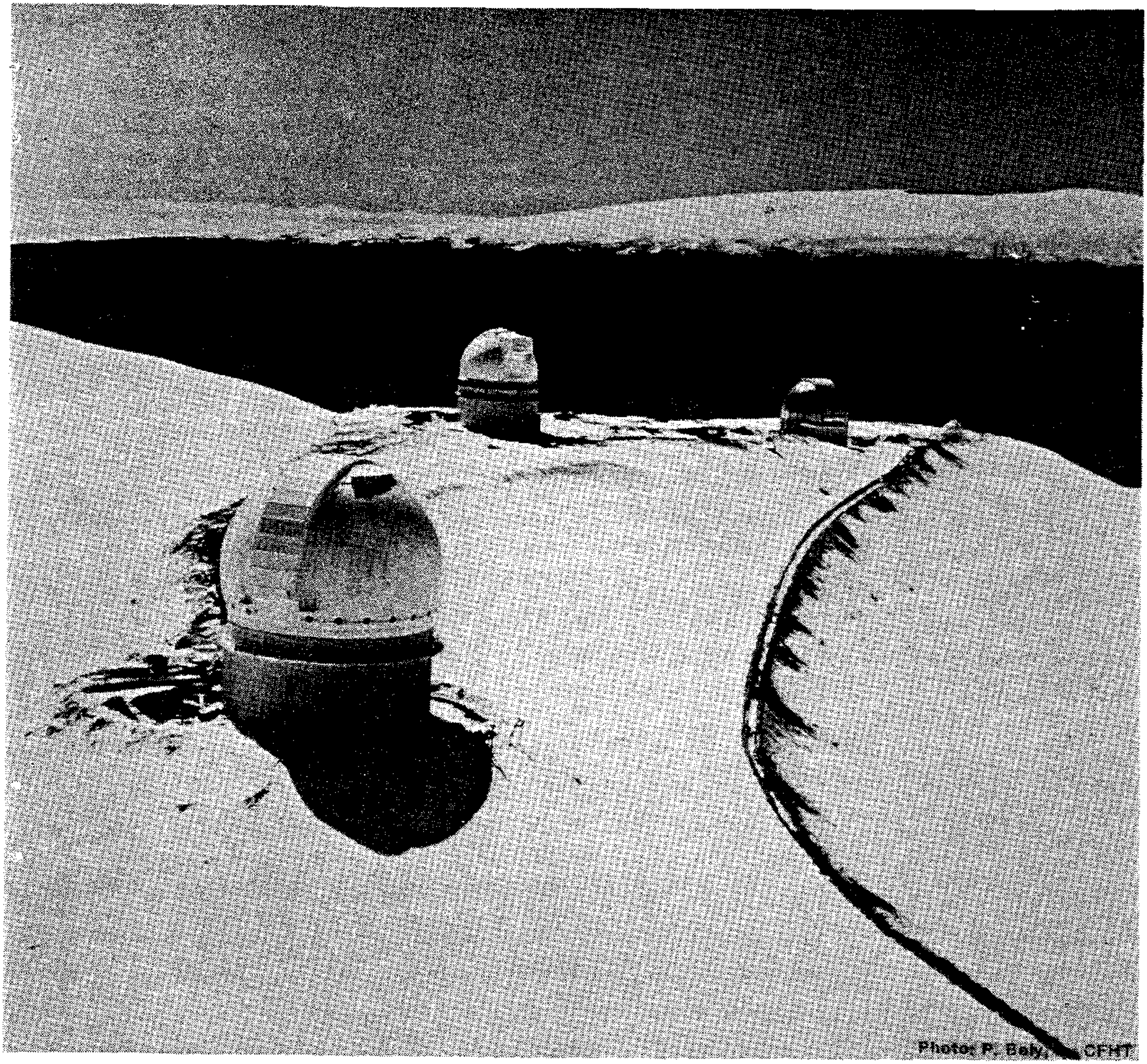
MAUNA KEA, HAMAKUA, HAWAII

January 1983

Prepared for:
Research Corporation of the University of Hawaii

Prepared by:
Group 70

GROUP 70 • Architects • Planners • Interior Designers • 924 Bethel Street • Honolulu, HI 96813 • Phone (808) 533-4445



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Research Corporation

of the

University of Hawaii

Mauna Kea Science Reserve Complex Development Plan

Mauna Kea, Hamakua, Hawaii

FINAL ENVIRONMENTAL IMPACT STATEMENT

January 1983

FINAL

ENVIRONMENTAL IMPACT STATEMENT

The University of Hawaii

Mauna Kea Science Reserve Complex Development Plan

Mauna Kea, Hamakua, Hawaii

Harold S. Masumoto
Vice-President for Administration

January 1983

Prepared

by

Group 70

Honolulu, Hawaii

CONTENTS

This document contains the following:

An addendum listing all of the revisions contained in the Final EIS

Copies of all pages that were changed in the Final EIS

Copies of all comments and responses received and sent during the review period of the draft EIS

The complete bound version of the Final EIS is available for review at the following public depositories:

Office of Environmental Quality Control (OEQC)

Department of Planning and Economic Development Library

Legislative Reference Bureau

State Archives

Hamilton Library - Hawaiian Collection

U.H./Environmental Center

Main Library

Regional Libraries

Hilo
Kaneohe
Kaimuki
Pearl City
Wailuku
Lihue

Branch Libraries - Island of Hawaii

Honokaa
Kailua-Kona
Keaau Community School
Laupahoehoe Community School
Thelma Parker Memorial/Waimea Area
Bond Memorial
Holualoa
Kealakeaua
Mountain View

PREFACE

This Final Environmental Impact Statement consists of Volume 1 of the draft EIS, as revised; comments received during the public review period of the draft EIS; and, responses to reviewers comments. Volume 2 of the draft EIS, Technical Appendices, is hereby incorporated by reference, in its entirety, into this Final EIS.

FINAL

ENVIRONMENTAL IMPACT STATEMENT

JANUARY 1983

PROJECT:	MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN
LOCATION:	MAUNA KEA, HAMAKUA, ISLAND OF HAWAII, STATE OF HAWAII
PROPOSING AGENCY:	UNIVERSITY OF HAWAII VICE-PRESIDENT FOR ADMINISTRATION 2444 DOLE STREET HONOLULU, HAWAII 96822 CONTACT: GINGER PLASCH TELEPHONE: (808) 948-8768
ACCEPTING AUTHORITY:	GOVERNOR GEORGE ARIYOSHI STATE OF HAWAII
CONSULTANT:	GROUP 70 924 BETHEL STREET HONOLULU, HAWAII 96813 CONTACT: MARILYNN METZ TELEPHONE: (808) 533-4445

ADDENDUM

January 1983

The Final EIS for the Mauna Kea Science Reserve CDP, which was filed with the Environmental Quality Commission (EQC) on 4 January 1983, contains revisions and additions to Volume 1 of the draft EIS. Volume 2, Technical Appendices, was not reprinted but was incorporated into the Final EIS by reference. The revised pages, together with the letters received during the review period and our responses, are attached for your information. (Note: Material in parentheses () has been deleted, underlined material has been added). The following changes were incorporated into the Final EIS:

1. The title pages have been revised to state that the document is a Final EIS, dated January 1983.

2. A PREFACE has been added which explains the contents of the Final EIS.

3. The Table of Contents has been reprinted. PART XVII has been added to the listing on page v and the statement Incorporated in the Final EIS by Reference has been added to page ix.

4. Page x, para.3: Amendments to the 1977 DLNR Mauna Kea Plan (may) will be required in order to implement some of the (proposed) recommendations.

5. Page xiv: The word (draft) has been deleted. Comments received during the review period (will be) were addressed and incorporated into or appended to the Final EIS.

6. Page 7, Figure 3: The title of the map is "Mauna Kea Plan Management Areas". It was inadvertently omitted from the original graphic.

7. Page 17, Para. 1: Amendments to the 1977 DLNR Mauna Kea Plan (may) will be required. . .

8. Page 19, Figure 4: Puu Pohaku, is identified on the revised Master Plan map as being N.A.R. Pt. 2. It was inadvertently omitted from original graphic.

9. Page 20, Figure 5: Recommended siting areas were labeled A, B, C and D.

   (CHFT) CFHT-the letters were transposed on the original graphic.

   The parking area was relocated to the south of the comfort station.

10. Page 21, Figure 6: (CHFT) CFHT

11. Page 33, Figure 10, Legend: Proposed Paved Road (1st phase); (Proposed) Future Road Extension (2nd phase). The word changes were made for the purpose of clarification, no revisions were made on the map itself.

12. Page 43, Figure 12, Title: Revised to Hale Pohaku Expansion.

13. Page 62, Figure 14: N.A.R. Pt. 2 was deleted from proposed UH Management areas. It was inadvertently left in on the original graphic.

14. Page 69, Para. 2: Visitors accompanied by children under 10 years of age will also be discouraged from proceeding upslope. This sentence was added because medical evidence shows that the elderly and young children are most likely to be affected by the altitude at the summit.

15. Page 76, Para. 5: The last sentence of the paragraph should read "Permafrost layers may exist within the cinder cones; but if present, are not expected to be encountered by any construction". This was an error in typing the original document.

16. Page 107 and 108: These pages were accidently transposed in the draft.

17. Page 109, Table 2: The latitude of Encumeada Alta, Madeira is (433°N) 43°N. This was a typographical error. Altitude for all sites is in meters.

18. Page 174, Visual: Sentence 3 should read: Any new (telescopes) telescope building on the summit ridge would probably replace one of the smaller (facilities) domes that are already located there. This change was made to clarify the fact that if one of the smaller telescopes is relocated, the entire building will be replaced.

19. Page 177: The third sentence should read: Amendments to the Mauna Kea Plan (may) will be required. . .

20. Pages 180 and 181: Various typographical errors were corrected.

21. Page 283, References and Footnotes: The following references were inadvertently omitted from the draft document (see attached page 283): 25; 27; 35.

22. Page 284, PART XVII: This is a completely new section which includes a list of agencies and individuals who reviewed and commented on the draft EIS and copies of their letters and UH responses.

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VOLUME 1

ILLUSTRATIONS

TABLES

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TECHNICAL APPENDICES

VOLUME 2

(Incorporated in the Final EIS by Reference)

SUMMARY

The University of Hawaii is preparing the "Mauna Kea Science Reserve Complex Development Plan" (SRCDP), (formerly called the Mauna Kea Science Reserve Master Plan), which reflects future development of the summit of Mauna Kea and related facilities to the year 2000, as set forth in the Research Development Plan (RDP). The RDP which was adopted by the UH Board of Regents on 22 January 1982, and was prepared to serve as the programmatic Master Plan for the continued development of the Mauna Kea Science Reserve, Hale Pohaku and related improvements. The purpose of the SRCDP is to develop a physical plan (PART III provides a description of the physical plan), with supporting programmatic data and environmental analyses, which addresses all proposed development within the Mauna Kea Science Reserve and related facilities (as set forth in the UH RDP) to the year 2000.

Because the UH is lessee of the Mauna Kea Science Reserve, and thus has been responsible for developing and maintaining the area, the Board of Land and Natural Resources (BLNR), has asked that the University also be responsible for managing and monitoring all activities that may affect the Reserve. The University is prepared to accept this responsibility, and has included a draft Management Plan (PART IV of this EIS), as part of the SRCDP. The purpose of incorporating a management plan as an integral part of the SRCDP is to protect the natural and man-made attributes of the summit area while at the same time allowing development and use of its scientific and recreation resources in a responsible, conservation-oriented manner.

The SRCDP is guided by the policies set forth in the 1977 DLNR Mauna Kea Plan and the Hale Pohaku Complex Development Plan. PART II of this EIS discusses the relationship of the SCRDP to these earlier plans. Amendments to the 1977 DLNR Mauna Kea Plan will be required in order to implement some of the recommendations.

It should be emphasized that the SRCDP is only in the draft stage; more public input is required before the various elements are finalized. This EIS is one method of obtaining public comment on the plan. The final plan will be subject to appropriate agreements among affected State agencies and approval by the UH Board of Regents and the BLNR.

Based on the RDP, the SRCDP identifies siting areas for a total of thirteen telescopes (including the 6 existing facilities and the proposed Caltech, UK/NL and UC telescopes) on the mountain by the end of the century. Although the actual number of facilities which will be realized by the astronomy program at Mauna Kea will depend on demand and on the role determined for this activity by public policy makers, the University of Hawaii has determined that 7 additional telescopes is reasonable and feasible number of telescopes to expect between now and the year 2000 (PART VI). Alternatives to the proposed telescope development on Mauna Kea include: alternative means of obtaining astronomical information and alternative locations for telescopes worldwide.

Three telescopes have been proposed for construction during the 1980's. They are: (1) the California Institute of Technology (Caltech) 10-meter submillimeter telescope (CDUA filed June 12, 1982); (2) the Science and Engineering Research Council (SERC) of the United Kingdom 15-meter millimeter-wave telescope (UK/NL MT) (CDUA filed August 27, 1982); and, (3) a 10-meter optical/infrared telescope sponsored by the University of California (UC TMT) and proposed to begin construction by late 1984.

The probable number and characteristics of the remaining telescopes (which are projected within this plan for construction during the 1990s) is derived from analyses of possible telescope demand by both national and international institutions. Based on this demand, it is assumed that of all requests for permission to locate additional telescopes on the mountain, one additional millimeter-wave telescope; two additional 10-meter optical/infrared telescopes; and one National New Technology Telescope (NNTT) (a 15-meter [600-inch] optical telescope), will request permission to locate within the Science Reserve before the year 2000.

Taking the general locational characteristics of each type of telescope into consideration, seven areas within the Science Reserve were selected for analysis. The methodology employed to evaluate each analysis area involved four major screens: (1) technical - which evaluated variables such as wind direction and horizon obscuration; (2) environmental/physical attributes including slope and geological analysis, biological resources, archaeological sites, and visual analyses, (3) recreational uses such as skiing; and (4) future infrastructure requirements and costs of development. As a result of these analyses, four areas were recommended for future telescopes.

The SRCDP recommends that the road to the summit be improved and paved for safety, maintenance, and environmental reasons (PART VII); paving will require an amendment to the Mauna Kea Plan. The road improvements are only in the planning phase; a design consultant has not been selected as yet. Visitor parking areas are proposed along the summit access road and within the summit area. It is anticipated at this time that the parking areas will be constructed in conjunction with improvements to the various road segments. Alternatives to the proposed paving of the summit road which have been considered include: no action, alternative level of road improvements, and alternative road alignments.

After consideration of the alternatives of additional diesel generators and alternative energy sources, it was determined that the only reliable and economical means of supplying the 3000 KW of power necessary to meet the current and future needs of UH astronomy would be by a connection to the public utility system (HELCO); this powerline is described in PART VIII. Accordingly, a transmission line is being planned to transmit electrical power from the existing 69-KV HELCO powerline (parallel to the Saddle Road) to a substation and from this point a 12-KV line to the existing central distribution transformer at the 13,040-foot elevation of the summit. Four alternative corridors and associated substation and switching station locations for the 69-KV line from the Saddle Road to Hale Pohaku are being considered. Both underground and overhead installations are being evaluated for each corridor. The SRCDP recommends overhead powerlines along this route. Construction of overhead powerlines will require an amendment to the 1977 DLNR Mauna Kea Plan. The 12-KV powerline from Hale Pohaku to the summit will be underground.

The projected increase in the number of telescopes at the summit by the year 2000 will generate the need for expansion of the mid-level facilities at Hale Pohaku. There is space for additional dormitories in an already disturbed area near the temporary UH buildings. If construction of the UC TMT is approved, it is possible that one new dormitory building could be constructed as early as 1984, if all appropriate approvals are obtained. Expansion of the mid-level facilities (PART IX) was provided for in the Hale Pohaku Complex Development Plan (HPCDP) which was prepared by the Department of Land and Natural Resources in 1980.

A 1,200-square-foot visitor reception area and Information Station is being constructed as part of the permanent mid-level facility at Hale Pohaku. The Information Station is expected to serve as the control point for management and monitoring of the mountain. Usage of the Information Station and adjacent parking area will be monitored. Expansion of astronomy facilities at the summit and paving of the access road may create demands for additional facilities within the Information Station or for additional parking spaces.

The presence of a total of thirteen telescopes at the summit will change the visual appearance of the area. Some of the new telescopes may also be visible from populated areas on the Island of Hawaii, although the appearance of the mountain, as seen from Hilo, is not expected to change significantly from present conditions.

The use of the summit and Hale Pohaku areas by an increased number of astronomers and visitors could adversely affect the biota of the area. Increased foot traffic in vegetated areas could result in some plants being trampled. Increased traffic to and within the area also increases the chance of new exotic species being introduced into the area.

Construction of the powerline overhead or underground between the Saddle Road to Hale Pohaku will involve the removal of some mamane trees; a significantly greater number of trees will be removed for underground construction of the powerline as compared to overhead construction.

The major impacts on fauna of the area will be on various species of resident arthropods. Most of the direct impacts will be localized and related to specific telescopes sites. Impacts on fauna related to increased public usage of the summit area will be mitigated by implementation of the Management Plan.

Future telescopes will be sited to avoid archaeological sites in the summit area. Impacts on this resource that might occur as a result of increased public usage of the summit area, and provisions to enforce their protection of these resources are addressed in the Management Plan.

Paving of the County road to Hale Pohaku has greatly increased accessibility to the area. Once the summit road is improved and paved, the number of visitors who travel above Hale Pohaku may increase. The presence of new telescopes and the Information Station may also generate traffic to the area. It is estimated that by the year 2000, traffic over the summit roads could approximate 300 vehicle trips per day during the weekdays, and over 500 vehicle trips during weekends with heavy snowfall. The draft Management Plan describes suggested measures to control traffic from Hale Pohaku to the summit area.

If the proposed actions are implemented, construction will represent an irreversible and irretrievable commitment of human labor, construction materials, energy and capital investment. Land for the utility easements, telescopes, improved road, and mid-elvation facilities will be committed until the year 2000. However, the SCRDP is proposed in order to expand, not curtail the range of potential uses of the Mauna Kea Science Reserve.

Unresolved issues include whether the powerline will be constructed overhead or underground from the Saddle Road to Hale Pohaku; whether or not the road will be paved; and, approval of the elements of the Management Plan.

PURPOSE OF THIS ENVIRONMENTAL IMPACT STATEMENT

This Environmental Impact Statement has been prepared to accomplish the following:

1. to comply with Chapter 343, Hawaii Revised Statutes;
2. to inform the public of the proposed SRCDP and to obtain comments on the proposed actions;
3. to assess the environmental setting of the project site and surrounding area;
4. to outline the possible environmental impacts of the proposed actions;
5. to outline mitigating actions for potential impacts;
6. to consider alternatives to the proposed project and the impacts of those alternatives; and,
7. to fulfill the environmental assessment requirements for Conservation District Use permits.

Comments received during the review period were addressed and incorporated into or appended to the Final Environmental Impact Statement.

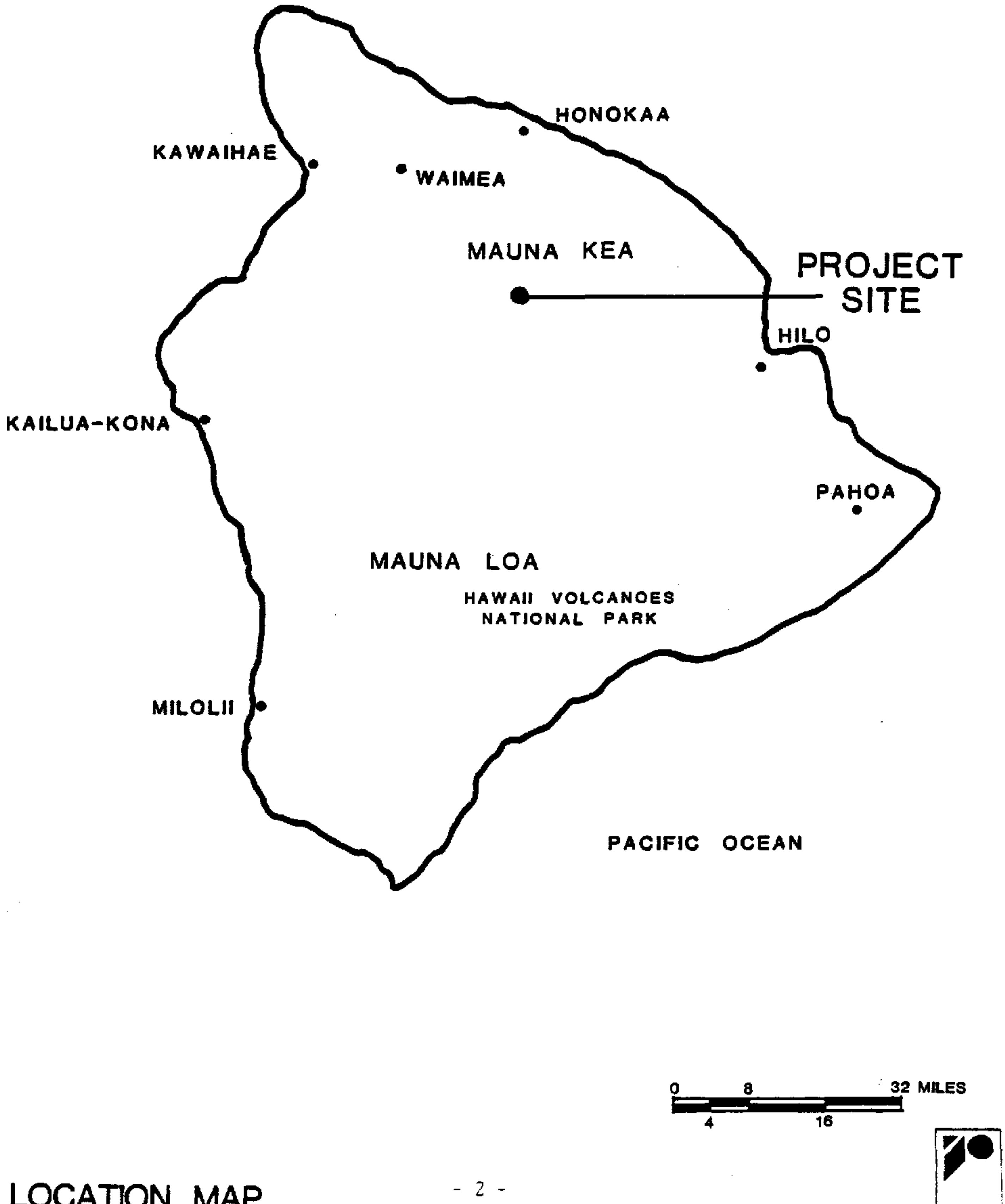
PART I: INTRODUCTION

The University of Hawaii (UH) is actively advancing mankind's understanding of the physical universe through the operation of an astronomical training and research facility on Mauna Kea, Hawaii (Figure 1). Mauna Kea's excellent qualities for astronomical observation derive from its high altitude (13,796 feet), atmospheric dryness, and minimal seasonal variation. In addition, its isolated location on an island in the Pacific and its tropical latitude which insure minimum cloud cover; the high altitude (45°) at which the galactic center transits; and a large fraction of total sky-availability make it one of the best sites in the world for ground-based astronomy. The local availability of support technicians and related personnel and the relatively flat terrain which facilitates construction of the telescope facilities also contribute to Mauna Kea's attractiveness as a major international astronomical site.

Some 20 years ago, a pressing need for new ground-based observatories was identified to meet the requirements for this rapidly expanding discipline, to take advantage of new technology, and to replace the fading capacity of the few pre-War installations. Correspondingly, and because of the increased federal support for the science with the advent of the Space Age, extensive tests were carried out to locate the best sites for observing facilities. For studying southern hemisphere skies, the Chilean Andes were ultimately found to be superbly endowed in the special qualities required for astronomical observations. For the northern hemisphere, mountain sites in the Tucson, Arizona area were selected; these now boast some of the most sophisticated observing instruments in the world. In recent years, many sites in the continental United States have been compromised to some degree - - primarily as a result of air pollution and proliferating, uncontrolled city lights. Thus, the search for new sites of the highest quality has continued.

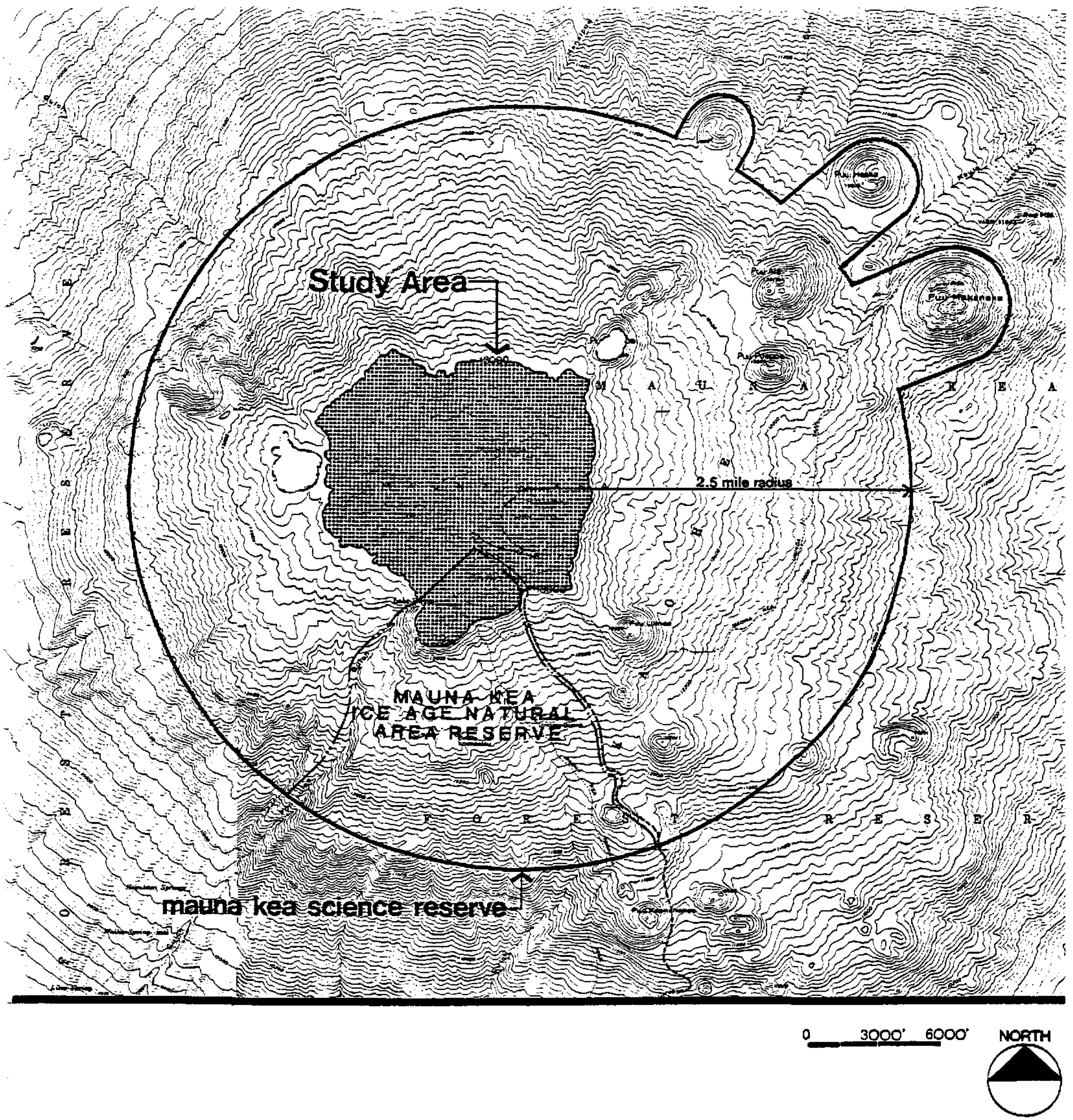
The current focus on astronomy at Mauna Kea can be dated to 1963, when the late Dr. G.P. Kuiper of the University of Arizona initiated a study of "seeing" conditions on Haleakala for NASA. Haleakala was the first site tested because, at that time, there was essentially no access to the Mauna Kea summit. Because he felt it desirable to test Mauna Kea also, Kuiper persuaded the late Governor John Burns to provide funds to put through a jeep trail to the summit area. Immediately after the completion of this trail, in 1964, Kuiper and his colleagues conducted a limited series of "seeing" tests from Puu Poliahu, a summit area cinder cone. Kuiper concluded, on the basis of his observations, that the Mauna Kea summit area was an exceptional site, and a more promising prospect for an astronomical observatory than Haleakala. This assessment was strengthened by extensive studies of the site qualities of Mauna Kea and Haleakala conducted by the University of Hawaii in 1965-1966.

In November 1967, the Board of Land and Natural Resources (BLNR) approved a 65-year lease (beginning January 1, 1968) with the UH for all lands above he 12,000 foot elevation of Mauna Kea. The lease refers to these lands as the Mauna Kea Science Reserve (Figure 2). The Reserve was established 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." (General Lease No. S-4191).



LOCATION MAP

MAUNA KEA SCIENCE RESERVE CDP — FIG. 1



STUDY AREA

MAUNA KEA SCIENCE RESERVE CDP - FIG. 2

Since the original "seeing" tests were conducted and since the execution of the lease between the UH and the BLNR, the national and international scientific community has established four major telescopes within the Mauna Kea Science Reserve. These are: (a) the University of Hawaii (UH) 2.2-meter (88-inch) optical telescope; (b) the 3.6-meter (144-inch) Canada-France-Hawaii optical telescope (CFHT); (c) the 3.8-meter (150-inch) United Kingdom Infrared Telescope (UKIRT); and (d) the 3.0-meter (120-inch) NASA Infrared Telescope Facility (IRTF). There are also two smaller (0.61 meter) telescopes located in the Science Reserve. They are used by faculty and students of UH in a variety of programs where the light-gathering power of the larger telescopes is not necessary.

In the early 1970s it was recognized that an overall Mauna Kea plan was necessary in order to control development on the mountain and to resolve the conflicting demands of various users who wanted to use the mountain for their activities. Extensive citizen participation in the planning process followed. The main objective of the process was to "Determine the compatibility of Mauna Kea's resources to accommodate various uses without unacceptable damage to biotic and other natural values and historic values and the visual appearance of the mountain." (1977 DLNR Mauna Kea Plan) The "Mauna Kea Plan", a policy framework for the management of Mauna Kea, was adopted by the Board of Land and Natural Resources on February 11, 1977. It is henceforth referred to as the "1977 DLNR Mauna Kea Plan".

Since the construction of the six existing telescopes on the mountain, and since the adoption of the 1977 DLNR Mauna Kea Plan, applications have been received from three organizations requesting approval to construct their telescopes on the mountain. The first, California Institute of Technology (Caltech), has prepared and filed an EIS which was accepted by the Governor in August, 1982. They propose to construct a 10.4-meter telescope for millimeter and submillimeter astronomy within the Science Reserve. A CDUA for this project is currently being processed.

A consortium from the United Kingdom and the Netherlands have begun the process of obtaining approvals to locate a 15-meter millimeter wave telescope (UK/NL MT) on Mauna Kea in the general vicinity of the Caltech site. A CDUA for this telescope is currently being processed by the Department of Land and Natural Resources (DLNR). A third facility, a 10-meter optical/infrared telescope, has been proposed by the University of California (UC TMT). They are currently completing preliminary negotiations with the University of Hawaii to begin their approval process. U.C. does not expect to submit a CDUA for their project until sometime in 1983.

Because of the excellence of the site, it can be expected that the State will continue to receive requests for permission to locate additional telescopes on Mauna Kea. In order to guide and control the expected growth of facilities on the mountain, the University has formulated a "Research Development Plan" (RDP) which will serve as the programmatic Master Plan for the continued development of the Mauna Kea Science Reserve, Hale Pohaku and related improvements. The Plan was adopted by the UH Board of Regents on 22 January 1982.

The "Mauna Kea Science Reserve Complex Development Plan" (SRCDP), (formerly called the Mauna Kea Science Reserve Master Plan), which is the subject of this EIS, is a physical plan which reflects future development of the summit of Mauna Kea and related facilities to the year 2000, as set forth in the RDP. The objective of the SRCDP is to guide and control development in order to preserve the scientific, physical and environmental integrity of the mountain.

The SRCDP will consist of two documents: "The Complex Development Plan Report" (CDP) and "The Environmental Impact Statement" (EIS). The CDP will describe the considerations which lead to the siting, organization, and general physical characteristics of future facilities; present programmatic information pertinent to actual development of the area; specify the design and environmental criteria which should be followed when implementing the development program; and present a plan and implementation strategy for managing and monitoring the various uses of the mountain. The EIS describes the elements of the CDP; evaluates alternatives to each action; assesses the possible environmental impacts of implementing the actions proposed in the plan; and describes mitigating actions for potential negative impacts. Criteria and constraints that evolve from the planning and EIS process will be incorporated into the CDP. The reports will form the basis of future requests for CDUAs and for amendments to the 1977 DLNR Mauna Kea Plan.

PART II: RELATIONSHIP OF THE PROPOSED ACTION TO LAND USE PLANS POLICIES, AND CONTROLS FOR THE AFFECTED AREA

A. MAUNA KEA PLAN

1. Management Areas

The 1977 DLNR Mauna Kea Plan, a policy framework for the management of Mauna Kea, was adopted by the Board of Land and Natural Resources on February 11, 1977. The area covered by this Plan includes all of the Conservation District land on the mountain from the summit down to the Saddle Road. The policy plan consists of five management areas, each appropriate to specific uses or combination of uses. (Figure 3). They are:

Mamane/Naio Forest Ecosystem Management Area;
Science Reserve Management Area;
Special Natural Area and Historic/Archaeological Management Area;
Silversword Management Area; and
Military Management Area.

All of the existing telescopes are located within the Science Reserve Management area. The alternative powerline corridors from the Saddle Road to Hale Pohaku and Hale Pohaku itself (the site of the UH mid-level facilities), are located within the Mamane/Naio Forest Ecosystem Management Area. Powerline corridor "A" is partially located within the Military Management Area.

2. Jurisdiction

Administration, jurisdiction, and use of Mauna Kea cuts across many lines of responsibility. It involves several divisions within DLNR as well BLNR, UH, the County of Hawaii, the Hawaiian Homes Commission, and to some degree, the Federal government. Plan review and adoption of amendments is the responsibility of the BLNR.

Management functions and jurisdictional responsibilities for areas affected by the SRCDP, as currently delineated in the 1977 DLNR Mauna Kea Plan, are as follows:

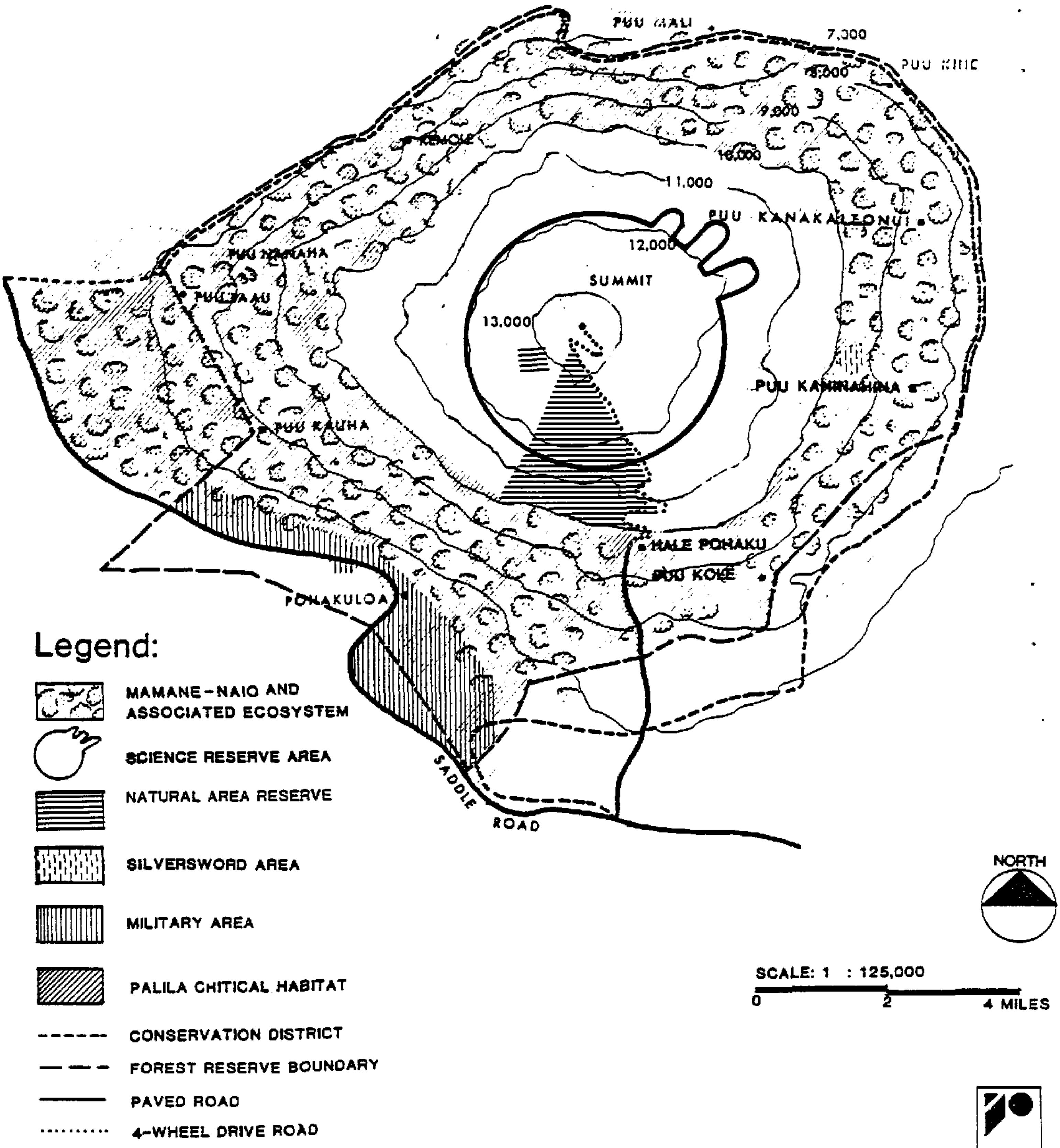
University of Hawaii

(a) Management and upkeep of the Mauna Kea Science Reserve as provided under the lease from DLNR;

(b) Management and upkeep of the Hale Pohaku area astronomy facilities as provided in the lease from DLNR;

(c) Management, improvement, and upkeep of access road from Hale Pohaku to the Summit;

(d) Responsibility for any portable skilifts, portable restrooms, and warming huts allowed for winter recreation under CDUA law.



MAUNA KEA PLAN MANAGEMENT AREAS

MAUNA KEA SCIENCE RESERVE CDP — FIG. 3

DLNR Division of Forestry and Wildlife

(a) Management of trails, firebreak roads, and forest camping areas;

(b) Inspection of sites covered by CDUAs;

(c) Management of threatened and endangered plants and their critical habitat;

(d) Management of feral and exotic game wildlife;

(e) Management of threatened and endangered wildlife;

(f) Management of wildlife habitat, including critical hibitat for endangered species;

(g) Wildlife research;

(h) Maintenance of hunter cabins, hunter access roads and public hunting areas;

DLNR Division of State Parks, Outdoor Recreation and Historic Sites

(a) Management of Mauna Kea State Park at Pohakuloa;

(b) Management of historical, archaeological, and geological features of the mountain.

Natural Area Reserve Commission

Management and upkeep of Mauna Kea Ice Age Natural Area Reserve (which includes the adze quarries, Puu Pohaku, and Lake Waiau).

DLNR Conservation and Resources Enforcement Division

Enforcement of all DLNR regulations applicable to the 1977 DLNR Mauna Kea Plan Management areas.

3. Possible Changes to the Mauna Kea Plan

Access

The road from Hale Pohaku to the summit is presently unpaved; however, paving has been recommended in the SRCDP. Because the 1977 DLNR Mauna Kea Plan precludes paving as a matter of policy, an amendment to the Plan will be requested.

Power

The 1977 DLNR Mauna Kea Plan allows for electric power to be generated on the mountain or to be provided via an underground power line connecting the summit facilities with HELCO, the public utility system. Construction of overhead lines will require an amendment to the Plan.

Jurisdictional Responsibilities

In order to minimize overlapping jurisdiction, the Management Plan portion of the SRCDP recommends several changes in the jurisdictional responsibilities outlined in the 1977 DLNR Mauna Kea Plan.

B. GENERAL LEASE NO. S-4191

On June 21, 1968 the University of Hawaii entered into an agreement with the Board of Land and Natural Resources to lease approximately 13,000 acres at the Summit of Mauna Kea for a Science Reserve (Figure 2). The period of this 65-year lease is January 1, 1968 through December 2033.

The lease specifies that. . . "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 the scientific complex include but are not limited to light and dust interference to observatory operation and certain types of electric or electronic installations). Certain additional rights and responsibilities of the UH with regard to the Science Reserve land, are summarized below:

1. Maintenance of the Premises: UH is to keep the premises and improvements in a clean and orderly condition.

2. Improvements: UH may construct on the land; plans must be submitted to the Chairman of the Board of Land and Natural Resources for review and approval prior to commencement of construction. The improvements are to be removed by UH at the end of the lease, or may be abandoned in place. UH is required to keep all improvements in good condition.

3. General Liability: UH is liable for property damage, personal injury or death within the Science Reserve resulting from negligence of UH.

4. Laws, Rules and Regulations, etc: UH must comply with DLNR Regulation 4 and with all other laws, ordinances, rules and regulations of the federal, state, municipal or county governments affecting the land or improvements.

5. Objects of Antiquity: UH must not damage, remove, excavate, disfigure, deface or destroy any object of antiquity, prehistoric ruin or monument of historical value.

6. Undesirable Plants: In order to prevent the introduction of undesirable plant species in the area, UH or its sub-leasees shall not plant trees, shrubs, flowers or other plants in the leased area except those approved for such planting by the Chairman of BLNR.

The BLNR reserves the following rights to itself:

1. Water Rights: All rights to surface and ground waters, provided, that the BLNR does not unreasonably interfere with UH's use of the land. UH has the right to use the waters of Lake Waiau under the following conditions:

(a) The purpose for using the water is necessary or incidental for the use permitted by the leasee.

(b) They do not drill or disturb Lake Waiau's bottom, banks or adjacent areas;

(c) They do not pollute the waters of Lake Waiau;

(d) They do not take or divert any of the waters from Pohakuloa springs.

2. Access: BLNR has the right to cross the leased land for inspection or for any government purposes.

3. Hunting and Recreation Rights: All hunting and recreation rights on are subject to rules and regulations issued by the BLNR in discharging its fish and game or state parks responsibilities. Hunting and recreation activities in the Science Reserve, however, shall be coordinated with UH and shall be limited to day-light hours only.

4. Right to Use the Science Reserve: BLNR has the right to use any portion of the Science Reserve and has the right to grant this privilege to others. However, no such use shall be permitted unless BLNR and UH determine mutually that such use will not unreasonably interfere with the UH's use of the Science Reserve.

All actions proposed in he SRCDP which affect the Science Reserve are generally in accordance with the lease.

C. RESEARCH DEVELOPMENT PLAN FOR MAUNA KEA SCIENCE RESERVE AND RELATED FACILITIES

The University has formulated a Research Development Plan (RDP) which will serve as the programmatic Master Plan for the continued development of the Mauna Kea Science Reserve. The RDP, which was adopted by the UH Board of Regents on 22 January 1982, was developed to reflect State policies such as those set out in the 1977 DLNR Mauna Kea Plan and the Hale Pohaku Complex Development Plan.

The Research Development Plan projects a total of 13 major telescopes on the mountain by the year 2000. The RDP envisions a single Environmental Impact Statement (EIS) and overall physical plan for all Science Reserve and telescope related development to the year 2000. Other elements of the Plan include paving of the access road above Hale Pohaku; the construction of a Hawaii Electric Light Company (HELCo) powerline to service both the mid-level and summit facilities; and expansion of the mid-level facilities at Hale Pohaku. The SRCDP addresses the land use allocations and physical facilities necessary to implement the RDP.

D. HALE POHAKU MID-ELEVATION FACILITIES COMPLEX DEVELOPMENT PLAN

The Hale Pohaku CDP was prepared to fulfill the requirements of the 1977 DLNR Mauna Kea Plan which directed that: "A master plan for the Hale Pohaku area shall be prepared by the Department of Land and Natural Resources. Said plan shall incorporate plans for all intended uses of Hale Pohaku . . ." (1977

DLNR Mauna Kea Plan,1977). The EIS for the CDP, with an amendment, was accepted by the Governor in October 1980. The facilities described in the Plan are currently under construction.

Future expansion of the mid-elevation facility was addressed in the 1980 CDP and EIS. The CDP states that. . ."space designated for future expansion is located within the existing disturbed site where adverse effects to the environment would be minimal. Because the designated location is very general, it will be necessary to conduct a site survey when, and if, development becomes necessary. All requirements and controls which are stated in this Plan for the programmed facilities should also be followed in any expansion program."

The site plan for the mid-elevation facility of the building was modified from that described in the 1980 CDP. An environmental assessment of the proposed changes was submitted and OEQC determined that the proposed changes did not constitute a major change. A negative declaration for the modifications was filed with the Environmental Quality Commission in November 1981.

Because the revised site plan necessitated using the designated expansion area for programmed facilities, a new expansion area was identified. This new area is also located within the existing disturbed site where adverse effects to the environment will be minimal.

Actions included in this SRCDP which were not addressed in the Hale Pohaku CDP are: (1) additional expansion of the Information Station; and, (2) expanded visitor parking near that facility.

E. HAWAII STATE PLAN

The Hawaii State Plan sets forth long range and comprehensive goals, objectives, and policies to guide the future development of the State of Hawaii. It further details priority directions which indicate areas of Statewide concern meriting immediate attention.

As part of the proposed action, the development of the Mauna Kea Observatory fulfills one of the State Plan's stated objectives of "increasing and diversifying Hawaii's economic base." The Observatory also fulfills the related policy of "Promoting Hawaii's gèographic, environmental, and technological advantages to attract new economic activities into the State."

Astronomical development in general, possesses the characteristics of the type of industry which the State Plan singles out as desirable for Hawaii. Part III, Priority Directions, Section 103, subsection (e) lists the characteristics of a desirable industry: (1) An industry that can take advantage of Hawaii's unique location and available manpower resources. Part III of this Environmental Impact Statement describes the qualities of Mauna Kea that make it the most desirable site in the world for location of telescopes.

Subsection (e) (2) states that new industry should be a clean industry that would have minimal effect on Hawaii's environment. Astronomy is a clean, non-polluting industry. It does not generate noxious waste products nor does it pollute the water and air. Astronomers have a vital interest in maintaining a clean environment; pollution has already had an effect on existing mainland observatories, and it is in the astronomers' interest to vigorously protect the local environment.

Subsection (e) (3) gives priority to an industry which is willing to hire and train Hawaii's people to meet the industry's labor needs. It is known that CFHT, the UH-88inch, UKIRT hire from the local labor pool, wherever possible, and train these people in the necessary skills. It is the intent of UK/NL and UC to do this as well.

F. INTERIM STATE HIGHER EDUCATION FUNCTIONAL PLAN

Until the legislature adopts the necessary functional plans pursuant to Chapter 226, HRS, the State Higher Education Plan delineates specific objectives, policies, and high priority actions with respect to higher education to be addressed in seeking to achieve the ideals expressed in the State Plan. Functional Plans are intended to act in a coordinated fashion with County General Plans and Development Plans.

The development of "the Mauna Kea Observatory into a pre-eminent international center for observational astronomy" is specifically identified in the Higher Education Plan as a high priority implementing action which will "maintain and strengthen the position of the University of Hawaii at Manoa as a leading national and international research center." The development of the observatory as an international center for astronomy is cited in the State Conservation Lands Plan as a complementary interest.

G. CHAPTER 344 HRS - STATE ENVIRONMENTAL POLICY ACT

Chapter 344 HRS, Section 3 establishes a state policy that will encourage productive but non-damaging use of the environment. The relationship of the proposed action to the state environmental policy, follows:

(1) <u>"Conserve the natural resources, so that land, water, mineral, visual, air and other natural resources are protected by controlling pollution, by preserving or augumenting natural resources, and by safeguarding the State's unique natural environmental characteristics in a manner which will foster and promote the general welfare, create and maintain conditions under which man and nature can exist in productive harmony, and fulfill the social, economic, and other requirements of the people of Hawaii."</u> - The proposed project is essentially a "clean industry" which can provide employment opportunities for Hawaii residents. It is believed that the implementation of the proposed project will not adversely affect the aesthetic, recreational and scientific values of the project area.

(2) "Enhance the quality of life by:

(A) "Setting population limits so that the interaction between the natural and man-made environments and the population is mutually beneficial;" - The impacts of the additional population on the environment at the project areas are expected to be minimal, if the proposed visitor monitoring and management plans are implemented.

(B) "Creating opportunities for the residents of Hawaii to improve their quality of life through diverse economic activities which are stable and in balance with the physical and social environments;" - As previously stated, the proposed project will create employment opportunities in an industry which is stable and relatively pollution-free.

(C) "Establishing communities which provide a sense of identity, wise use of land, efficient transportation, and aesthetic and social satisfaction in harmony with the natural environment which is uniquely Hawaiian; and" - While the proposed project does not include establishment of a community on the summit, to accomodate the astronomers associated with the proposed telescopes, the Hale Pohaku mid-elevation facilities will have to be expanded. The mid-elevation facilities have been designed to: minimize the marring of the existing landscape; avoid changing sub-surface drainage patterns; be constructed of wood or stone, and stained in earth tones to harmonize with the surrounding area; minimize to the greatest extent possible the removal of existing vegetation; and to use vegetation of endemic species for landscaping.

(D) "Establishing a commitment on the part of each person to protect and enhance Hawaii's environment and reduce the drain on nonrenewable resources." - Other than the use of petroleum-based electricity, the operation of the telescope will not require the use of non-renewable resources.

H. ENDANGERED SPECIES ACT

Hale Pohaku is located within the boundaries of the Mamane/Naio Forest Eco-System Management Area which was established by the 1977 DLNR Mauna Kea Plan (1977). (Figure 3) It is also within the critical habitat of the rare and endangered Palila (*Psittirostra bailleui*), a bird which is found nowhere else in the world. Development within a federally recognized critical habitat of an endangered species is subject to the rules and regulations of Section 7 of the Endangered Species Act of 1973 (U.S.C. 1536) and 1978 amendments to the Act, if a federal presence is involved in the project. Hale Pohaku and the powerline corridors from the Saddle Road to Hale Pohaku are within the critical habitat.

I. HAWAII COUNTY GENERAL PLAN

The General Plan for the County of Hawaii contains general economic policies which pertain to the development of the Mauna Kea Observatory:

1. Strive for an economic climate which provides its residents an opportunity for choice of occupation;

2. Encourage the expansion of the research and development industry by working with and supporting the University and other agencies' programs developed to aid the County of Hawaii; and,

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

Hawaii County has encouraged diversified agriculture, manufacturing, the visitor industry, and scientific research and development as suitable economic alternatives for broadening and diversifying its economic base from its earlier reliance on the sugar industry. Development of the Mauna Kea Observatory will create new permanent jobs. As an addition to the research and development industry, the operation of the proposed telescopes will add to the critical mass necessary to support related jobs, such as computer technicians and mechanical engineers, and in doing so, will contribute to the potential of creating a new range of jobs for Hawaii's youth.

J. NORTHEAST HAWAII COMMUNITY DEVELOPMENT PLAN

The area covered by the Northeast Hawaii Community Development Plan (NHCDP) includes the districts of Hamakua, North Hilo, and portions of South Hilo from Honoli'i Stream northward. It is intended to provide implementation guidance over a fifteen year period.

Scientific research and development and, more specifically, the development of Mauna Kea, are discussed in several sections of the NHCDP. The Economic Element, Environmental Quality, Historic Sites, Natural Beauty, and Recreation sections all have recommendations pertaining to the use of the Mauna Kea summit for astronomy.

1.0 Economic Element

Scientific research and development is identified as one of the existing major sources of primary income for the Planning Area. Fifty-nine percent of the residents in the area believe that greater use should be made of the scientific resources located atop Mauna Kea. Because an increase in primary sources of income is cited in the NHCDP as necessary to best serve the interests of the Planning Area residents, the following was one recommendation to help insure at least the medium level of employment projected:

"The County and community should support State and Federal development of the scientific and recreation resources of Mauna Kea and Mauna Loa, but should also insist that uses be consistent with an approved master plan that adequately protects the environmental qualities of the mountains." The 1977 DLNR Mauna Kea Plan, adopted by the Board of Land and Natural Resource, February 1977, is the approved Master Plan for Mauna Kea.

2.0 Historic Sites

The NHCDP describes evidence of ancient religious activity which occurred at Mauna Kea's summit. Puu Poliahu and Lake Waiau are considered candidates for high value ranking as potential historic sites. It should be noted, however, that the historical value of Puu Poliahu has been questioned. An archaeological survey has been conducted by Dr. Patrick McCoy of the Bishop Museum and his evaluation of the historical/archaeological significance of Puu Poliahu is as follows: "While a cinder cone is presently called Poli'ahu, native testimony states that Poli'ahu is a cave where 'Lilinoe' lived. If located, this cave could be of particular importance because of the prominence of Lilinoe and Poli'ahu as legendary figures described in the section on Myths and Legends." In other words, while the name "Poli'ahu" has historic significance, the cinder cone known as Puu Poliahu, is not a historic site. (Appendix A).

3.0 Natural Beauty

Mauna Kea is described as a "Distinctive and identifiable landform(s)" and a Natural Beauty Area in the Hamakua District. Puu Poliahu, Puu Hau Kea, the summit cone, and Lake Waiau are identified as specific features of natural beauty whose future must be addressed.

As part of the project, a visual analysis has been conducted to evaluate the impact of further telescope development on the summit's aesthetic value. The results of this study are discussed in this EIS.

4.0 Transportation

Realignment of the access road within the summit region is recommended by the NHCDP to allow easier access to the upper elevations, to provide new access to the area proposed for further telescope expansion, and to allow the removal of the existing switch-back road which is considered to be the major visual surface scar within that region. This realignment was evaluated during the planning process for the SRCDP; however, it was rejected for the time being because of environmental and cost considerations.

K. SPECIAL MANAGEMENT AREA

The subject property is not located within the Special Management Area and is therefore not subject to the requirements of Chapter 205-A, Hawaii Revised Statutes, Relating to Coastal Zone Management or Rule 9 of the Planning Commission of the County of Hawaii Relating to the Special Management Area.

L. POLICIES AND PLANS INCORPORATED IN THIS EIS BY REFERENCE

Air quality	Clean Air Act, as amended (42 U.S.C. 1857h-7 et. seq.)	No effect expected
Fish and wildlife habitat	Fish and Wildlife Coordination Act (16 U.S.C. Sec. 661 et seq.)	To be determined
Historic and cultural properties	National Historic Preservation Act of 1966, as amended (16 U.S.C. Sec. 470 et seq.)	No effect
Water Quality	Clean Water Act of 1977 (33 U.S.C. 1251 et seq.)	No effect
Water Quality	Potable Water Systems, (Chapter 20, formerly Chapter 49, HRS)	________

PART III: DESCRIPTION OF THE PHYSICAL PLAN

A. PURPOSE

The purpose of the Mauna Kea Science Reserve Complex Development Plan (SRCDP) is to develop a physical plan, with supporting programmatic data and environmental analyses, which addresses all proposed development within the Mauna Kea Science Reserve and related facilities (as set forth in the UH RDP) to the year 2000. This plan is guided by the policies set forth in the 1977 DLNR Mauna Kea Plan and the Hale Pohaku Complex Development Plan. Amendments to the 1977 DLNR Mauna Kea Plan will be required in order to implement some of the proposed recommendations. The goals, objectives and needs of each of the user groups and the goals, objectives and priority directions of the Hawaii State Plan, the County of Hawaii General Plan, and the State Higher Education Interim Guidelines were all considered in the planning process. A plan to manage and monitor summit activities will also be incorporated into the SRCDP.

B. OBJECTIVES

The overall objectives of the SRCDP are derived from the 1977 DLNR Mauna Kea Plan and the UH RDP. They are to:

1. Study Mauna Kea's summit for expanded astronomical research and set a planning limitation for facilities to the year 2000 based on need and environmental concerns;

2. Determine appropriate areas at the summit that can accommodate the uses permitted within the plan without unacceptable damage to biotic values, scientific attributes, archaeological resources, and the visual appearance of the mountain;

3. Establish a physical plan, within the constraints established in objectives 1 and 2, for use of the Mauna Kea Science Reserve and related facilities based on the activities outlined in the 1977 DLNR Mauna Kea Plan, RDP, and the Hale Pohaku Master Plan; and

4. Maintain and protect the harmonious and compatible uses of the mountain by developing and implementing a management plan that will monitor and control all usage of the summit area.

C. GENERAL PHYSICAL PLANNING CONSIDERATIONS

Several planning considerations are embodied in this plan. They are:

1. Minimize disturbance to mountain ecosystems;

2. Locate facilities within the Science Reserve in as compact a configuration as is consistent with the technical requirements of the telescopes;

3. Recognize biological and cultural criteria as well as physical characteristics when evaluating potential development areas;

4. Within the constraints of the technical requirements of the telescopes, locate facilities to minimize visibility from developed areas of the Isalnd;

5. Minimize disturbance to undeveloped areas by locating utility lines and road alignments within currently disturbed areas as far as is practical and feasible;

6. Preserve Puu Hau Kea (Goodrich) and Puu Wekiu (the summit cinder cone); and

7. Insure that Lake Waiau and the adze quarry are not compromised by nearby development.

The proposed physical plan to the year 2000 for the Mauna Kea Science Reserve and Related Facilities is depicted in Figures 4 and 5. Descriptions of the elements of this plan follow.

D. TELESCOPES

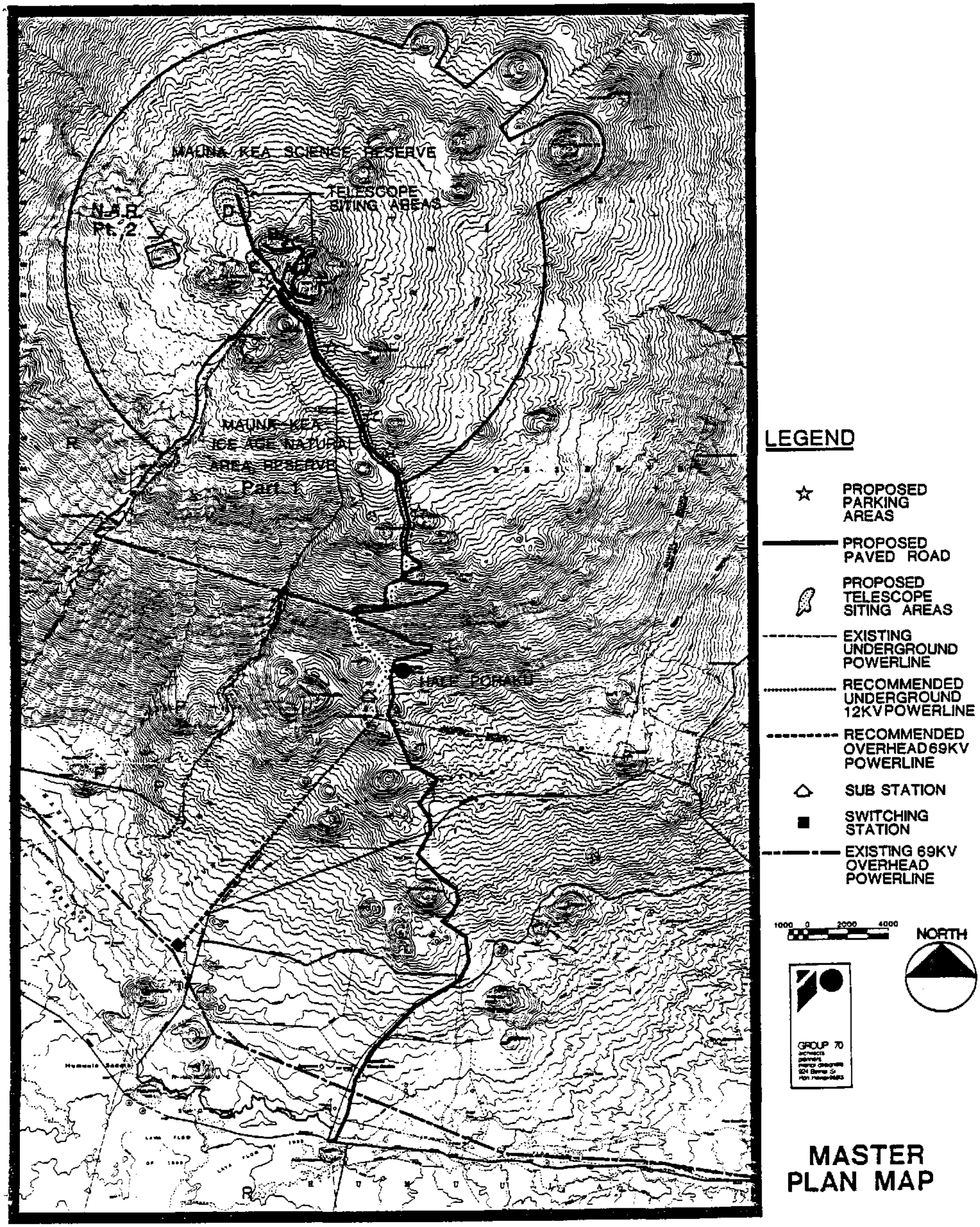
1.0 Overview

Based on the RDP, the SRCDP identifies siting areas for a total of thirteen telescopes on the mountain by the end of the century. Although the actual number of facilities which will be realized by the astronomy program at Mauna Kea will depend on demand and on the role determined for this activity by public policy makers, the University of Hawaii has determined that it is reasonable and feasible to project a total of 13 telescopes on the mountain between now and the year 2000.[1]

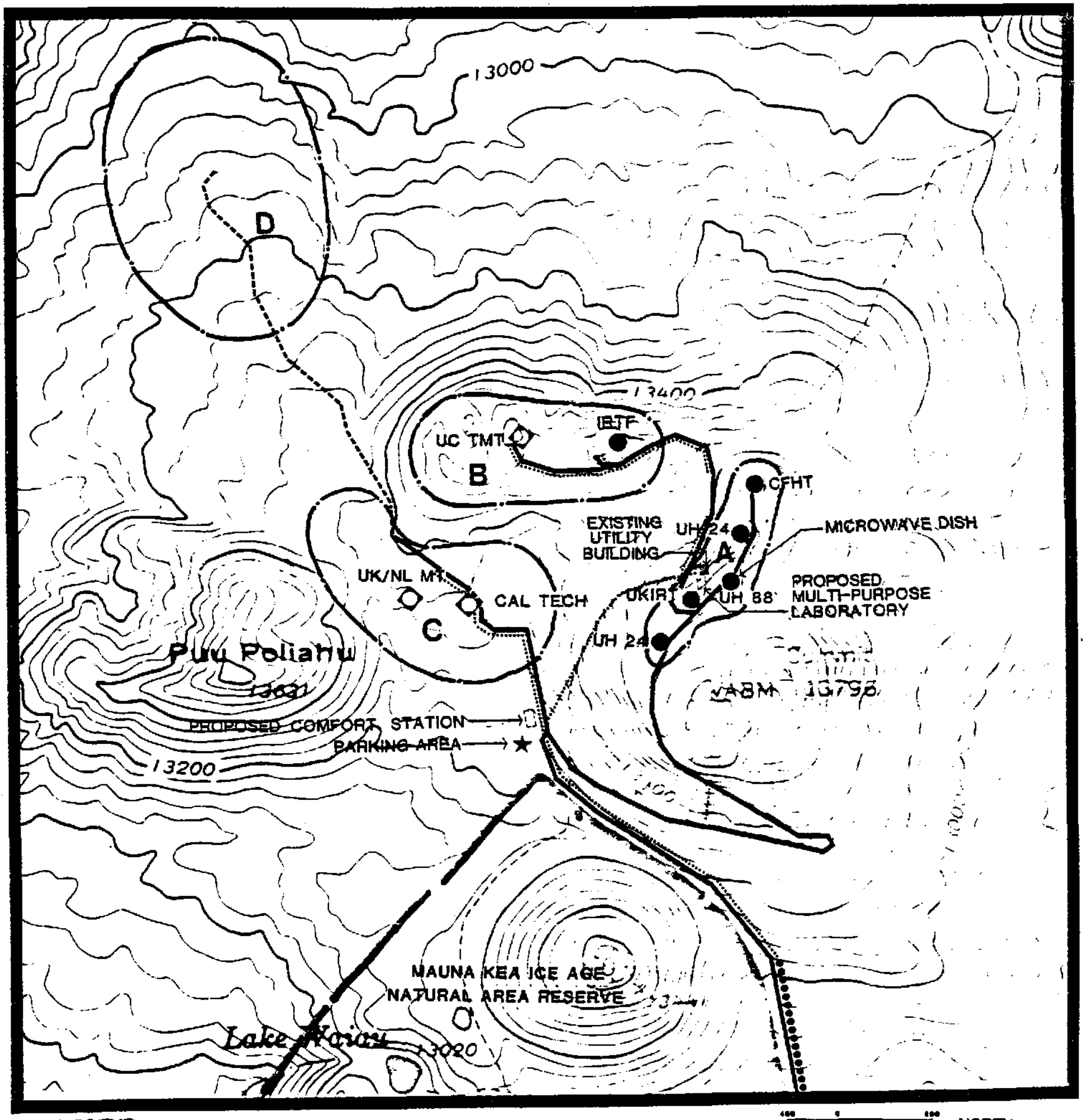
Three telescopes have been proposed for construction during the 1980's. They are: (1) the California Institute of Technology (Caltech) 10-meter submillimeter telescope (CDUA currently being processed); (2) the Science and Engineering Council (SERC) of the United Kingdom 15-meter millimeter-wave telescope (UK/NL MT) (CDUA currently being processed); and, (3) a 10-meter optical/infrared telescope sponsored by the University of California (UC TMT) and proposed to begin construction by late 1984.

The probable number and characteristics of the remaining telescopes (which are projected within this plan for construction during the 1990s) is derived from analyses of possible telescope demand by both national and international institutions. Based on this demand, it is assumed that of all requests for permission to locate additional telescopes on the mountain, one additional millimeter-wave telescope; two additional 10-meter optical/infrared telescopes; and one National New Technology Telescope (NNTT) (a 15-meter [600-inch] optical telescope), will request permission to locate within the Science Reserve before the year 2000.

The locations of the existing and proposed telescope sites are shown on Figure 6. The areas which were evaluated for future telescope development are shown on Figure 7. Because the actual mix of the four



MAUNA KEA SCIENCE RESERVE CDP — FIG. 4



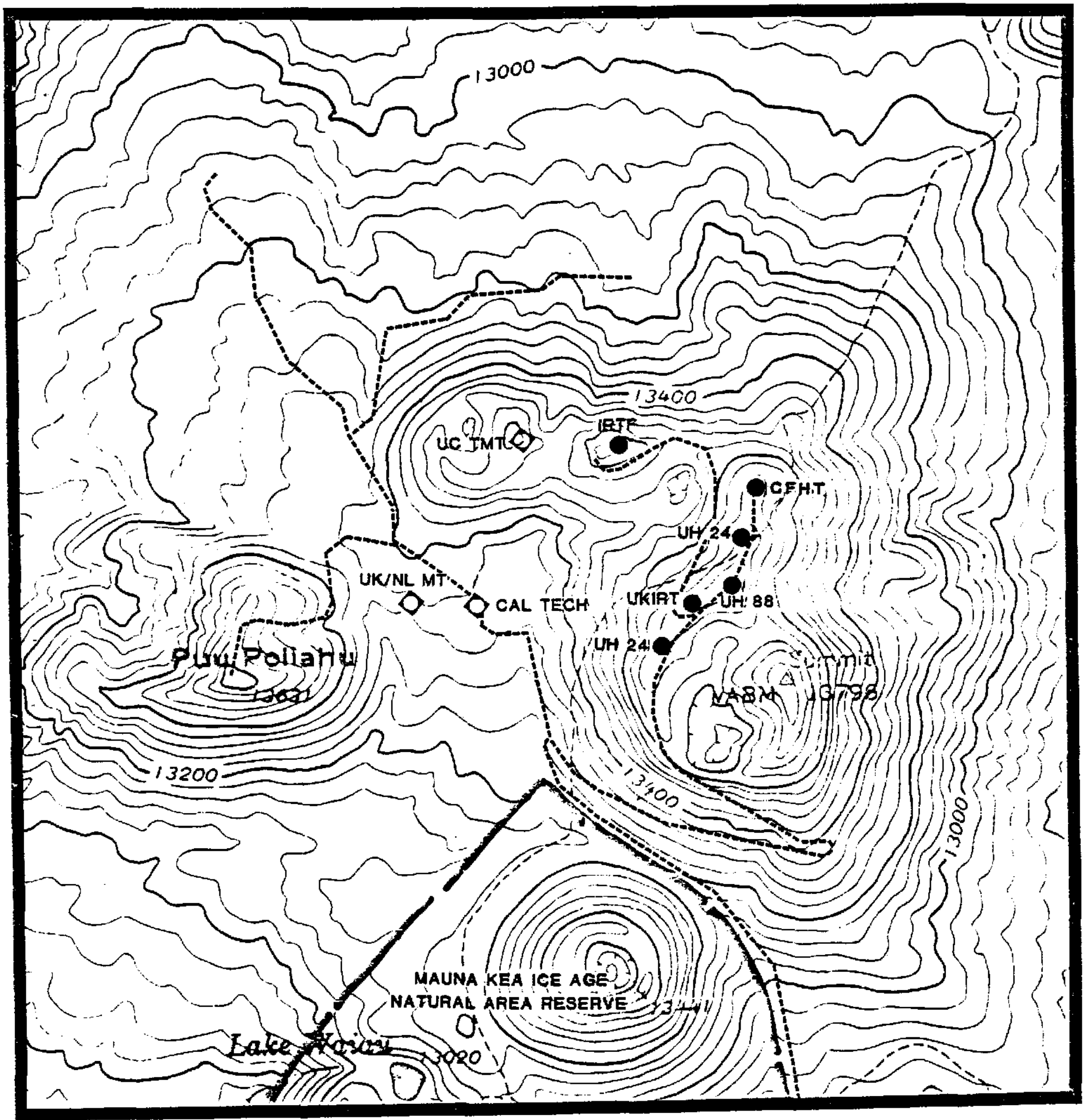
LEGEND

- ● EXISTING TELESCOPES
- ◇ PROPOSED TELESCOPES
- ——— ROAD IMPROVEMENTS 1ST PHASE
- - - - - ROAD IMPROVEMENTS 2ND PHASE
- ••••••• HELCO POWERLINE
- ········ UNDERGROUND COMMUNICATIONS & POWERLINE CONDUITS
- ◯ TELESCOPE SITING AREAS

GROUP 70

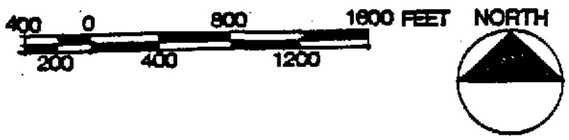
PROPOSED PHYSICAL PLAN FOR THE SUMMIT TO YEAR 2000

MAUNA KEA SCIENCE RESERVE CDP - FIG. 5



LEGEND

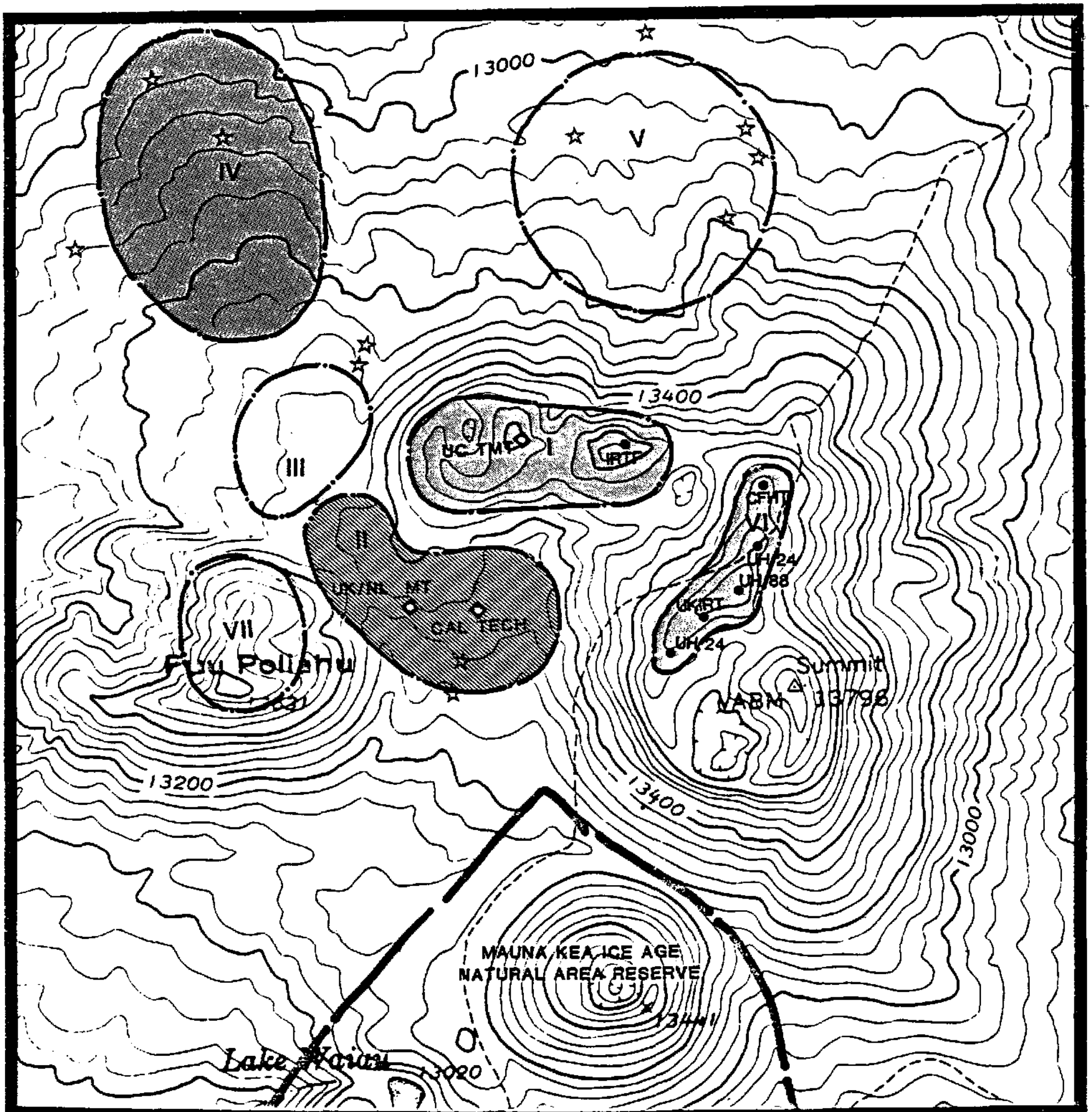
- ● EXISTING TELESCOPES
- ◇ PROPOSED TELESCOPES



GROUP 70

EXISTING & PROPOSED TELESCOPE SITES

MAUNA KEA SCIENCE RESERVE CDP – FIG. 6



LEGEND

☆ ARCHEOLOGICAL SITES
● EXISTING TELESCOPES
◇ PROPOSED TELESCOPES

OPTICAL / INFRARED TELESCOPE SITING AREAS
MILLIMETER WAVE TELESCOPE SITING AREAS
SECONDARY TELESCOPE SITING AREAS

NORTH

400 0 800 1600 FEET
200 400 1200

FUTURE TELESCOPE SITING AREAS TO THE YEAR 2000

GROUP 70

MAUNA KEA SCIENCE RESERVE CDP – FIG. 7

telescopes projected for construction in the 1990s is unknown, the possibility of locating all millimeter-wave, all optical/infrared, or two millimeter-wave plus two optical/infrared telescopes was considered in evaluating potential telescope locations.

2.0 Millimeter Wave Telescopes

2.1 California Institute of Technology (Caltech) 10-Meter Submillimeter Telescope

The planned 10.4-meter Caltech telescope will operate in that part of the electromagnetic spectrum called the submillimeter, which lies between the radio and infrared bands. It covers one of the few unexplored regions of the astronomical electromagnetic spectrum; unexplored because of the attenuating effects of the earth's atmosphere and the difficulties involved in constructing large telescopes to high accuracy and sensitive receivers at high frequencies. The submillimeter band is only available for study on very high and very dry mountains, such as Mauna Kea, because the water vapor in the earth's atmosphere absorbs radiation emitted by celestial objects in the wavelength region.

The telescope will be located on a 0.75-acre site within the Mauna Kea Science Reserve at approximately the 13,360-foot elevation, about 430 feet lower than the summit cinder cone (Puu Wekiu) (Figure 6). It will consist of a 10.4-meter dish-shaped reflector housed in a 60-foot diameter dome. The dome will rotate on circular rails at ground level. It will be a slotted aperture astronomical dome having the external appearance of a truncated sphere. The dome has been designed to fit around the telescope with minimum clearance and will also be able to open to clear the full aperture at all opening angles. It will have two movable shutter doors; a spherical top-cap which will roll on rails toward the rear of the dome; and a front door shutter which will roll up and over the dome, nesting between the top-cap and the rear dome surface.

The facility will include a 6,000-square-foot paved parking area with truck access and turnaround. A 14-x-30 foot paved driveway will provide access to the telescope site from the unpaved access road. A 10-foot wide band around one-half the circumference of the building will also be paved.

The telescope will require an average of 15 KW of electrical power with a 60-KW peak demand. These immediate power needs can be met by the existing 850 KW generator, located nearby at the 13,000-foot elevation. Upon completion of a permanent power line, the power will be provided through the same ducts to the HELCO transformer.

An estimated five to seven people will probably be present on the mountain at one time, operating in two shifts at the telescope site. These people include visiting astronomers as well as engineers and technicians. A base support facility with a staff of approximately 6 people will be located in Hilo.

The costs of the telescope dish and mount construction have been covered by National Science Foundation (NSF) grants and Caltech funds. Site preparation and construction of the dome is expected to begin in early 1983, with operations beginning in 1985. Total construction costs are currently estimated to be approximately $2 million, of which approximately $200,000 will go to Hawaii salaries. Annual operating costs are estimated at close to $1 million of which approximately $500,000 will be spent in Hawaii.

An EIS for the project was accepted by the Governor on 26 August 1982. A CDUA was filed on June 12, 1982.

2.2 UK/NL Millimeter Wave Telescope

The UK/NL Millimeter-Wave Telescope (UK/NL MT) is being developed by the Science and Engineering Research Council of the United Kingdom (SERC) in collaboration with the Netherlands Organization for the Advancement of Pure Science (ZWO). It will be a very accurate radio telescope, designed to operate through the millimeter and into the submillimeter wave-band.

Detailed information about the cold material in the universe, particularly the enormous clouds of interstellar molecules and dust, can be obtained by observing at millimeter wavelengths. This material, its distribution, and the identification of molecules and their excited states, provide clues on star formation and the re-cycling of enriched material produced by earlier generations of stars. An important long-term objective is to understand the way galaxies have evolved to reach their present condition.

Millimeter-wave studies of nearby galaxies will give a global view of molecular clouds and, through spectral measurements, the dynamics of galaxies themselves. Of special interest is the galactic center which is rich in molecular species and difficult to study at other wavelenths. In addition the study of molecules in the space between stars will result in a better understanding of their formation and destruction.

Compact radio sources emit synchrotron radiation. By monitoring these systematically information from active galactic nuclei close to the ultimate energy sources can be obtained. Other objects, like old stars, which eject shells of matter are also strong emitters of millimeter line spectra; the proposed millimeter-wave telescope will allow mass loss and dust formation be studied. Millimeter-wave observations will also help us understand the origin. Of microwave background radiation which is a remnant of the earliest phase of the universe; and solar system observations will give new information about the surfaces of planets and their satellites and about the lower atmosphere of the sun itself.

The proposed 15-meter diameter millimeter-wave telescope will consist of a dish-shaped reflector mounted on horizontal and vertical axes. It will will be situated on a 2-acre site at approximately the

13,390-foot elevation on Mauna Kea, about 400 feet below the summit at the base of Puu Poliahu (Figure 6). The telescope will have a cylindrical enclosure (carousel) with a flat roof for protection from the severe weather conditions at the summit. This carousel will be about 92 feet in diameter and 88 feet high. It will be mounted on a circular track and rotate with the telescope. The carousel and the telescope will be mounted on independent foundations.

The main front doors and the roof shutter of the carousel will open to enable the telescope to either view the sky directly or through a protective membrane transparent to millimeter waves. When closed, the main doors and roof shutter will provide a seal against storm conditions. (Exterior elevations and schematics of the dome interior and telescope design are presented in Appendix B).

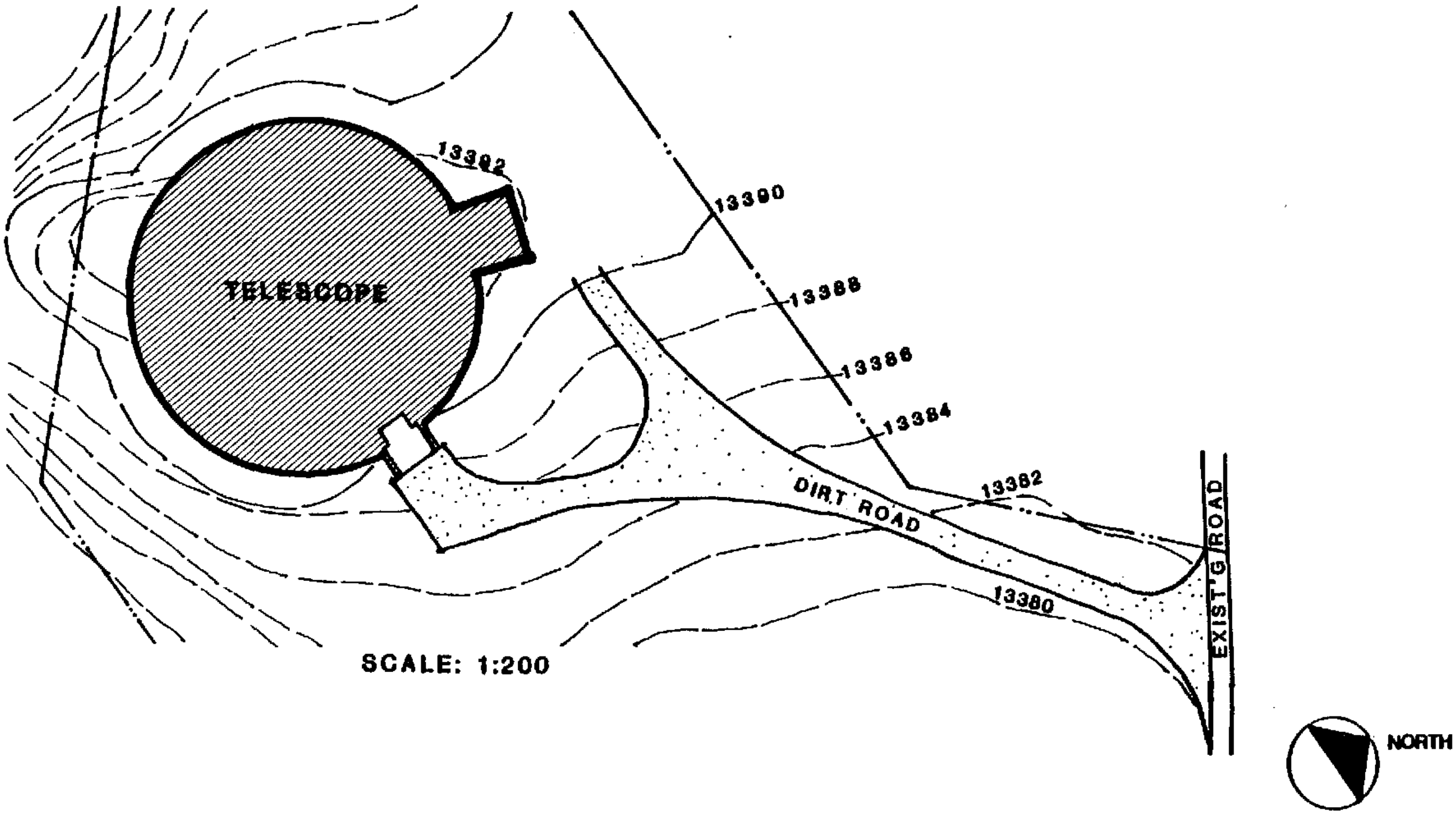
Aside from the telescope, the interior of the carousel will also contain a computer/control room/office and workshop. A reinforced concrete footing will incorporate the telescope pad, the circular rail bed, toilet and washroom facility, 1,000-1,500 gallon watertank and batteries to provide standby power for the door, roof and carousel.

The facility will include a 66-foot by 38-foot parking area for 4-5 vehicles, with truck access and turnaround. A 224-foot driveway will provide access to the telescope site from an existing spur from the main summit road. (Figure 8 shows the preliminary site plan for the telescope).

The telescope will require an average of 105 KW of electrical power with a 150 KW peak demand. These immediate power needs can be met by connection to the existing 850-KW generator, located nearby at the 13,000-foot elevation. Future power will be supplied by the proposed HELCO transmission line; at that time additional instrumentation may be added which could increase peak power consumption to 225 KW.

The telescope will have the capability to be operated by remote control. At the UKIRT base support facilities in Hilo, almost all operations which can be carried out at the summit are already available to a remote observer. Recently a remote control experiment in which the UK Infrared Telescope on Mauna Kea was operated by astronomers located at the Royal Observatory in Edinburgh was successfully carried out. When fully operational, the intercontinental link will allow British astronomers to use their facilities on Mauna Kea (for some types of observations) without leaving the UK.

In the period after commissioning, but prior to the transition to remote operations, approximately two people will usually be present at the site on night shift and four people on day shift. When the telescope is completed it will be turned over to UKIRT for operation out of Hilo. Both support and operational staff will work a shift system. Remote monitoring and operating techniques and the



UK/NL MT PRELIMINARY SITE PLAN

MAUNA KEA SCIENCE RESERVE CDP — FIG. 8

joint operation with UKIRT will keep the number of people on the mountain from both facilities to no more than 14 at any one time, including visiting astronomers. For these reasons it is anticipated that there will be sufficient dormitory space allocated to UKIRT at the Hale Pohaku mid-level facilities to accomodate the astronomers and technical personnel that will be associated with UK/NL MT project.

Construction of the carousel and telescope is expected to last three to four years. Total construction costs are estimated at $15 million; construction expenditures in Hawaii are currently estimated to be over $4 million. Local labor will be used wherever feasible, the objective will be to maximize the participation of Hawaii residents. Of the twenty permanent employees to be based in Hilo at least a third will be hired locally.

The annual operating expenditures on the Big Island are estimated to be $1 million per year. In addition, approximately $500,000 per year from UK/NL salaries will probably be expended on the Island of Hawaii. 80% of the funding for the telescope is being provided by the SERC of the United Kingdom and the remaining 20% is being provided by the Netherlands (ZWO).

2.3 Future Millimeter-Wave Telescope(s)

Additional single-dish millimeter wave or radio telescope(s) are likely to make application to locate in the Mauna Kea Science Reserve in the 1990s. If approved, the most probable sites for one or more such facilities would be near the Caltech and UK/NL MT telescopes on the plateau between Puu Poliahu and the summit cinder cone. (Area II, Figure 7). The dish of such a telescope could range in size from 10 meters (such as Caltech) to over 25 meters (as once proposed by the National Radio Astronomy Observatory [NRAO]).

Using a large telescope (in the range of 25 meters) as an example of the type of millimeter wave telescope that may be proposed in the future, a 3-acre site might be required. Figure 7 shows that there are suitable areas near the two proposed millimeter wave telescopes which are also in close proximity to the existing unpaved spur road. Location of these sites on relatively flat lava flows indicates that such a telescope could be constructed with minimal disturbance to the terrain. The location in a valley, between cinder cones, will insure that the telescope dome will not be visible from populated locations or any other point on the island outside of the immediate area.

Based on previous estimates, and depending on the degree of remote operations that are undertaken, it can be anticipated that a telescope of this type and size would average approximately 10 people on the mountain at one time, (operating in two shifts), and would require about 10 bedrooms at Hale Pohaku. Electric power needs would be supplied by connection to the proposed HELCO transmission line.

Capital costs for projects of this size could be in the range of \$30 million (1981 dollars) with operating costs of \$2 million per year (1981 dollars).

3.0 Optical/Infrared Telescopes

3.1 University of California 10-Meter Telescope

The University of California 10-meter telescope (UC TMT), will be the world's largest optical/infrared telescope. It will be able to produce images of unprecedented clarity and detail. In addition to being able to look farther back toward the beginning of creation than any telescope now in existence, it will also allow closer objects to be studied in much greater detail and precision than is possible with existing instruments. For example, the telescope will be able to observe new stars being formed or even see new solar systems being born. This new instrument will contribute to the establishment of new theories and understanding about the Universe.

The proposed UC TMT site is located on a cinder cone approximately 850 feet directly west of the IRTF at an elevation of 13,618 feet (Figure 6). Although the telescope mirror will be twice the diameter of the largest optical telescope in the U.S. (400-inches compared to the 200-inch Hale telescope on Mt. Palomar), its design (36 computer-controlled mirror segments, rather than one very large mirror) permits housing in a relatively small, cost-efficient dome approximately 103 feet in diameter and 124 feet high (similar in size to CFHT).

A preliminary design study has produced an architectural model of the dome and a tentative description of its characteristics. Based on this study, the dome will be 24-sided, spherical in shape, and composed of 15-degree segments radiating from the top. It will be mounted on a precision ground steel rail fixed to the building ring girder. Dome rotation will be accomplished by two electric motors. The dome will include four shutters. The shutters are moved by a cable drive and guided by cam followers.

Aside from the telescope, the interior of the dome will also contain a control room, computer room, coude room, equipment and storage room, aluminizing room, engineering and document room, visitors' gallery, pump room, relay room, heat and ventilation room, transformer room, auxiliary power room, darkroom, data preparation room, instrument assembly room, restrooms, three small offices, small electronics and machine shops, and mirror maintanance room. (Conceptual drawings of the telescope design are presented in Appendix C).

Within the summit, access to the proposed telescope will be via an extension of the road which now terminates at the IRTF. The building has been sited to allow the access road to arrive on the southerly side. The road will be paved. Parking for approximately 8 vehicles will be provided on-site.

A 10,000-gallon water tank (4-to-6 week supply) and a 2,000-gallon diesel fuel storage tank will be located below grade at the terminating point of the truck manuvering space. The fuel storage tank will have adequate capacity to run a stand-by 300-KW - 500-KW generator for 48 hours. A approximately 60 to 70 inches in diameter tunnel will be constructed to convey unwanted warm air to a point approximately 130 feet north of the telescope building. (Figure 9 shows a preliminary site plan for the UCTMT telescope.)

The telescope will require an average 265 KW (500 KW peak) of electrical power. This will be supplied by the proposed HELCO transmission line. Underground conduits will be extended from the transformer located at the UH 88-inch telescope to the site.

An estimated twelve to fourteen people will probably be present at the telescope site in two shifts. Fourteen rooms will be required at the mid-level facility at Hale Pohaku so that personnel can remain acclimatized during their on-duty periods.

The number of personnel to be based in Hawaii is estimated at thirty-six. Twelve to fourteen will work primarily at the summit and twenty-two to twenty-four at a base support facility. A minimum of one-third of total personnel will be hired on the Big Island.

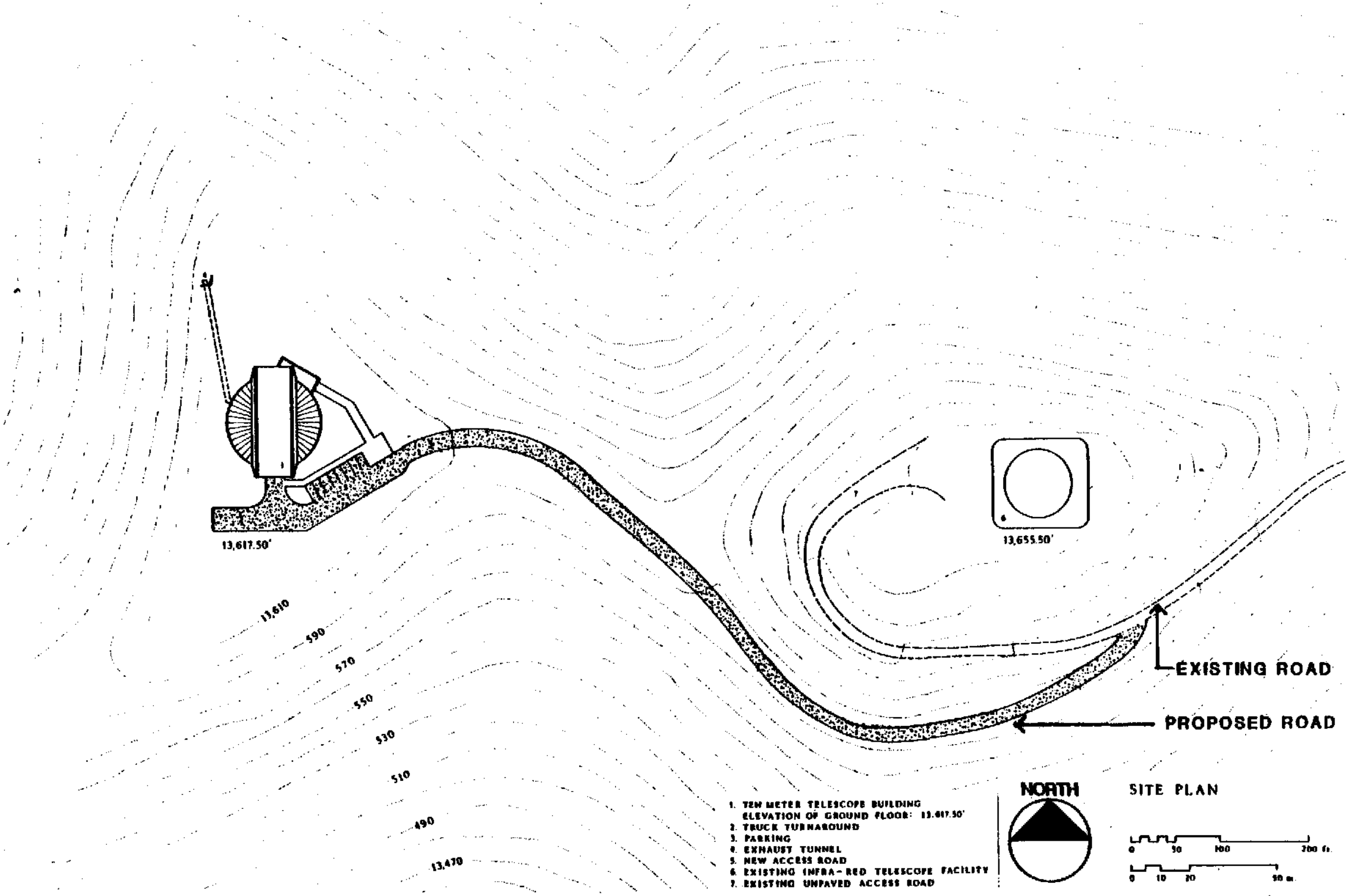
Construction of the dome and telescope is expected to last four years. Total project costs are currently estimated to be approximately $62 million of which about one-third is expected to be expended on the Big Island. Local construction labor will be used wherever feasible. Funding for the project's capital expenditures will be from University of California sources.

Total operating expendures are estimated to be 8-10% of capital expenditures. Operating expenditures on the Big Island are estimated at $2.3 million per year including $1.1 million in personnel costs.

3.2 National New Technology Telescope (NNTT)

Mauna Kea is being considered as the location for a proposed 15-meter (600-inch) National New Technology (NNTT) optical/infrared telescope which will probably be funded by the Federal Government. When operational, this telescope will be the largest in the world, exceeding the light - gathering power of the proposed UC TMT and any other telescope either in existence at the present time or proposed for construction in the near future. The location of the facility is expected to be chosen sometime in 1986. Construction of the $100 million project will probably be some time in the 1990's, depending upon the availability of federal funding.

The actual dimensions of the dome and auxiliary buildings cannot be determined at the present time because the telescope design is only in the discussion stages. Two major designs are being tested; one is similar to the segmented mirror concept being developed for



UC TMT PRELIMINARY SITE PLAN
MAUNA KEA SCIENCE RESERVE CDP FIG. 9

the UC TMT, consisting of a 15-meter diameter mosaic of 90 hexagonal mirrors, each 2 meters across. The second concept is a larger version of a multi-mirror telescope (MMT) which began operation in 1980 on Mount Hopkins in southern Arizona; this design would achieve an equivalent diameter of 15 meters with an array of four or six individual mirrors, each 6 meters across. (Each of the six mirrors would be larger than the Palomar 200-inch mirror). The dome needed for either of these designs would probably be larger than the UC-TMT (103 feet in diameter, 124 feet high); however, the size of the dome would not necessarily be commensurate with the 15-meter diameter equivalent total light gathering power of the telescope because each mirror would be considerably smaller than 600 inches.

Although further testing will be required to choose the exact location on Mauna Kea that would be technically most suitable for the proposed facility, three areas within the summit study area appear to meet most of the site selection criteria for optical/infrared telescopes. As shown in Figure 7, they are:

1. Area I - Puu Hau Oki, near the UC TMT and IRTF sites. Soil conditions may be a determining factor, depending upon the weight of the facility when the actual design is chosen, as cinder cones do not have the weight bearing characteristics of the more solid lava flows.

2. Area VI - The summit ridge, where five of the six existing telescopes are located. This area is highly suitable technically, as evidenced by its being selected for major telescopes. There does not appear to be room for a large facility to locate there at the present time. There is a possibility, however, of that one of the smaller 24-inch telescopes might be relocated to a lesser site, if this would allow enough space for the NNTT.

3. Area IV - the north shield area. The lava flow will support buildings of any weight and size.

Because the telescope design has not been finalized, estimates of infrastructure requirements are also preliminary at this time. The Institute for Astronomy, however, has made several assumptions in order to facilitate its future planning. Based on the experience of other large facilities, and assuming a certain degree of remote operations, it can be estimated that the telescope will require a minimum three acre site for construction of the building and dome, auxiliary buildings and parking areas. (In comparison, the land area of the CFHT site is 1.5 acres.) During telescope operations, an average 12 to 14 people could be present at the telescope in two shifts. Approximately 12-14 rooms might be required at the mid-level.

Power to service the facility, estimated at 500-1,000 KW peak, would be supplied by connection to the proposed HELCO transmission line.

Base support facilities on the Big Island to accommodate a staff of approximately 40 people will also be required.

3.3 Future Optical/Infrared Telescopes

The plan provides for the development of two additional optical/infrared telescopes of the 10-meter class during the 1990's. Based on the requirements of the UC TMT, each of these facilities would require a site of approximately 2 acres.

Depending on the final siting of the NNTT, sites for these facilities are available in areas I, IV and VI. (Figure 7).

Assuming that each telescope will operate with 12 to 14 people on-site in two shifts, approximately 24 to 28 additional rooms could be required at Hale Pohaku to provide for acclimatization during on-duty periods. Base support facilities in Hilo, Waimea, or Kona will also be required.

Electrical needs of each telescope, estimated at 265 KW each on the average (500 KW peak), would be met by connection to the HELCO transmission line. Each facility will also require a paved access road, the length of such a road will be determined by the proximity of the selected site to the existing summit road network.

E. MULTI-PURPOSE RESEARCH LABORATORY

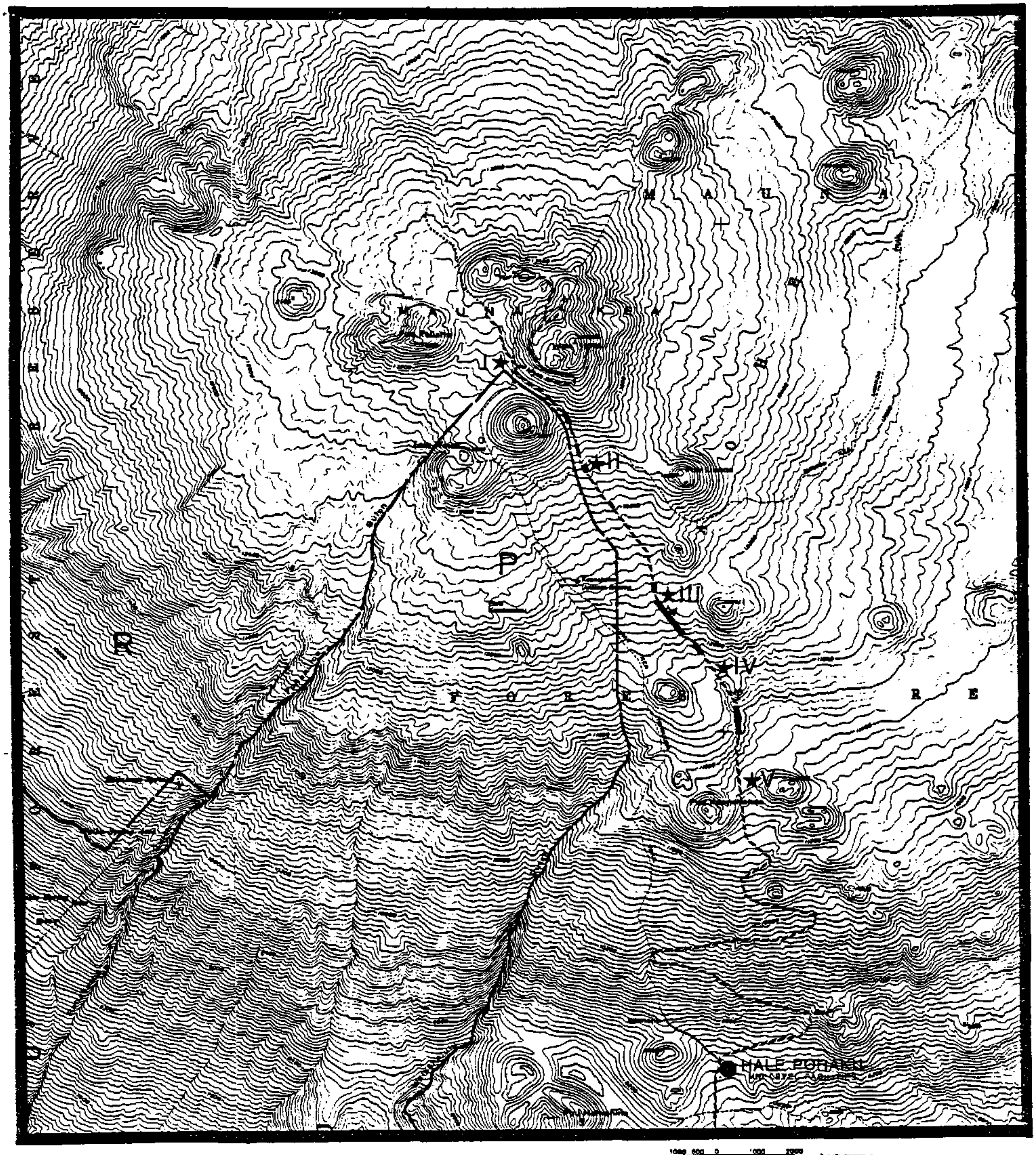
It is expected that the University of Hawaii will continue to receive requests from local, national and international organizations to conduct research (which does not require the use of a telescope) at the summit on an intermittent basis. At the present time, there is no facility available that can be used primarily as a laboratory for these scientists. The current practice is to borrow space within the UH 88-inch telescope building; this space is not always adequate and is frequently unavailable at the times that it is requested.

The SRCDP recommends that a simple metal laboratory of approximately 200 to 300 square-feet be added to the existing utility building located between the UKIRT and the UH dome (Figure 5). The building should contain spaces for work and minimal storage. The facility could have a roll-back roof (not a dome) so that open-air experiments can be conducted at the site. The building should have electricity and heat, however, plumbing is not necessary as the scientists can use the facilities in the UH building for that purpose. The low, single-story building would not be visible from areas outside the Science Reserve.

F. ROADS

1.0 Hale Pohaku to the Summit (Figure 10)

The SRCDP recommends that the road to the summit be improved and paved for safety, maintenance, and environmental reasons; necessitating an amendment to the Mauna Kea Plan. The existing road is dusty, rough and



LEGEND

PROPOSED PAVED ROAD

FUTURE ROAD EXTENSION

SLOPE≥15%

★ PARKING AREAS

SUMMIT ACCESS ROAD IMPROVEMENTS

MAUNA KEA SCIENCE RESERVE CDP — FIG. 10

GROUP 70

dangerous, and safety features are lacking. There are no shoulders or gutters and there are no drainage culverts on the upper section. The road is steep in places with grades in excess of 15%. Dust from the road not only interferes with astronomical observations but also is detrimental to resident flora and fauna.

It should be emphasized that road improvements are only in the planning phase. Precise alignments, grading requirements, and details of the actual construction will be specified in greater detail when the road is actually designed.

Roadway improvements could include construction of: a new road-bed, gutters and culverts for drainage, guard rails and signs for safety, and retaining walls for embankment stabilization. It appears that the roadway will not have to be widened significantly, and that an improved road could basically follow the present alignment, except for short sections where a new alignment may have to be adopted to reduce grades to less than 15 percent.

Alternative levels of road improvements are being considered, but these differ primarily in the width of the pavement. One alternative would have a 15-foot paved travel surface with a 5-foot paved gutter (where required) or a 5-foot shoulder. The other is to design the road to County standards; this will require a 20-foot paved surface. Pavement would consist of 2 inches of asphaltic concrete on a 6-inch aggregate base course.

For analysis purposes this plan envisions the gutter constructed of precast concrete sections; the concrete may be tinted for reduced visual impact. Five-foot shoulders would permit the installation of guardrails where they are required for safety considerations. These guardrails may be made of "Corten" steel which oxidizes slightly to form a protective layer of rust. This type of guard rail material will blend with the terrain. The low humidity on the mountain is expected to mitigate problems with this material that have been experienced at sea-level installations. For economic and aesthetic reasons, the guard rails may be supported by wood posts rather than concrete.

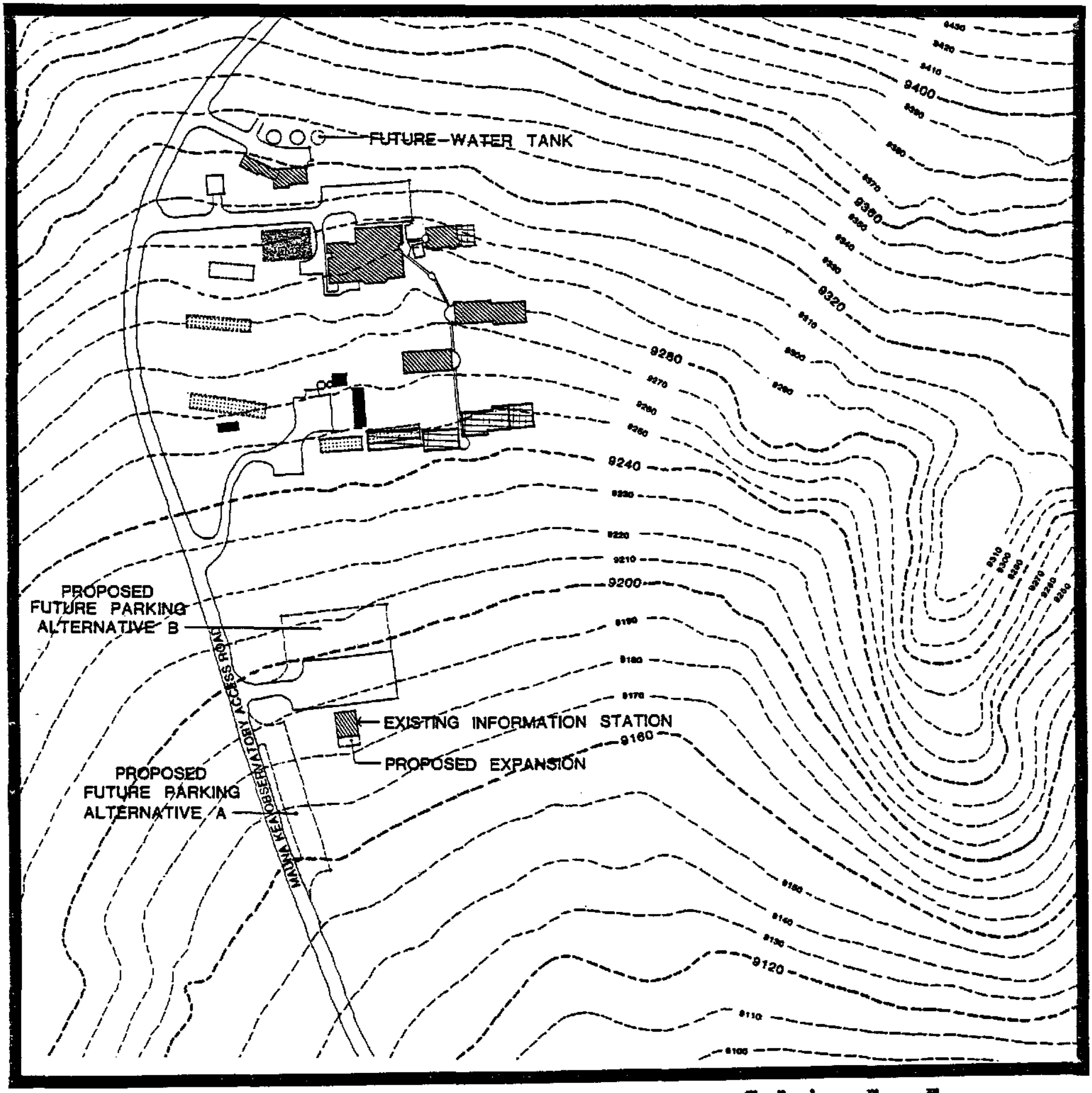
Signs will be placed in appropriate locations. Pavement markers will be used to enhance traffic safety.

Paving and other road improvements will allow use of the road by standard two-wheel drive vehicles. For safety reasons, it is proposed that only vehicles with chains be allowed on the road when snow and/or ice are present.

The spur road from the existing 850-KW generator to the boundaries of the UK/NL MT site will also be improved and paved. Pavement widths and other improvements will be similar to the main access road.

Cost Estimates

The remote location, the high altitude and unusual climatic conditions (for Hawaii), as well as the lack of detailed plans and specifications for the project allow only rough estimates to be made of



LEGEND

- NEW MID LEVEL FACILITIES
- EXISTING STONE CABINS
- PROPOSED DORMITORY EXPANSION
- EXISTING TEMPORARY BUILDINGS

HALE POHAKU EXPANSION

MAUNA KEA SCIENCE RESERVE CDP - FIG. 12

Each new building will have a cesspool similar to those presently under construction for the main facility. The Department of Health will be consulted to insure that the method of sewage disposal meets its requirements. Space will be reserved for a water storage facility to service the new buildings and to provide additional reserve for fire flow if this becomes necessary.

3.0 Phasing

If construction of the UC TMT is approved, it is possible that UC and Caltech will join together to construct one new dormitory building containing 17 to 20 rooms. This construction could begin in 1984, if all appropriate approvals are obtained. As recommended by the U.S. Fish and Wildlife Service, (Appendix D), the following conservation measures will be undertaken in conjunction with development of the new dormitory building:

a. As few mamane trees as possible will be removed or transplanted from the project site (currently, all future dorms are sited so as not to require removal of any mamane trees); and

b. Construction will not be initiated during the palila breeding season unless birds are discouraged from nesting in the construction area prior to and continuing into the nest site selection, pairing and breeding/rearing period.

Phasing of any future buildings will be coordinated with the construction of specific telescope projects.

I. CONSTRUCTION CAMP HOUSING

1.0 Temporary UH Facilities

One of the temporary UH buildings adjacent to the large stone cabin can be used for sleeping accommodations for construction workers. The building has ten bedrooms and two storage areas. It is currently being used by scientists and other astronomy personnel who are working at the summit. Dining and recreation facilities for construction workers can be accommodated in the other temporary UH building. This building was formerly a messhall but is currently being used as a research preparation area.

Both UH buildings are electrically lighted and heated and have hot and cold running water and indoor bathrooms. Sewage generated by these facilities is disposed of in an existing cesspool nearby. Water storage facilities are located adjacent to the buildings.

When the area on which the temporary UH buildings are located is needed for construction of permanent dormitory space, it will no longer be available to accommodate construction workers. When, and if, this occurs, other arrangements for construction camp housing must be made.

2.0 Stone Cabins

The University of Hawaii and DLNR are currently discussing the possibility of the University assuming responsibility for the two stone cabins, located at Hale Pohaku, which are currently under the jurisdiction of DLNR Division of State Parks, Outdoor Recreation and Historic Sites. If this transfer of jurisdiction takes place, the large stone cabin can be used to house construction workers working on the telescopes at the summit. The cabin is electrically lighted and heated; however, there is no potable water or plumbing available in the building. Water and bathroom facilities are available in the adjacent UH temporary building; the cabin can be arranged to sleep 12 people.

3.0 Other Temporary Buildings

In accordance with the CDU permit for construction of these buildings, they will be turned back to DLNR for dispositon after current construction is completed.

J. INFORMATION AND RECREATION FACILITIES

1.0 Information Station at Hale Pohaku

A 1,200-square-foot visitor reception area and Information Station is being constructed as part of the permanent mid-level facility at Hale Pohaku. The Information Station will contain exhibits depicting the various features on the summit of Mauna Kea and its lower slopes. Restroom facilities for visitors are also located in this building. A parking area for 25 cars is adjacent to it. The Information Station is expected to serve as the control point for management and monitoring of the mountain. It will be manned. By the year 2000 approximately 100 visitors or more are expected to stop at the station during an average day. On heavy snow weekends this number could approach 500 to 1,000.

A proposal to install a small telescope at the Information Station for public use is being evaluated. The telescope would be available for visitors to use in the daytime and citizen and school groups to look through at night. Location of this telescope at Hale Pohaku will require expansion of the Information Station. This can be accomplished with minimal difficulty by extending the building approximately 550-feet in the downslope direction. The building's extension can be architecturally compatible with the main building; the telescope will not require a dome.

Usage of the Information Station and adjacent parking area will be monitored. Expansion of astronomy facilities at the summit and paving of the access road may create demands for additional facilities within the Information Station or for additional parking spaces. It may be necessary to expand the facility even if a telescope is not installed. (The proposed expansion area for the Information Station and alternative locations for future parking are shown on Figure 12).

2.0 Visitor Facilities at the Summit

2.1 Parking

Visitor parking areas will be provided along the summit access road and within the summit area. All visitors will be required to park in designated areas. The areas were selected because of their proximity to known recreation areas and because most are already being used for parking durinng the snow season. As shown on Figure 10, parking is proposed for the following areas:

Area I: A gravel or paved parking area for approximately 50 vehicles near the existing 850-KW generator. (This area is currently being used for this purpose during snow season). This parking area is centrally located in relation to ski runs and snowplay areas;

Area II: The "skiers" parking lot at the 12,700-foot elevation (15 to 20 vehicles). This area will be used occasionally as a batching site during non-snow periods;

Area III: A parking area for 15 to 20 vehicles, primarily for snowplay participants, at approximately the 12,200-foot elevation. (This site also provides excellent downslope views).

Area IV: A area for approximately 5 to 10 vehicles at the 11,800-foot elevation. This area is planned to provide lower elevation parking for snowplay participants; and,

Area V: A area for approximately 15 vehicles near known hunting areas. This will allow hunters to park their vehicles off the access road before proceeding on foot to hunt.

When the road and parking areas are designed, these general locations may be slightly modified in order to provide sites which require minimum grading. Drainage improvements will be incorporated into any paved areas. In addition, the design consultant for the access road may be asked to provide additional "pull-over areas" for safety and other functional seasons.

Screened areas, containing covered containers for disposal of trash, will be constructed in the Science Reserve. They will be located adjacent to parking areas. Collection of trash for disposal at the dump in Hilo will be the responsibility of the UH. Management and monitoring of solid waste is addressed in the Management Plan (Part IV).

It is anticipated at this time that the parking areas will be constructed in conjunction with improvements to the various road segments.

2.2 Toilets and Comfort Station

An area of approximately 1,200 square feet is reserved for possible future construction of a visitor comfort station in the area now occupied by the generator trailer (Figure 5). When this building is planned it should be designed to have a rustic appearance. It should contain toilets for men and women, a small storage room for security personnel supplies and equipment, and a water tank. The building should have electricity and running water. Heat can be provided by electric space heaters. Toilets should be either waterless or watersaving. The sewage disposal system associated with the toilets should be sited so that effluent flows away from Lake Waiau.

It is proposed that a concessionnaire be contracted to provide portable chemical toilets, adjacent to parking areas, during the ski and snow play season. These facilities should be removed during the summer months.

K. WATER STORAGE AND TRANSMISSION FACILITIES

1.0 Telescopes at the Summit

Each telescope facility will have its own on-site water storage tank and distribution system. Because of the distance between facilities and the irregular terrain, a central water storage and distribution system is not feasible. Water will continue to be trucked from Hilo by tanker, as is the practice at the present time.

Current water usage at the summit averages approximately 10 to 20 gallons per person/per day. Based upon the above ratio, and assuming all facilities are fully operational, the following demand for water is anticipated by the year 2000:

Facility	Estimated Consumption (Gallons/Day*)
Existing Facilities	500 to 1,000
Caltech	60 to 120
UK/NL MT	60 to 120
UC TMT	150 to 300
Future Millimeter-Wave	100 to 200
NNTT	150 to 300
Future TMT	150 to 300
Future TMT	150 to 300
TOTAL YEAR 2000	1,300 to 2,600 - Gallons Per Day*

*Rounded

The water storage capacity differs by facility; some telescopes have tanks with capacity to store a 2-week supply on-site while others, such as UC TMT, envision larger tanks which would hold enough water for a month to six weeks. After each storage tank is filled initially (requiring, at the maximum, two tanker trucks of water), the supply can be maintained by the 5,000-gallon water tanker which makes 3 to 4 trips per week from Hilo to "top off" the tanks at each facility; if required, the tanker can make additional trips. Fire protection is provided for in the individual facilities by chemical fire extinguishers, which will be available in sufficient number. Personnel at each facility will be trained to use them.

2.0 Hale Pohaku Mid-Elevation Facilities

2.1 Astronomy Facilities

Two 40,000 gallon water tanks are under construction at the permanent mid-level facility. It is estimated that 8,400 gallons of water per day will be required to service the human consumption needs of the astronomy facility and 3,000 gallons per day will be used at the Information Station. The approximately 30,000 gallons remaining is a reserve for fire flow. This computation is based on estimated usage of 70 gallons per day per person at the astronomy facility (60 people) and 15 gallons per day per person at the Information Station (100 people). A safety factor of two times daily requirements was applied to estimate total water storage requirements.

In order to provide water for an additional 61 to 77 people at the astronomy facility, an additional 8,400 to 10,780 gallons per day will be required. Actual water usage will be monitored closely to determine if the existing water storage capacity might be sufficient to supply the needs of the expanded facility by increasing the number of daily water tanker trips. As future dormitories are proposed, the water requirements will be evaluated carefully. It is possible, an additional water tank may be required by the year 2000. There is space available for another water tank in the maintenance area of the mid-level facility (Figure 12).

Additional water requirements for expansion facilities will necessitate additional trips by the water tanker to keep the storage tanks full. Because the water being trucked from Hilo will serve over 25 people, the truck carrier will have to comply with the State of Hawaii Chapter 20, Title II, Administrative Rules, Section 11-20-31 on Use of trucks to deliver drinking water.

2.2 Construction Camp Housing

The 2,000 to 3,000 gallons of water per day necessary to fulfill the needs of approximately 12 to 22 construction workers can be provided from the existing water storage tank, located near the temporary UH buildings. This system will be retained until both UH buildings are moved from the area.

2.3 Information Station

Water requirements at the Information Station have been estimated for moderately heavy usage of the toilet facility (100 people per day, 3,000 gallons per day). This water will be provided via a pipeline from the water tanks located in the maintenance area of the astronomy facility. Actual water usage will be monitored carefully. If visitors to the Infomation Station increase remarkably and water shortages occur, additional water storage capacity will be required. Options available to meet this need are:

a. Increased delivery of water to the mid-level facility tanks; or

b. Construction of a separate water tank and distribution facility for the sole use of the Information Station.

L. SEWAGE DISPOSAL

1.0 Telescopes at the Summit

Estimates of effluent discharge by facility (assuming each telescope is fully operational) are:

Facility	Discharge (Gallons/Day*)
Existing Facilities	360 to 710
Caltech	40 to 80
UK/NL MT	40 to 80
UC TMT	100 to 200
Future Millimeter-Wave	70 to 140
NNTT	100 to 200
Future TMT	100 to 200
Future TMT	100 to 200
TOTAL AT FULL DEVELOPMENT	910 to 1,820 - Gallons Per Day*

*Rounded

Each telescope facility will have its own wastewater disposal system consisting of either a cesspool or septic tank with leaching field. All systems will be designed to conform to Department of Health regulations.

Effluent from telescopes on top of cinder cones (the existing facilities, and the UC TMT) will tend to disperse downward in all directions. Telescopes sited in Area IV and northern portions of Area II are on the north side of the summit and effluent generated by them will tend to flow northward. Flow from the telescopes sited in area II (Caltech and possibly UK/NL MT), will tend to percolate downward and lateral flow will tend to flow parallel to the surface drainage pattern which turns westward in a depression north of Lake Waiau and then gradually turns south, well to the west of the Lake.

(Part VI and Appendix E describe the environmental impacts associated with sewage disposal in each analysis area).

2.0 Hale Pohaku

2.1 Astronomy Facilities

An additional 61 to 77 people at the facility will generate an estimated 3,000 to 3,800 gallons per day of liquid sewage. At present it is planned that a cesspool will be constructed at each new dormitory for sewage disposal. This method was approved by the Department of Health for the facility now under construction. The additional cesspools will also be subject to approval by that agency.

2.2 Construction Camp Housing

The cesspool located near the temporary UH building has sufficient capacity to dispose of the 600 to 1,000 gallons per day of effluent generated by construction workers.

2.3 Information Station

A cesspool is currently being constructed near the Information Station. If the Information Station is expanded in the area designated by this Plan, this cesspool may have to be relocated.

M. COMMUNICATIONS

Communications facilities and equipment are required for data and voice transmission to and from the summit, Hale Pohaku, and the world. At the present time data and voice communication between the summit and Hilo is accomplished by a microwave link from a four-foot diameter dish located on the UH-88 inch telescope building to a similar dish located in Hilo. Communication between Hale Pohaku and the summit and Hale Pohaku and Hilo is via two VHF mobile two-way radio systems. Both the microwave link and the mobile radio system are inadequate to provide the high speed data links that are now required by the existing and proposed telescopes and for Hale Pohaku. Several alternative means of providing the necessary communications links are being considered; the additional equipment required will be determined by the method that is chosen.

1.0 Summit Requirements

1.1 Microwave Link

Additional communications equipment will have to be installed in order to transmit data from the Mauna Kea summit to Hilo and beyond at data rates in excess of 20 kilobits per second. This could take the form of a microwave link, requiring a dish antenna four to eight feet in diameter on Mauna Kea with line of sight to Hilo, and a similar installation in Hilo with line of sight to Mauna Kea. The antenna would be similar to those currently in use by Hawaiian Telephone and by HELCO. The dish could either be attached to the extension of the UKIRT building or to the UH 88-inch telescope building. The dish would not be visible from Hilo with the naked eye.

Frequency bands used for communication would be determined by bandwidth required; precise frequencies used are allotted by the Federal Communications Commission (FCC). Candidate frequency bands are assumed to be 2.2 GHz and 6 GHz. The FCC controls use of the electromagnetic frequency spectrum for communications to avoid interference between users.

1.2 Satellite Communication

By the end of the decade it is likely that earth satellite communication relays will become the usual means of long distance high-speed communication. When this becomes a reality, a communications antenna would probably be installed on Mauna Kea. Because this antenna does not require line-of-site to sea level, it would not be located on the summit ridge. Its probable location would be on the plateau near the proposed millimeter wave telescopes. It would not be visible from areas outside the Science Reserve.

The diameter of the communications dish would be approximately 24 feet and its appearance similar to antennae used for satellite broadcast reception, e.g. by cable companies. An example of such a dish is the one sited at COMTEC in the vicinity of the Hilo Shopping Center.

1.3 Fiber Optics

Long wavelength fiber optics utilize thin glass strands bound together in a thin cable. Ten of these strands, which have the capability of carrying 3,360 two-way voice transmissions, can be bundled together in a cable which is only slightly bigger than an ordinary pencil. A fiber optics cable is being considered to connect the summit and Hale Pohaku. If fiber optics technology is far enough advanced by the time the powerline trenches are excavated (that is, having the capability to handle the data rates required), and cost is competitive with other communications systems, then a fiber optics cable may be installed in the trench at that time. In any event, a conduit will be placed in the trench with the electric power conduits so that in the future, this communications link can be installed. No regenerators or repeaters are required when fiber optics is used. With a hardline connection between Hale Pohaku and the summit, it will not be necessary to have microwave dishes at both locations.

2.0 Hale Pohaku

The Hale Pohaku CDP states that: "The future telephone requirements of the mid-elevation facility will be satisfied through a digital radio system link to Hilo, via Mauna Loa, using an 8-foot diameter microwave dish. The dish should be mounted on the side of a building in the maintenance area. This will eliminate the need to construct any support such as a tower. The terminal equipment should be housed in enclosed cabinets inside of the building. A similar microwave radio system has been installed at the Mauna Kea summit without any adverse consequences to the environment." (DLNR 1980).

The method described above does not include a direct connection between Hale Pohaku and the summit and would require that microwave dishes be located at both places. Other options being investigated at the present time are:

a. Tying in to a proposed State/Federal inter-island communications system. A eight-foot dish at Hale Pohaku would still be required under this option; however, it would beam to a federally owned repeater station on Mauna Loa and from there to the Hilo Federal Building. From the Federal building, the link would be via hardline to the State building and base support facilities. There would still be no direct connection between Hale Pohaku and the summit and a microwave dish would still be required at the summit.

b. As previously described, fiber optics could provide a direct connection between Hale Pohaku and the summit. One microwave dish could be eliminated, either the one at Hale Pohaku or the one at the summit.

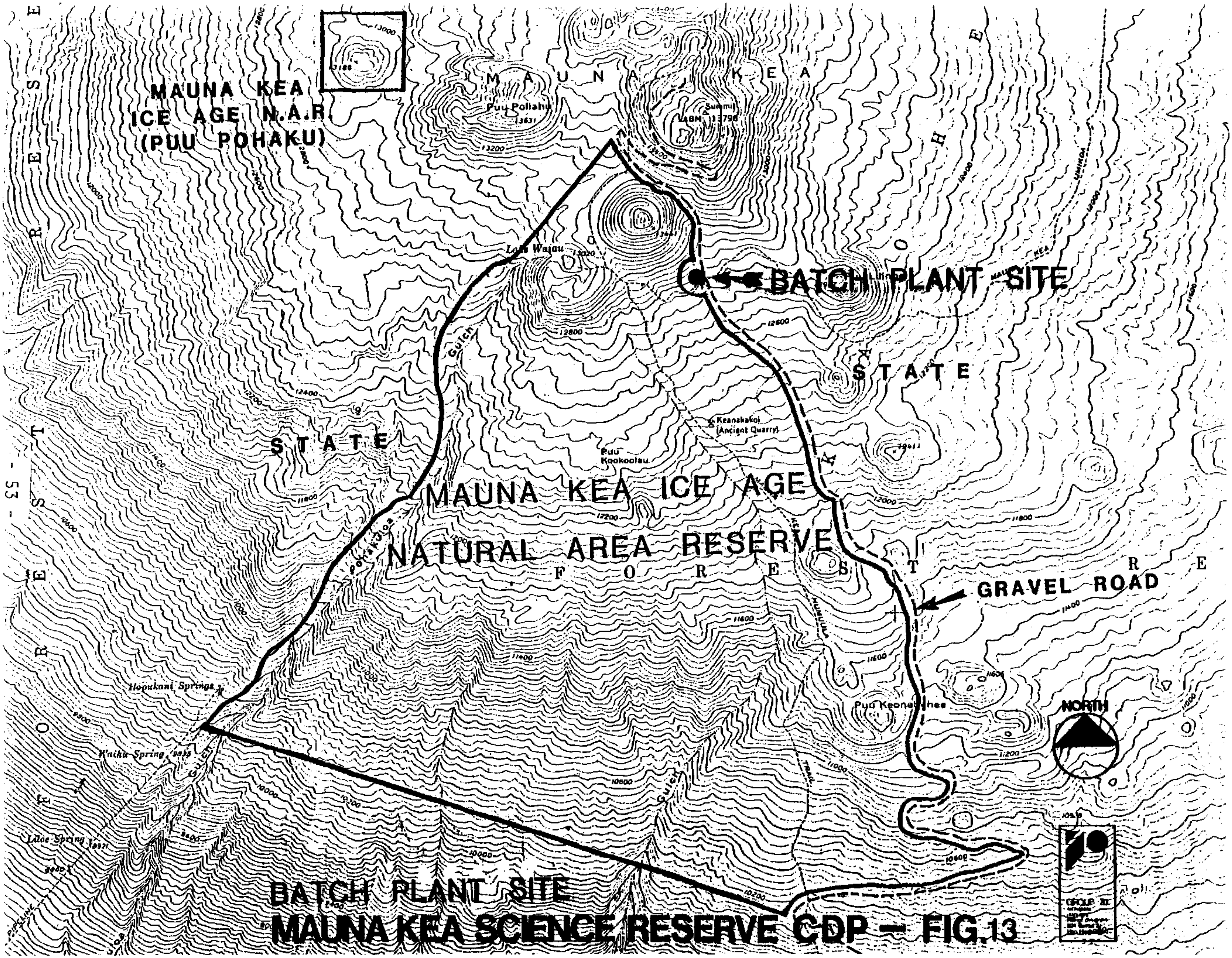
c. Overhead or underground telephone lines could be strung or buried from the Saddle Road to Hale Pohaku and/or the summit. If the quality of the telephone cable is good enough for data transmission, then no microwave dishes will be necessary. If telephone lines go from the Saddle Road and terminate at Hale Pohaku, then the dish at Hale Pohaku could be eliminated, but not the one at the Summit.

N. CONCRETE BATCHING PLANT

From time to time during the construction of a telescope facility a temporary concrete batching plant will be required. Although concrete is usually mixed in Hilo and trucked directly to the site, occasionally when large continuous pours are required, it is necessary to mix the concrete near the construction site. An area approximately 10,000-20,000 square feet is needed for this purpose.

An area known as the "skier's parking lot" at the 12,700 foot elevation has been used for this purpose in the past. (Figure 13). Most of this lot is located within the Natural Area Reserve; however, the Natural Area Reserve Commission is considering adjusting the eastern boundary of the Ice Age Natural Area Reserve (as shown on Figure 4) so that the area is completely within the Science Reserve.

The "skier's parking lot" is already disturbed and is the most suitable location for future batching activities. Use of the area for that purpose would not conflict with usage of the area for a parking lot during the winter. The SRCDP recommends that the area be designated for use as a temporary concrete batching site for all future construction activities on the summit.



BATCH PLANT SITE
MAUNA KEA SCIENCE RESERVE CDP — FIG.13

O. PROTECTIVE SERVICES FACILITIES

1.0 Fire

A fire plan for the summit and Hale Pohaku areas is being developed in cooperation with the Hawaii County Fire Department and DLNR. The UH proposes to acquire a fire engine, to be stationed at Hale Pohaku. A volunteer fire brigade, made up of MKSS personnel will be trained in fire fighting techniques. In addition to protecting buildings, the brigade will be prepared to fight rush fires in the surrounding area. The Hawaii County Fire Department has indicated a willingness to train and certify these personnel.

The following fire prevention measures will also be undertaken to protect the facilities and surrounding areas:

(a) Combustible materials, such as paper cartons and boxes, will be kept at a minimum;

(b) Rubbish will be removed daily;

(c) Storage of combustible and flammable liquids will be according to NFPH #30 requirements;

(d) A communication system between buildings at the summit will be devised to summon a volunteer fire brigade;

(e) A fire plan and evacuation instructions will be posted in all buildings at both the mid-level and the summit; and

(f) Fire drills will be held regularly at both locations.

2.0 Security

Security for both the summit and the mid-level is addressed in the Management Plan. No additional physical facilities will be required as security personnel will operate out of the Information Station.

3.0 Medical

3.1 Summit

An ambulance, equipped with a stretcher and first aid supplies, oxygen, and a two-way radio for contacting the County rescue squad is parked between the UKIRT and 88-inch buildings. It is available in case of emergencies at the summit. All MKSS personnel are trained in advanced first aid and cardio-pulmonary resuscitation.

3.2 Hale Pohaku Mid-Elevation Facilities

An appropriately furnished emergency room is located within the astronomy complex. If needed, it can be made available for emergency treatment of visitor injuries and illnesses.

P. ACCESS CONTROL

1.0 Gate

The SRCDP recommends that a gate be installed across the summit access road above the Information Station. Initially, this gate should be open during daylight hours. It should be closed at night and when weather conditions make travel upslope hazardous. (The Management Plan discusses control functions of the gate).

2.0 Sign

A sign should be installed near or at the approaches to at the approaches to the intersection of the Saddle Road and the Mauna Kea access road. This sign will inform visitors of hours when the summit road is open. It should be equipped with a yellow light which will flash when road is closed at times other than stated on the sign.

Q. BASE SUPPORT FACILITIES

Major new telescopes on the mountain will require base support facilities for activities that do not require summit or mid-level locations. Each sponsoring agency will locate its base support buildings in the area which best serves its needs. Hilo, Waimea, and Kailua-Kona are all possible locations for these facilities (Figure 2).

The UKIRT is presently in the process of designing an office building, on land leased by the University of Hawaii, adjacent to the University's Hilo campus. The UK/NL MT and Caltech are planning to locate their sea-level offices there. The Mauna Kea Support Services office (MKSS) is also located in Hilo, it is anticipated that it will either rent space in the UKIRT building when it is completed or use space on UH land.

The CFHT corporation completed construction of an office/laboratory facility in Waimea in October 1982. Vacant land adjacent to this building is suitable for construction of facilities to support future telescopes on the mountain.

The industrial area surrounding the OTEC facility in Kailua-Kona also has sufficient area available for base support facilities. Future telescopes may consider this area when evaluating locations for undertaking their support activities.

R. ALTERNATIVES TO THE PLAN

1.0 No Action

No action implies that no further telescopes will be constructed on the summit of Mauna Kea, including the facilities currently proposed for development in the 1980's (UK/NL MT and UCTMT).

The County of Hawaii would lose the potential jobs and income that would be generated by future telescope projects. The State would not become the location of the "pre-eminent international center for observational astronomy".[2]

The no action alternative also means that the road will remain unimproved and unpaved. If unimproved, the road will remain rough and dangerous, increasing the possibility of accidents. In addition, constant maintenance of the road surface with a road grader will be required due to the "wash-boarding" of the loose gravel surface, particularly on the steeper slopes and curves. Serious dust problems caused by travel of observatory personnel and visitors over the unpaved roads within the Science Reserve will continue. Dust adversely affects astronomical observations. Dust contamination reduces the reflectivity of optical surfaces, causing some corrosion and reducing the life of the coating of the optical surfaces. These effects in turn result in increased "down" time in order to remove the mirrors for cleaning and re-application of the coating. If mirrors are damaged, this could cause a telescope to be inoperative for a minimum of two years. In addition, dust can enter the mechanical parts of a telescope to cause wear of, or interference with, measurement and drive systems; this can reduce telescope performance and force a shutdown. Dust not only disturbs astronomical observations but also adversely affects the flora and fauna of the area.

This alternative implies that power will continue to be provided by the 850-KW generator, and, therefore the generator will continue to burn expensive diesel fuel and to generate exhaust fumes into the air. Continued use of the generator increases the possibility of oil spills caused by malfunctioning equipment.

On the other hand, no additional visual impacts will be produced and any biological communities present will not be disturbed by further astronomical development, although they may be disturbed by other activities (e.g., recreation).

The no action alternative means that expansion of mid-level facilities at Hale Pohaku will not be necessary. The benefit of not expanding the facilities at Hale Pohaku would be avoiding the removal of a few mamane trees, a food source of the Palila bird.

The no action alternative also implies that there will be no need to develop base support facilities that do not require summit or mid-level locations. As the environmental impacts associated with the siting of the base support facilities in Hilo, Waimea or Kailua-Kona are minimal, the no action alternative would not appreciably alter the physical or biological environment of these areas.

2.0 Alternative of Placing New Telescopes in Existing Domes

It has been suggested that as telescopes become obsolete, the old telescopes could be replaced with new ones in the same enclosures (domes). Telescopes are primarily light-gathering devices, however, whose basic concept and function has not changed significantly over the past 75 to 100 years. The principle advances in astronomical observations have occurred as a result of the invention of more sensitive light detectors and more sophisticated means of recording and depicting characteristics of the light received from astronomical objects. Therefore, with updated instrumentation and detectors, the existing telescopes will continue to play as important a role in the future as they have in the past in contributing to the knowledge of astronomy. The proposed and planned future are intended to provide new capabilities in new wavelength ranges (infrared and submillimeter) or to provide telescopes to groups who presently have none; they are not intended as replacements to existing facilities.

2.0 Alternative Levels of Development for the Mauna Kea Science Reserve

2.1 Scenario One - Infrastructure Improvements

This scenario envisions that no new telescopes will be constructed on the summit after the Caltech facility is completed, however, a permanent power line from a HELCo source to the summit will be constructed and the road from Hale Pohaku to the summit will be improved for safety and paved. Roads within the Science Reserve will also be paved. The Hale Pohaku mid-elevation facility will not be expanded.

A permanent connection to the public power supply and the paved road with adequate safety features are both part of the State's original planned contribution to the development of the Mauna Kea Observatory.

2.2 Scenario Two - Maximum Capacity of Mauna Kea Science Reserve

This scenario envisions development to the maximum physical capacity of the summit cinder cones (Puu Hau Oki, Puu Poliahu, and Puu Wekiu), the 13,000-foot plateau, the shield areas to the north of the summit cinder cone, and the eastern plateau. Development would include two to five single dish millimeter-wave telescopes, two interferometers, and 15 to 18 major optical facilities for a total of 19 to 22 total major facilities on the mountain. It also includes a widened, as well as paved, access road, a permanent powerline, and expansion of the mid-level facility at Hale Pohaku.

Although development of this scale may or may not exceed the "carrying capacity" of the mountain, such development is not possible in the foreseeable future. Even if it could be demonstrated that development could be accomplished without unacceptable environmental impacts, it is certain that the international demand for telescope sites (and the necessary funding) would fall well below the number of facilities projected under this scenario.

PART IV: DRAFT MANAGEMENT PLAN

A. INTRODUCTION

The Mauna Kea Science Reserve is located within a Resource subzone of the Conservation District. The objective of this subzone is . . "to develop, with proper management, areas to ensure sustained use of the natural resources of those areas." (DLNR-Regulation 4). Although Mauna Kea belongs to the people of Hawaii, and its resources should be available for all to enjoy, it is important that the qualities that make Mauna Kea an important scientific resource not be compromised by activities which may damage its environment. The purpose of incorporating a management plan as an integral part of the SRCDP is to protect the natural and man-made attributes of the summit area while at the same time allowing development and use of its scientific and recreation resources in a responsible, conservation-oriented manner.

Because the UH is lessee of the Mauna Kea Science Reserve, and thus has been responsible for developing and maintaining the area, the Board of Land and Natural Resources (BLNR), through discussions with staff and contingencies placed on recent CDUA's, has asked that the University also be responsible for managing and monitoring all activities that may affect the Reserve. The University is prepared to accept this responsibility, including the seeking of funds required to support the positions necessary to effectively implement the plan.

It should be emphasized that the Management Plan is only in the draft stage; more public input is required before the various elements are finalized. This EIS is one method of obtaining public comment on the plan. The final plan will be subject to appropriate agreements among affected State agencies and approval by the UH Board of Regents and the BLNR. Upon approval of the plan, new regulations will be promulgated in accordance with the State Administrative Procedures Act.

B. PLANNING GUIDELINES

Implementation of the SRCDP could attract more people to the upper regions of Mauna Kea by making the area more accessible to the general public. The Management Plan, therefore, addresses management of both the summit resources and visitors to the summit area. The objectives of the plan are to:

1. Protect the astronomical qualities of the site;

2. Protect the biological and historical/cultural resources of the area;

3. Preserve the natural features of the area;

4. Enhance the experience of visitors to the summit and Hale Pohaku;

5. Safeguard the health and safety of both visitors and astronomy personnel; and,

6. Provide for the security of the area.

C. ASSUMPTIONS

The Plan is predicated on the following assumptions:

1. The BLNR will transfer jurisdiction for management and enforcement functions within the Mauna Kea Science Reserve, at Hale Pohaku, and along the summit access road to the UH, subject to Regulation 4 regulating uses in the Conservation District.

2. The lease for the Mauna Kea Science Reserve will be taken out of the Mauna Kea Ice Age Natural Area Reserve, and uses within this Natural Area Reserve (NAR) will be regulated by the Natural Area Reserves Commission and enforced by the DLNR Division of Conservation and Resources Enforcement.

3. The Mauna Kea Science Reserve; the summit access road, including a corridor approximately 400 yards on either side of the road; and Hale Pohaku will be removed from the Forest Reserve.

4. The 1977 DLNR Mauna Kea Plan will be revised to reflect the transfer of jurisdictional responsibilities.

D. ISSUES TO BE ADDRESSED IN THE PLAN

During the planning process groups and individuals interested in Mauna Kea were contacted. They have identified several major concerns which are addressed in the Management Plan. It is also recognized that a management plan is an immediate as well as a long-range need. The major issues identified are:

1. Access

Access refers to both the effect people have on the natural environment of the mountain and to the number and/or nature of the people. Members of the public have voiced concern regarding the possible over or uncontrolled use of the mountain.

Most groups and individuals contacted during the planning process did not feel that paving of the road to the summit from Hale Pohaku was in itself a bad thing. Indeed, most favored the paving of the road for reasons of comfort and safety, increased access for their own use, less erosion of the mountain, and reduced dust.

Each group also felt that the potential negative effects of increased access could be mitigated through a management plan.

2. Off-Road Vehicles

The problem of off-road vehicles scarring cinder cones and disturbing the terrain was a concern that was expressed often when improved access and protection of the summit environment were discussed. An almost unanimous opinion of those having an interest in the mountain was that a major objective of any management plan should be to restrict all vehicles to designated roadways and to enforce this restriction vigorously.

3. Health and Safety of Visitors

Visitors to the summit often are unprepared for the high altitude, cold and possibly inclement weather, and poor road conditions. Many get into trouble and are rescued by astronomy personnel. This is expected to continue. The Management Plan should address ways to inform visitors of the hazards upslope, monitor their visits, and control when and how they travel to the summit.

4. Skiing and Snowplay

While skiing and snowplay are uses approved in the 1977 DLNR Mauna Kea Plan, questions have been raised about the current practices of skiers and snowplay participants. For example, when the snow is not near the road, the skiers and snowplay enthusiasts drive off-road to find it, and many get stuck in the snow. Other concerns relate to illegal parking, drinking and use of drugs, rubbish, lack of sanitary facilities and safety. Concern has also been expressed about commercial ski activities being conducted at the summit without appropriate review by BLNR through the Conservative District Use permit process. More aggressive monitoring and controls are suggested to minimize impacts of these activities while still allowing the public access to this unique activity in Hawaii.

5. Maintenance

Rubbish is considered to be a problem on the mountain; much of the material is non-biodegradable. In addition to being unsightly, rubbish is affecting components of the mountain ecosystem. At the present time, UH has assumed the major responsibility for rubbish collection. Regulations and enforcement are necessary to insure that all visitors dispose of their rubbish in an appropriate manner.

6. Liquor and Drugs

Indiscriminate use of alcohol and drugs is a problem which is encountered primarily during the snow season. Drinking and smoking marijuana has, on occasion, resulted in fights and damage to the area. Litter of cans and bottles and reckless driving down the summit road are major concerns related to this problem.

7. Adze Quarry and Other Archaeological/Cultural Sites

"The most immediate concern in preserving the adze quarry's integrity and information value for research and public appreciation purposes is the curtailment of surface collecting and unsupervised walking over fragile areas, particularly large piles of waste flakes and discarded artifacts fronting rock shelters. It is difficult to assess the amount of cultural materials that has been removed or displaced in the past, or to what extent this one form of vandalism is occurring today. One fact is certain - the remoteness of the quarry, the altitude and the climate have not prevented degradation." (Pat McCoy, Bishop Museum)

8. Disturbance of Nightime Observations

Headlights from vehicles interfere with the astronomical observations. Unaccompanied visitor access to the summit should be limited to daylight hours.

E. BOUNDARIES OF MANAGEMENT AREAS (Figure 14)

1. Mauna Kea Science Reserve and the road within its boundary;

2. Hale Pohaku; and,

3. The summit access road from Hale Pohaku to the Science Reserve Boundary including a corridor approximately 400 yards on either side of the road.

F. RESOURCES TO BE MANAGED

1. Astronomy

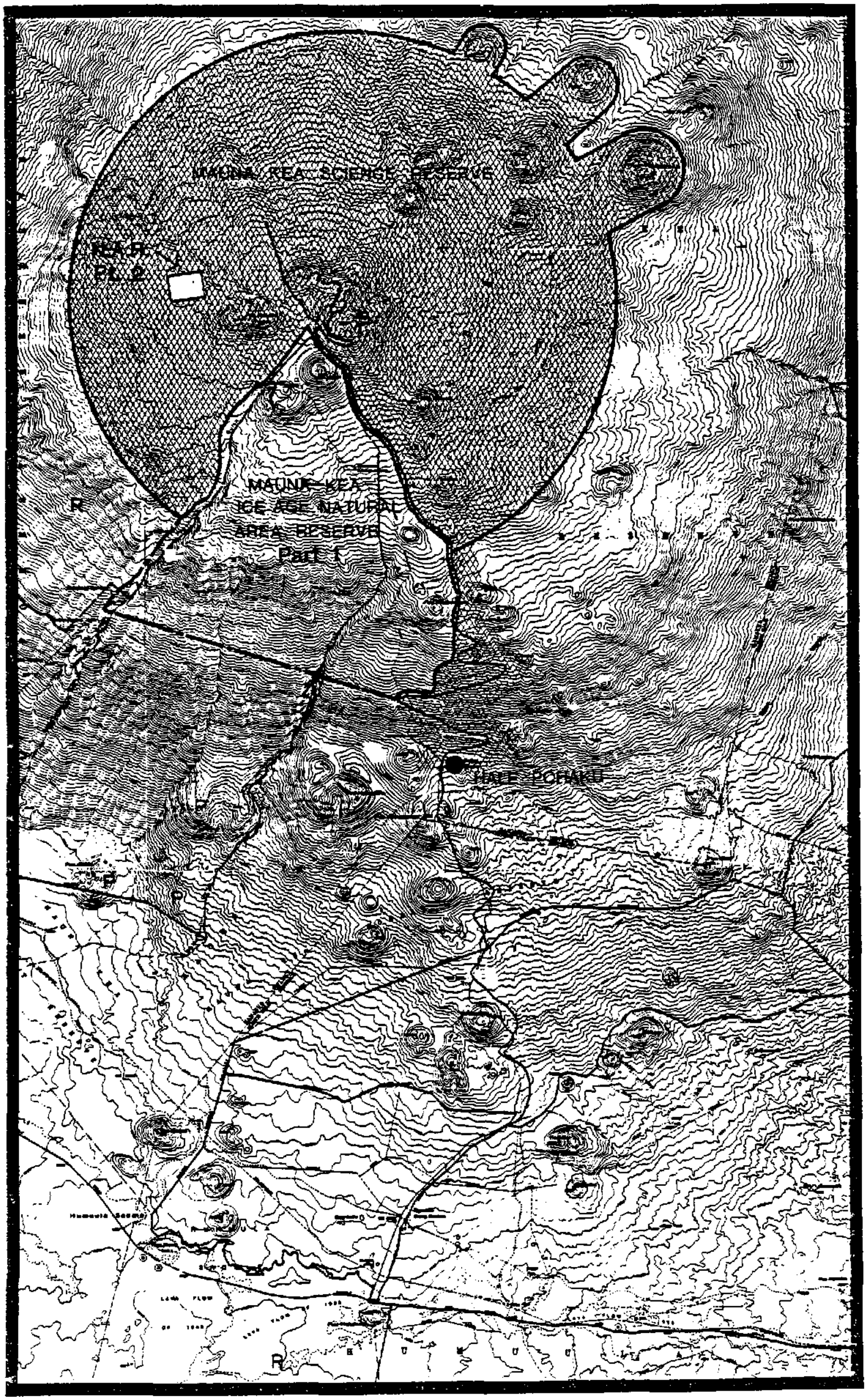
Mauna Kea is world-renowned as an excellent site for ground-based astronomy. Management concerns involve security of the telescope facilities; interference to observations by auto headlights and other artificial light sources; dust; electronic interference; heat from, and obscuration by, structures built in the observatory area; and spurious light from sea level.

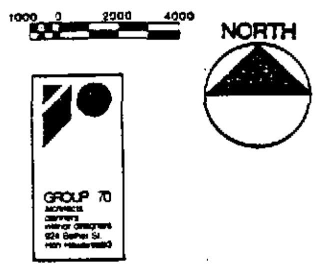
2. Flora

Although the severe climate and lack of precipitation preclude most higher forms of flora, lichens, mosses and some flowering plants are found at the summit. The summit of Mauna Kea is not a unique habitat essential for the survival of plants growing there; however, it does provide the opportunity to observe the ability of some Hawaiian plant species to survive at extremes of moisture, temperature and substrate. Disturbance by construction, casual hikers, and dust from the road can affect the flora and other aspects of the mountain environment.

3. Fauna

The fauna on Mauna Kea consists primarily of arthropods (bugs), although some game birds may transit the area from time to time. The bugs have adapted to the stressful environment on the mountain and some species may not be found elsewhere in the State.





PROPOSED U.H.
MANAGEMENT
AREAS

MAUNA KEA SCIENCE RESERVE CDP — FIG. 14

4. Historic/Cultural/Natural History

Keanakakoi Adze Quarry is located within the Mauna Kea Ice Age Natural Area Reserve at the 12,400-foot elevation, and was designated as a National Historic Landmark in 1968. The site, which was a very important and extensive center of Hawaii adze manufacturing, is subject to various kinds of vandalism. Management of the Adze Quarry is the responsibility of the Natural Area Reserves Commission.

Lake Waiau, elevation 13,020 feet, is one of the highest lakes in the United States. In addition to being a significant geological feature of the area, Lake Waiau has been regarded by the Hawaiians as a sacred place and as a cultural tie with the past. This area is also under the jurisdiction of the Natural Area Reserves Commission.

Other Geological Features, including cinder cones such as Puu Goodrich, are valuable for their aesthetic attributes.

Other Historical Sites on the summit have been identified in recent reconnaissance surveys. Their significance is described in Appendix A.; their protection should be addressed in the Plan.

G. USERS

The lease between UH and BLNR states that the Mauna Kea Science Reserve. . . "shall be used 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". In addition, the lease states that the Department of Land and Natural Resources reserves to itself all hunting and recreation rights on the lands provided that such hunting and recreation activities shall be limited to daylight hours only. Therefore, the means by which the general public may visit and use areas above Hale Pohaku in a safe, pleasant manner without damaging the mountain ecosystem was addressed during the planning process. A description of each user group and some problems associated with each follows:

1. Astronomy Visitors: The telescopes currently attract a small number of visitors to the summit and it can be anticipated that this will continue into the future. Accommodation of these visitors, which could represent a substantial number by the year 2000, is of major concern. It is also necessary to provide a means by which those who are not physically able to travel to the summit can be warned not to do so, and are offered a satisfying alternative to actually visiting the telescopes.

2. Recreational Users: It can be anticipated that hikers, sightseers, skiers and snowplay participants will want to continue to use the summit area for their activities. Visitor safety, particularly during snow periods, is a major concern, as is control of commerical activities on the mountain. Crowd control on "snow" weekends and a means to monitor and control the great numbers of visitors at these times of the year are major considerations addressed in the Plan.

3. Hunters: Although the summit is rarely used for hunting, hunters do use areas in the lower elevations to hunt chuckar and mouflon. Safety of visitors who may wander away from the safety zones and a means to control public access to the upslope areas without unduly restricting hunters' access are concerns which are addressed in the Plan.

4. Scientists: Periodically, non-astronomy related scientists desire access to the summit to conduct research on various aspects of the mountain environment. Because many activities have the potential of damaging the ecosystem (and some may be inimical to the primary scientific activity of the mountain, astronomical research), development of guidelines for evaluating non-astronomy related research uses of the Science Reserve and procedures for insuring that the appropriate DLNR permits have been obtained prior to initiating research activity, are concerns addressed in the Plan.

H. ACCESS CONTROL

Access to environmentally sensitive areas is problematic in that the goal is to maximize use while not harming the environment. The following proposals address control of access from Hale Pohaku to the Summit area.

1.0 Information Station

The 1977 DLNR Mauna Kea Plan states that . . . "The Hale Pohaku facility will consist of mid-level facilities. . ., a central point for management of the mountain. . ." An Information Station is being constructed at Hale Pohaku to serve as the central point to control access to the upper regions of Mauna Kea. The Information Station will be manned. It will contain exhibits of the natural and man-made resources of the mountain and provide information about the hazards which could be encountered at higher elevations. A sign located near the entrance to the Station will instruct all visitors to stop and register before proceeding up the mountain. Station personnel will distribute regulations relating to activities on the mountain including rules for mountain driving.

Until the road is paved, access will be restricted to four-wheel-drive vehicles only. If the road is paved, standard vehicles will be allowed to proceed, provided there is no snow or ice on the ground. When snow or ice are present all vehicles will need to have chains.

2.0 Gate at Hale Pohaku

A gate, which should be installed on the summit access road above the Information Station, will be closed at night and opened in the morning. Hours will be posted outside the Information Station. A sign, setting out the hours that the road above Hale Pohaku is open will also be installed near the intersection of the Saddle Road and the Mauna Kea Access Road It will be equipped with a yellow light which will flash indicate to visitors when the summit road is closed at other than posted times.

UH will have the authority to close the road if they determine that use of it could be hazardous, (e.g. during blizzards and after heavy snowfalls). The road will also be closed when the snowblower is clearing the road and when cinder is being placed on icy sections. Whenever possible, UH will inform the local radio and TV stations of unscheduled closings of the road and will also inform them when the road is again reopened.

At certain times of the year, it will be necessary to man the gate in order to control traffic. This could occur during heavy snow weekends when large numbers of both skiers and snowplay participants desire access to the upper regions of the mountain. In the future, if traffic above Hale Pohaku increases to a level which requires additional control, the gate can be manned daily during daylight hours.

3.0 Parking At The Summit

In order to control off-road travel and parking, and to control numbers of vehicles, parking areas are planned at several locations along the access road. All vehicles will be required to park only in designated areas. Those found parked along the road or anywhere outside of the specified parking areas will be ticketed and fined. During periods of heavy usage, parking control will be instituted. That is, vehicles will be given parking passes at the Information Station; these passes will be valid for specific parking areas. Any vehicles parked outside of the area designated on their pass will be ticketed and fined. This method of control will be publicized widely to lessen the liklihood of visitors traveling from long distances to Mauna Kea to no avail. As stated in the physical plan, certain parking areas will be designated for those who only want to play in the snow.

4.0 Shuttle Bus Service

Over the long term, and if increased traffic warrants it, a shuttle bus service, possibly, contracted out to a concessionnaire, might be initiated as a means of visitor control. Such a plan could be total (i.e., on certain occassions everyone would be required to use it) or partial, certain vehicles would be allowed to travel on the road. In the former case, there would be no problem of discrimination. In the latter case, approved user groups who are familiar with the mountain could have permitted access for their vehicles while occasional visitors or tourists would be required to leave their cars at Hale Pohaku or Pohakuloa and take the shuttle. Although Hale Pohaku is the perferred terminus for the shuttle, it is possible that the service could run from the Mauna Kea State Park at Pohakuloa, (or perhaps from both locations).

I. ENFORCEMENT

In cooperation with DLNR, UH will develop rules and regulations regarding access and uses of the areas transferred by BLNR to UH control. Security personnel under the control of UH will enforce these regulations; they will also be responsible for the security of Hale Pohaku and the telescopes at the summit. These people should have full powers to enforce UH regulations, similar to DLNR enforcement officers. It may be necessary to deputize trained volunteers to assist with crowd control on snow weekends when the traffic is exceptionally heavy.

J. CONTROL OF PERMITTED USES

All uses of the summit area which are specifically permitted by the 1977 DLNR Mauna Kea Plan and the terms of the lease between the BLNR and UH will continue to be allowed; they will, however, be controlled. Permitted uses are:

1. Astronomy;

2. Other scientific research;

3. Recreation uses:

   a. Skiing and snowplay;
   b. Hiking;
   c. Hunting; and
   d. Sightseeing.

The following measures are suggested to control activities on the mountain:

1. Astronomy: The 1977 DLNR Mauna Kea Plan, the Hale Pohaku Master Plan, the University Research Development Plan, the SRCDP, and the CDUA process all act to control astronomy-related uses on the summit. Visitors to the astronomy facilities can be controlled directly through UH and the other astronomical users of the mountain. These means to accomplish this are:

   (a) Continue offering guided tours to the telescopes on the summit, as is the current practice. Visitors can be briefed at the Information Station concerning health and safety and can also be educated about the scientific programs being conducted in the summit area. Only those visitors in appropriate vehicles would be permitted to proceed.

   (b) Move a telescope to Hale Pohaku and hold open nights at the Information Station so that the public can look through this telescope. The purpose of this would be educational; it would also accommodate visitors at the 9,200-foot elevation, thus minimizing the number who venture to the summit.

   (c) When the number of visitors increases to a point where additional control is indicated, initiate shuttle bus tours to the Mauna Kea observatory, possibly operated by a concessionaire.

2. Other Non-Astronomy Related Scientific Research:

   General Lease No. S-4191 between UH and the BLNR specifically permits non-astronomy-related scientific activities within the Science Reserve as long as these activities are not inimical to astronomy operations. The lease states that "activities inimical to said scientific complex shall include dust interference to observatory operation and certain types of electric or electronic installation on the demised lands, but shall not necessarily be limited to the foregoing." In addition, those conducting scientific research on the summit require a Conservation District Use permit from the BLNR. The following guidelines for evaluating applications for non-astronomy-related research were adopted by the UH Board of Regents:

"Scientific activities carried out as field work, with little or no construction involved and only short-term occupancy, will be reviewed on an ad hoc basis by the UH, with final review and approval by the Board of Land and Natural Resources (BLNR). The main policy guideline here is that the activities should not interfere with the ongoing scientific work, or otherwise lead to inconsistencies with the terms of the UH lease. Permission should be received from the BLNR by the sponsor of any such activity; UH would require that the activity be financially self-supporting, including contributions where appropriate, to the cost of maintaining common-service facilities such as the Information Station and the access road.

If a long-term program of this character were to be proposed, the University would assess the application using guidelines equivalent to those established for the review of proposed astronomical facilities." (UH RDP)

People conducting such research within the area managed by UH will be required to register at the Information Station and show the person on-duty their approved Conservation District Use permit. They may also be required to carry their permit on their person at all times and show it to any security personnel upslope who may request them to do so.

3. Recreation Uses

Recreation uses are specifically allowed within the terms of the lease and the policies of the 1977 DLNR Mauna Kea Plan. The lease restricts these uses to daylight hours only and this restriction will be incorporated in the Management Plan. Suggested controls for specific recreation activities are:

a. Skiing and Snowplay

(1) On weekends with heavy snow, when the number of people wanting to participate in snow activities exceeds the practical and safe capacity of the mountain as judged by UH (who is being required to protect the public and the ecosystem), institute strict access control measures such as closing the gate and assigning parking areas.

(2) Enforce the requirement that all commercial ski and snowplay operations have a Conservation District Use permit from the BLNR prior to conducting activities at the summit.

(3) Through the BLNR Conservation District Use permit process:

(a) require all commercial operators to: (i) register at the Information Station and be assigned specific parking areas; (ii) pick up all rubbish generated by their activities and carry it back to their base of operations; and (iii) see that the people in their group comply with all regulations at the risk of revocation of their permit; and,

(b) limit the number of commercial operators at the summit at one time by assigning them days and times that they can operate. In the future, a limit on total number of permits issued could be instituted.

b. Hiking

(1) For their safety, all hikers will be required to register at the Information Station prior to proceeding upslope. They should be advised of the location of hunting areas and safety zones. Plastic bags should be purchased or provided by each hiker so that they can pack out their rubbish.

(2) Guided tours to the features of interest in the NARS should be planned. The tours could start with a lecture at the Information Station and a presentation of interpretive exhibits showing what would be viewed at higher elevations.

(3) DLNR will be encouraged to identify the Information Station as a terminus for any system of trails which they may propose for the area. Registration of hikers at the Information Station will allow Information Station personnel to educate hikers on the climatic conditions upslope and the precautions that must be taken to protect the environment.

c. Hunting

(1) Hunters can be issued special access permits when they obtain their hunting licenses.

(2) Hunting in the Mauna Kea area above Hale Pohaku will be restricted to daylight hours, as posted at the Information Station. (This is in keeping with the lease between UH and BLNR.)

(3) It is anticipated that all relevant DLNR regulations concerning hunting will be incorporated into the Management Plan. UH security personnel will enforce hunting regulations within the UH management areas.

d. Sightseeing

It is anticipated that with improved access, the number of people who drive to the summit primarily to sightsee will increase. (At the present time sightseers and other recreation users, except hunters, must obtain a "Mauna Kea Entry Permit" from DLNR before proceeding upslope from Hale Pohaku. In recent years, however, permits have not been issued and DLNR has not enforced this requirement). The following measures should be initiated in order to control and monitor this activity and provide for visitor safety:

(1) Visitors will be required to register at the Information Station where they will be informed of precautions which must be taken and the rules to be followed when driving upslope; prior to paving of the road, sightseers will be denied access if are not in a four-wheel-drive vehicle.

(2) Visitors who are elderly, or who appear to be in ill health, or who are not dressed for the climate at higher elevations will be encouraged to terminate their visit at the Information Station. Visitors accompanied by children under 10 years of age will also be discouraged from proceeding upslope.

(3) All individuals who operate on Mauna Kea for a profit are required to obtain Conservation District Use permits. The days and times of their visits and the total number of permits allowed for this purpose may be regulated in the future.

(4) If the number of sightseers increases to a point where their presence might prove hazardous to themselves or to others, they may be required to use a shuttle service.

K. SPECIAL PROBLEMS

1.0 "Off-Road" Vehicles

All vehicles, including motorcycles, will be required to travel only on designated roadways and to park only in designated parking areas. This provision will be enforced rigorously by security personnel; all offenders will be ticketed and required to leave the area immediately. The regulations concerning "off-road" driving and parking will apply both in the snow and non-snow periods of the year.

2.0 Drinking and Drugs

No drinking of alcholic beverages will be allowed above Hale Pohaku. Security personnel will be advised to enforce this regulation vigorously. Violators will be cited and asked to leave; their beverages may be confiscated. The use of narcotics and certain other drugs is expressly forbidden and is illegal under Federal and State regulations. Commercial operators will suffer revocation of their permit to operate if these regulations are violated by their clientele.

3.0 Hazardous Driving

Drivers will be required to handle their vehicles in a safe manner as judged by the security personnel; offendors will be cited. If violations are flagrant, DLNR Enforcement Officers and/or Hawaii County Police may be called in to assist.

4.0 Rubbish

Covered containers for depositing rubbish will be located adjacent to each parking area. All rubbish must be deposited in the containers or taken back down the mountain. UH will be responsible for regular maintenance of the area; emptying of the rubbish cans; and hauling rubbish down the mountain. Commerical operators will be required to clean-up after their groups and pack out all rubbish generated by them. Security personnel will be authorized to cite individuals and groups for littering; a fine will be imposed for violation of anti-littering regulations. Commercial operators may risk revocation of their permit to operate if they do not insure that the people in their group comply with the regulation.

5.0 Disturbance of Nightime Observations

Unaccompanied visitor access to the summit will be limited to daylight hours. The gate at Hale Pohaku will be closed at night. Violators will be cited by security personnel.

6.0 Mauna Kea Ice Age Natural Area Reserve

Features within the Natural Area Reserve will be managed by the Natural Area Reserves Commission according to their Management Plan for the area. Regulations for activities within NARS have been promulgated by the Department of Land and Natural Resources. (Appendix F). University security personnel will, however, notify available DLNR Enforcement Officers of any violations observed within the NAR.

7.0 Archaeological Sites At The Summit

At the present time it is not planned to call the public's attention to the historical sites in the summit area. UH security personnel will inform people whom they observe tampering with sites outside the NARS of their significance. If these people persist in disturbing the sites, they will be cited and reported to the DLNR Historic Sites Section.

8.0 After-Hours Use Of The Information Station

Groups may be permitted to use the Information Station after closing hours, for approved reasons, by obtaining a temporary permit from the Mauna Kea Support Services (MKSS) office in Hilo. A deposit to cover cleaning and damage will be required. Unauthorized use of the Information Station will be specifically prohibited; violators will be prosecuted.

L. MONITORING

1.0 Existing Usage

At the present time there is no procedure for monitoring use of the mountain other than for astronomy. There are no reliable data on numbers and types of visitors, purpose of visit, and problems incurred in undertaking various activities on the mountain. In order to evaluate the existing usage of the mountain and to project future actions, a monitoring system should be initiated which would (a) provide a baseline from which to evaluate future activities; and (b) monitor activities in the future. At a minimum, such a system should be initiated upon the completion of the construction of the mid-level facilities at Hale Pohaku. It would be preferable if some data were aquired prior to that time. Suggestions for obtaining base information on summit users are:

(a) Automatic traffic counting: The University could borrow or purchase an automatic traffic meter so that traffic could be counted periodically. Because of the type of traffic involved, including heavy construction equipment, it would be preferable if a permanent loop could be installed under the pavement of the Mauna Kea Access Road somewhere above the Information Station. The meter could then be attached to the loop instead of the usual hose, which would be difficult to maintain. This action would monitor the number of vehicles going to the summit, but it would not provide baseline data on the occupants of the vehicles and the purposes of their trips which would have to be collected by personnel at the Information Station.

(b) Questionnaires: These could be given out at the Information Station for visitors to complete when they return from the top of the mountain. Types of information that might be obtained are:

(1) Purpose of trip;
(2) Origins and Destinations;
(3) Type of Vehicle;
(4) Length of stay on summit;
(5) Frequency of visits to the summit;
(6) Problems encountered, if any.

Collection of data need not be continuous nor expensive in order to give a reliable indication of the types of visits that are made above Hale Pohaku. A random schedule of interviewing visitors (including astronomers and other frequent users) could be instituted and this, if properly designed, would give accurate data.

2.0 Monitoring Of Resources

Baseline data on archaeological sites, arthropod fauna, and flora present in the summit area of the Science Reserve was obtained during special surveys by the Bishop Museum in conjunction with the development of the SRCDP. Discussions have been held with DLNR personnel concerning the possibility of DLNR specialists periodically monitoring these resources to determine if increased human activity has led to serious degradation of the summit ecosystem.

It has been suggested that one means of accomplishing this monitoring function would be to establish photo stations from which pictures could be taken at regular intervals and then analyzed and evaluated to determine if adverse impacts have occurred. This suggestion is being evaluated and may be incorporated into this Management Plan.

Regulations promulgated in conjunction with the Management Plan will address issues such as disturbance of historical sites and removal of vegetation from the area. These regulations will be enforced by UH security personnel.

3.0 On-Going Monitoring System

Monitoring of visitors should not only be concerned with checking them in and educating them to upslope hazards, but should also provide information relating to usage of the mountain. Some suggested methods of monitoring are:

(a) Direct Observation: This includes careful noting of where and how travel at and around the summit is accomplished and incidents of violations of regulations. Number of warnings to violators, number of citations issued by type of violation, and number of people asked to leave the mountain are examples of indicators which could be used to identify problem areas so that more appropriate controls and regulations could be initiated.

(b) Turn In and Mail Back Questionnaires: Visitors who register at the Information Station could be given a questionnaire to turn in on their way down the mountain or mail back in a stamped envelope provided them. They could be asked to provide demographic information, information on purpose and length of trip, and impressions of their experiences. Complaints are also an important indicator of visitor satisfaction with their experience.

(c) Mail Survey: Users of the mountain who obtain annual or semi-annual permits (such as hunters) and visitors who register at the Information Station, can be mailed questionnaires periodically. Their responses can be used to evaluate the successes and failures of the management plan.

(d) Contacting Local Groups: Local groups on the Big Island who frequently travel to the summit can be asked to comment on various aspects of the management activities at the summit. Key people in the County can also be interviewed to obtain their impressions of the effectiveness of summit management.

M. MANAGEMENT COMMITTEE

The most important requirement of an on-going monitoring system is that the data be summarized at regular intervals, at least quarterly, so that additional controls can be initiated before extensive damage to the environment has occurred. A management committee, advisory to UH, with membership consisting of representatives from UH, the County of Hawaii, DLNR should be established by UH. This committee should meet regularly and forward their recommendations to UH for appropriate action concerning control of access and management of resources in the UH Management Areas..

N. IMPLEMENTATION STRATEGIES/PHASING

UH has suggested the following schedule for implementation of management controls for areas upslope from Hale Pohaku:

Phase I:

UH will obtain funds to staff and furnish the Information Station to include exhibits of attributes of the mountain, pamphlets, and personnel to talk to visitors and warn them of the hazards upslope. For the first phase, one person will be on-duty during daylight hours seven days a week. It is assumed that most first-time visitors will stop at the Information Station. Usage will be monitored so that when warranted, Phase II can be implemented. During this phase, permitting of approved vehicles could also be initiated.

Phase II:

In addition to the person on-duty at the Information Station, additional positions will be funded as necessary for security personnel to patrol the upslope areas, enforce regulations, and insure that visitors do not get "in-trouble" due to high altitude and inclement weather.

Phases III and IV:

Additional security positions will be provided as warranted and as funds become available. If demand warrants it, a summit shuttle could be instituted and run by a concessionaire.

O. SUMMARY

The Management Plan has been designed to allow for flexible enforcement of access and control of uses. If evaluation of the results of periodic monitoring indicate that more stringent restrictions are necessary to protect the resources at the summit, these will be considered by UH and DLNR. UH has agreed to assume the responsibility of managing the mountain and obtaining the funds necessary to support the access control effort. They will request the cooperation of the DLNR and the County of Hawaii in assisting them to update the plan and enforce its provisions. Rules and regulations pertaining to UH management areas will be promulgated upon adoption of the Plan. It is anticipated that all applicable DLNR regulations will be incorporated into these rules.

This Plan, as presented in the draft EIS, has not been finalized. Comments and suggestions received during the review period of the EIS process are welcomed, and will be considered and incorporated into the plan.

PART V: DESCRIPTION OF THE ENVIRONMENT

A. GENERAL

1.0 Region

The island of Hawaii is the youngest and the largest of the Hawaiian Islands. Commonly referred to as the Big Island, it is composed of five volcanoes. The Big Island has a diverse climate and topography, with environments ranging from dense tropical forests to the snow covered peaks of Mauna Kea and Mauna Loa. The island of Hawaii is located approximately 200 miles southeast of Oahu (Figure 15). Oahu contains the State capital of Honolulu, and approximately 80% of the state's population.

Hawaii's largest city, Hilo, is located on the island's eastern coast, and is approximately a 1-1/2 to 2 hour drive away from the summit of Mauna Kea. The University of Hawaii has a four-year campus in Hilo.

2.0 Mauna Kea

The summit of Mauna Kea is the highest point in the Pacific basin. Mauna Kea is one of the two most voluminous volcanoes in the world, the other being its sister peak, Mauna Loa. It rises 30,000 feet from the ocean floor to the summit and the highest of its cinder cones (Puu Wekiu) towers 13,796 feet above sea level. The seasonally snow-covered slopes of Mauna Kea above the 10,000-foot elevation are used for skiing and snow play.

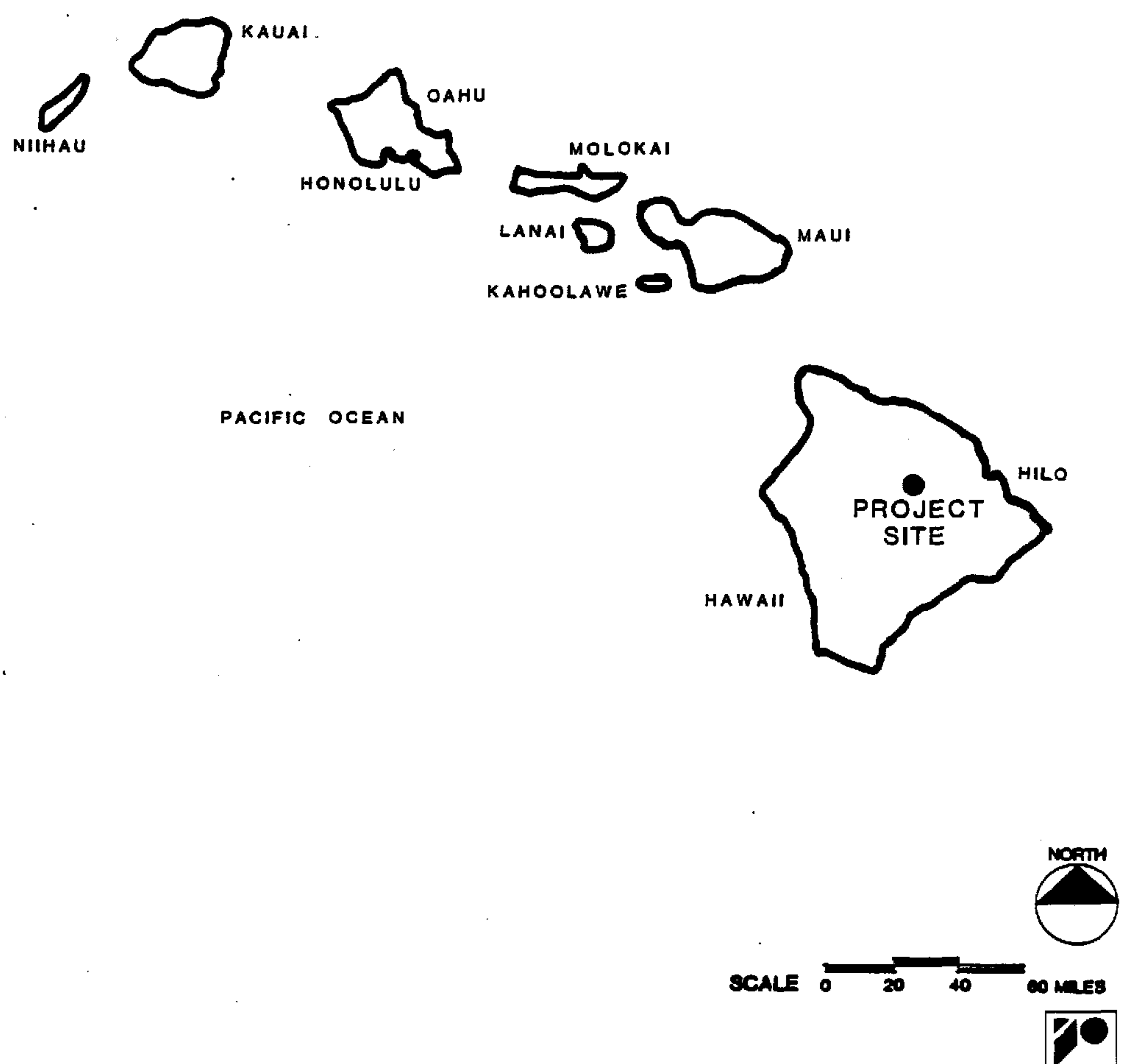
The summit of Mauna Kea is recognized as one of the finest sites in the world for astronomical research, because the skies above it are very dry, clear and dark. There are six telescopes at the summit at the present time. Mid-elevation facilities for astronomers, technicians and maintenance personnel are located at Hale Pohaku at the 9,200-foot elevation.

The mountain's unique natural and historical features makes it an ideal site for scientific field research. Endemic, and in some cases, indigenous plants and birds, are found between the 6,000-foot elevation and the summit. Over 30,000 acres of the Mamane/Naio forest area of the mountain have been designated as the critical habitat of the rare and endangered Palila, Psittirostra bailleui, (Federal Register, August, 1977). (Figure 3). Hunting of large game mammals and game birds is a traditional use within and on the perimeter of the Mamane/Naio Forest. Hiking, sightseeing and photography are also popular uses of the mountain.

The Pohakuloa Training Area encompasses a small portion of the lower slopes of the mountain below the Mamane/Naio forest and is used primarily for military operations in accordance with lease arrangements between the Army and the Board of Land and Natural Resources.

3.0 Mauna Kea Science Reserve

The Mauna Kea Science Reserve (Figure 2) is located on conservation land owned by the State of Hawaii and is under the jurisdiction of the Board of Land and Natural Resources (BLNR). Since January 1, 1968, the BLNR has leased all lands above the 12,000-foot elevation to the



STATE MAP

MAUNA KEA SCIENCE RESERVE CDP — FIG.15

University of Hawaii for 65 years. The lease refers to these lands as the Mauna Kea Science Reserve. The Reserve was established 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." (General Lease No. S-4191). The leased area is basically circular in shape, having a radius of 2.5 miles and encompasses over 13,000 acres, not all is suitable or appropriate for astronomical use. Much of it was intended to serve as a "buffer zone" to protect installations in the summit area.

B. DESCRIPTION OF THE EXISTING PHYSICAL CHARACTERISTICS

1.0 Geology

Mauna Kea is the only Hawaiian volcano known to possess a record of Pleistocene glaciation. Glacial sediments are interstratified with volcanic rocks on the upper slopes of the mountain. The striae, boulders, polish and grooves are evidence of as many as four periods of glaciation, interspersed with diminishing volcanic activity.

The rocks of Mauna Kea have evolved to a relatively mature stage. The most recently erupted rocks possess higher alkali and silica contents than the basalts which comprise the main mass of the volcano. Mauna Kea has been dormant for at least 3,500 years although occasional weak seismicity and the general evolutionary characteristics do not preclude future eruptions. The subaerial portion of Mauna Kea has been dated at least 315,000 ± 50,000 years.

"The lava flows on top of Mauna Kea consist of massive andesite, generally of the variety called Hawaiite. Basically these flows are of the aa type, but the lavas were more viscous than similar flows composed of the basaltic materials that are common throughout the Hawaiian Islands. The flows tend to be on much flatter gradients than the cinder cones and the surface of the flows is typically very uneven. Aa flows are characterized by a core of dense rock overlain and underlain by volcanic clinker. Clinker fragments typically are on the order of 3 inches and are very rough textured. The core is also greatly variable in thickness so that lateral contacts between rock and clinker are frequent."

"The cinder cones are composed of volcanic ash and cinder which have locally been weakly cemented to varying degrees and may be interbedded with other volcanic materials such as splatter, volcanic bombs and other ejecta. Competent rock may exist at depths shallow enough to provide support for deep foundations. The ash and cinder frequently are loosely packed and have low densities. They exhibit low crushing strength and high permeability. Natural angles of repose tend to vary between about 34 and 45 degrees, depending upon the grain size distribution and apparent cementation. The slopes of the cinder cones tend to be somewhat flatter that these inclinations. Permafrost layers may exist within the cinder cones, but if present, are not expected to be encountered by any construction." (Dames & Moore)[3]

1.1 UC 10-Meter Telescope Site

The cinder cone west of Puu Hau Oki (the proposed site for UC TMT) is classified as being tephra with bomb-rich dark gray cinders and coarse ash. Solifluction lobes and stone stripes are common along the flank of cones. The north flank of Puu Hau Oki is thought to have been locally modified and steepened by glacial erosion.

1.2 UK/NL Millimeter-Wave Telescope Site

The UK/NL MT is located at the base of Puu Poliahu. Puu Poliahu is composed largely of varicolored bomb-bearing hyaloclastite capped by bomb-bearing cinders. Flows in the valley between Puu Poliahu and Puu Wekiu, are commonly polished and striated along their crests and are mantled with rubbly colluvium along swales. Flow margins typically display glassy surfaces and pillowlike structures as much as 3 meters in diameter that have pronounced radial jointing. The features are indicative of ice contact at the margins of the flows.

The site for the proposed UK/NL MT has been interpreted to be an aa lava flow which vented in the vicinity of the site and flowed primarily northwest. The flow surface has been subject to subsequent galciation and the original flow paths of the lava are obscured. This aa flow overlies a slightly older flow which also moved to the south and southwest.

"The surface of the site is covered with volcanic ejecta consisting of gravel, cobbles and boulders with ash. The hill at the southern end of the site, where the telescope structure is to be located, is reported to be a vent through which most of the ejecta was generated. A second and smaller hill at the northwest edge of the site is also reported to be a vent source. The cobbles and boulders are semi-rounded and are generally porous and of low density. The hill at the southern end of the site is topped off with several feet of welded spatter or a thin flow of porous basalt." (Harding and Lawson)[4]

1.3 Hale Pohaku and Lower Slopes

"Cinder cones and associated tephra layers along the south rift zone of Mauna Kea accumulated during the explosive eruptions of alkalic rocks during the late Quaternary Period . . . The tephra succession on Mauna Kea includes many distinct layers that were erupted over a considerable span of time from a large number of vents . . . Exposed deposits are thickest and most widely distributed along the road to the Summit between the Humu'ula Sheep Station and Hale Pohaku, through a broad belt east and west of Hale Pohaku, and in a large Kipuka downslope from Puu Oo . . . Puu Hawaihine is one of the most massive cinder cones on the south flank of Mauna Kea and produced a thick and extensive blanket of tehra that is distributed mainly east of the cone (towards Hale Pohaku). It underlies much of the ground surface between Puu Hawahine and the Hale Pohaku flow and is exposed in most roadcuts and natural outcrops within a 2-KM radius of Hale Pohaku (Porter, 1973)."[5]

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Rubbly hawaiite aa flows which crop out mainly along the south and southwest sides of the volcano can be seen between the summit and Hale Pohaku. Below Hale Pohaku, between the mid-level facility and the Saddle Road, the aa flows are locally overlain by tephra. There are also postglacial stream sediments, largely gravelly sand or sandy gravel with a variable composition that reflects local bedrock.

2.0 Hazards

Mauna Kea has progressed to a later stage in its volcanic life cycle, a stage characterized by short and stubby flows, larger and more numerous cinder cones and less frequent eruptions. Based on the infrequency of its eruptions in the recent past, the probability of Mauna Kea erupting in the next several decades is very low. If Mauna Kea does erupt again some time in the future, its eruptions will likely be of the explosive type that produces abundant blocks and ash that cover areas near the eruptive site with large and small fragments.[6]

Mauna Kea, and the entire island of Hawaii, is located in Earthquake Zone 3 (on a scale of 0 - 3, this is in the zone of highest seismic occurrence and danger). All construction work is subject to provisions of the "Uniform Building Code" which requires that all structures be designed and constructed to meet Zone 3 requirements.

In 1966, Dames & Moore performed a scientific investigation of the summit for the University of Hawaii in order to determine whether observatory operations would be feasible there. They concluded that an observatory could operate successfully with a foundation system designed to minimize the magnitude of ground vibrations transmitted to the telescope.[7]

3.0 Topography

3.1 Mauna Kea Science Reserve

The Mauna Kea Science Reserve includes a number of cinder cones of varying sizes and shapes along the rift zones that descend from the summit. Slopes in the area vary from flat plateaus to close to vertical slopes on the cinder cones. Puu Wekiu, the summit cinder cone, rises several hundred feet above the surrounding lava plateau. Both the inner and outer slopes of this cone average about 28 degrees.

3.2 UC 10-Meter Telescope Site (Puu Hau Oki)

UC's proposed site, is on a flat portion on the highest point of Puu Hau Oki, elevation 13,625 feet.

3.3 UK/NL Millimeter-Wave Telescope Site

The proposed site for the UK/NL millimeter telescope is on a relatively flat area at the base of Puu Poliahu at an elevation of 13,396 feet. The hill at the northwest edge of the site is approximately 10 feet higher than the larger hill at the southern end of the site. The site slopes east from these hills at about 10:1 (horizontal/vertical) for approximately 150 feet. The slope then gradually steepens to about 3:1. West of the southern hill, the surface slopes away at about 10:1. A steep 2:1 slope lies just south of the site.[8] The groundslope towards Lake Waiau in the area is very gentle, only about 7/10 of 1 percent.

3.4 Hale Pohaku and Lower Slopes

Hale Pohaku is located between the 9,200- to 9,300-foot elevation. Slopes vary from ten to fifteen per cent west of the existing water tanks, while slopes to the east are as steep as fifty percent. The average slope of the existing developed area is twelve percent.

The County road to the summit branches off Saddle Road at the 6500-foot elevation. It varies in slope from five to fifteen degrees as it ascends to the 13,796 foot summit. A general description of the topography of the proposed permanent powerline between the Saddle Road and Hale Pohaku is found in PART VIII.

4.0 Climate

4.1 Precipitation

Precipitation at the summit averages approximately 15 inches annually, most of which is in the form of freezing fog or snow. Snowfalls are more common during the cooler half-year (October to April). Records kept by the University of Hawaii, Institute for Astronomy show that between April 1 and December 1 weather only causes minor interruptions in working schedules and then mostly because of high winds. From December through March, however, storms have in the past deposited several feet of snow on the summit, occasionally down to 9,000 feet. Snow in the summit area can cause schedule disruptions due to the difficulty of removing it from the road. Major snowfalls which have caused blockage of the summit road have occurred in at least seven of the past ten years. The winter of 1982 has been particularly severe with 10 road closings between January and March.

Records of rainfall show that Hale Pohaku averages approximately 25 inches annually, with the wettest months being November through March. Measurements of rainfall at Pohakuloa, near the Saddle Road, show the mean monthly rainfall for the area ranges from one to five inches.

4.2 Temperature

The temperature at the summit of Mauna Kea is relatively mild for its elevation. During most of the year, the mean temperature is a few degrees above freezing. The highest and lowest air temperatures ever recorded through 1973 were 18°C and -13°C respectively. The extremes in monthly average temperature ranges from 11°C maximum to -4°C minimum.

Existing data indicate that temperatures at Hale Pohaku range from the 30's (Fahrenheit) to the mid-70's (Fahrenheit).

4.3 Wind

Winds at the summit follow a diurnal pattern of prevailing west/northwest daytime and east/southeast nighttime wind direction. Wind velocity usually ranges from 10 to 30 miles per hour but typically between 10 and 15 mph. During severe winter storms, winds occasionally exceed 100 miles per hour on exposed summit areas such as the top of cinder cones.

The following table shows the average daily temperature and nighttime wind velocities at the Mauna Kea Summit as compiled by Morrison, Murphy, Cruikshank, et. al.

AVERAGE DAILY TEMPERATURE AND NIGHTTIME WIND VELOCITIES

Month	T_{max}(°C) (1965-69)	T_{min}(°C) (1965-69)	Nighttime Wind Speed (mph) (1965-69)
Jan	3	-4	11
Feb	3	-4	20
Mar	5	-1	17
Apr	5	-3	24
May	5	-1	17
Jun	10	0	15
Jul	10	0	15
Aug	11	-1	13
Sep	11	+1	13
Oct	10	0	15
Nov	6	-3	13
Dec	3	-4	19

Source: D. Morrison, R.E. Murphy, D.P. Cruikshank, W.M. Sinton, and T.Z. Martin, "Evaluation of Mauna Kea, Hawaii, as an Observatory Site", Publications of the Astronomical Society of the Pacific, Vol. 85, No. 505, (June 1973): 255 - 67.

Prevailing winds at Hale Pohaku and at the Saddle Road are from the northeast and are characterized by occasional strong to heavy gusts.

5.0 Air Quality

The summit area is well above the 7,000-foot temperature inversion layer as this layer limits the vertical convection transport of aerosols (particulates, including dust, salt particles, water droplets and man-made pollutants) and thus these aerosols do not cause any particular problem as long as they are generated below the inversion level. Atmospheric pollutants at the summit of Mauna Kea are generally locally generated by exhausts from automobiles, trucks and the existing diesel generator and by travel over unpaved roads.

There has been no monitoring of air quality at Hale Pohaku. Because it, too, is located above the inversion level, atmospheric pollution in the area will generally be locally generated and minimal when not dispersed by the predominent winds.

Along the Saddle Road, dust and hydrocarbon emissions are introduced into the air from vehicles traveling on the road. In the portion of the Saddle Road that crosses through the Pohakuloa Training Area (PTA) there are additional emissions from blank and live ammunition, pyrotechnics, demolition materials and simulators. However, due to the prevailing trade winds, these emissions are usually rapidly dispersed.[9]

6.0 Hydrology and Permafrost

6.1 Surface Water

The only perennial surface water present on the summit, except that trapped within the crater of Puu Pohaku, is Lake Waiau, a small body of water in the crater of Waiau cone, located at approximately the 13,020 foot elevation. The lake is approximately 240 feet in diameter and 8 feet deep at overflow stage.[10] Its origin is considered to be due to either: (1) water ponding above a permafrost layer or, (2) water perched above hyaloclastitic tuff which occurs in the base portions of Puu Waiau. The water of the lake is greenish-blue in color and is somewhat cloudy. The lake is believed to be fed mainly by snow melt. [11]

Woodcock (1980) presents groundwater and surface water level data for the waters of Puu Waiau crater and lake over 13 years. Groundwater levels from piezometers along the south and east margins of the lake indicate primary flow into the lake from the east (groundwater measurements along the north and west margins of the lake are not available). This water moves through the lake and out to the southwest feeding Pohakuloa Gulch.

A chemical water quality analysis was conducted by the U.S. Department of the Interior, Geological Survey in 1978. The data is reproduced in Appendix E.

The biological water quality of Lake Waiau follows an annual cycle from which some inferences can be made regarding groundwater flow, as follows:

"1. In summer, the lake level drops and an upward head from groundwater beneath the lake sediments tends to circulate nutrients up into the water column. A phytoplankton bloom results.

2. In spring, melt water fills the lake, and curtails the bloom. During recent drought conditions (about six years ago), however, this bloom was extreme due to the low volume of melt waters which failed to check the biological activity during the spring thaw. It has taken to 2 to 3 years for the lake to begin to

re-establish its normal cycle. This indicates that natural variations of water flow and significant natural biological activity do occur within Lake Waiau." (Woodcock)[12]

The influence of an array of physical and chemical factors on diatom populations and phytoplankton productivity in Lake Waiau was studied by Jane Ellen Massey and reported in her dissertation for Doctor of Philosophy in Botanical Sciences, May 1978.[13]

6.2 Groundwater

Because of the very limited precipitation and high permeability of the soils at the summit, "the only groundwater known to exist consists of perched water in the center of some of the cones, including the area immediately east of Lake Waiau (Woodcock, 1974, 1980). Borings for existing telescopes did not encouter groundwater." (Dames & Moore, Appendix E)

"No water table is known to exist anywhere in the vicinity of Hale Pohaku, nor are any groundwater supplies developed in the vicinity." (Dames & Moore, Appendix E)

6.3 Permafrost

Permafrost is known to have been identified in only two locations, Puu Wekiu (the summit cone crater) and Puu Goodrich, both sheltered portions of cinder cone craters. "Woodcock and Friedman (1979) speculate that permafrost might exist 60 meters below the top of the Summit Cone, and Woodcock (1981) speculates that permafrost may underlie the groundwater body east of Lake Waiau, (but not <u>under</u> Lake Waiau). In general, the climate on Mauna Kea is considered to be slightly too warm for permafrost, and whether the few permafrost bodies are modern or relics of the last ice age is uncertain. Thus, it appears highly unlikely that a permafrost layer exists at any locations but few very local, special ones. . . Borings for the foundation investigations for new telescopes will explore the subsurface and reveal the presence or absence of permafrost to the depths observed. No borings for existing facilities are known to have encountered permafrost." (Dames & Moore)[14] No permafrost is expected to exist outside of the Science Reserve area.

C. DESCRIPTION OF THE EXISTING BIOLOGICAL CHARACTERISTICS

1.0 Vegetation

1.1 Summit

Lichens and bryophytes are the principal components of the flora at the summit of Mauna Kea. The climatic conditions at that altitude tend to be so severe as to exclude most higher plants; the lichen and bryophyte flora are known to be very sparse on the Mauna Kea summit. The Bishop Museum Department of Botany, has conducted a botanical survey of the summit area of Mauna Kea (Appendix G). A discription of the vegetation of the summit as reported by these scientists follows:

1. One alga that was seen was a snow alga, Haematococcus sp., which stains the snow a blood red. Small patches were located on almost every snow bank investigated.

2. No liverworts were found in the study area. This result is not surprising because the majority of these organisms are mesic or humic in their ecological preference.

3. Approximately 12 species of mosses were collected in the summit area. Less than a quarter of the species are endemic. From a bryological viewpoint, the mosses and suitable niches are widely dispersed over the summit area.

Andreaea acutifolia Hook. f. and Wils.
Amphidium tortuosum (Hornsch.) Robins.
Bryum caespiticum Hedw.
Bryum hawaiicum Hoe
Grimmia sp.
Grimmia apocarpa var. pulvinata (Hedw.) Jones
Grimmia cf. pilifera P. Beauv.
Pohlia cruda (Hedw.) Lindb.
Pohlia cf. mauiensis (Broth. ex Bartr.) Schltze-Motel
Tortella humilis (Hedw.) Jenn.
Zygodon tetragonostomus A. Br.

4. There are approximately 25 different lichen species in the study area. Approximately half of the determined species are endemic to Hawaii. Two lichens, Pseudephebe pubescens and Umbilicaria pacifica are confined to Mauna Kea. The two other species of Umbilicaria could also be unique to Mauna Kea.

Acarospora depressa Magn. apud Malme
Acarospora pyrenuloides Magn.
Acarospora sp.
Bacidia sp.
Caloplaca lithophila Magn.
Candelariella insidiata Magn.
Candelariella vitellina (Ehrh.) Muell. Arg.
Lecanora melaena (Hedlund) Fink
Lecanora muralis (Schreb.) Rabh.
Lecidea skottsbergii Magn.
Lecidea vulcanica Zahblr. in Magn. & Zahlbr.
Lepraria spp.
Physcia dubia (hoffm.) Lett.
?Placopsis sp.
Pseudephebe pubescens (L.) Choisn.
Rhizocarpon geographicum var. hawaiiensis Raes.
Rinodina cf. cacuminum (Th. fr.) Malme
?Rinodina interrupta Magn.
Umbilicaria hawaiiensis Magn.
Umbilicaria magnussonii Llano
Umbilicaria pacifica Magn.

5. Six species of vascular plants belonging to 3 different families were collected within the Science Reserve Study Area at the summit of Mauna Kea. The species of Agrostis, Trisetum, and Cystopteris found at the summit are endemic to Hawaii. Agrostis sandwicensis and Trisetum glomeratum are also common at lower elevations on Mauna Kea. Cystopteris douglasii is known only from a few high altitude localities in Hawaii. The species of Hypochaeris, Taraxacum and Aspelenium are common temperate plants with world-wide distribution. Fragments of other plant species (1 grass, 1 legume) were collected from the study area but live plants were never found. These fragments were probably blown up to the summit by wind.

PTERIDOPHYTA (ferns)
Asplenium adiantum-nigrum L.
Cystopteris douglasii Hooker

POACEAE (grass family)
Agrostis sandwicensis Hbd.
Trisetum glomeratum (Kunth) Trin. in Steud.

ASTERACEAE (daisy family)
Hypochaeris radicata L.
Taraxacum officinale Weber in Wiggers

6. The summit of Mauna Kea is not a unique habitat essential for the survival of any of the flowering plants growing there.

1.2 Hale Pohaku

The State Department of Land and Natural Resources, Division of Forestry and Wildlife Endangered Species Program, conducted a botanical survey of Hale Pohaku in October 1981. Their general description of the vegetation at Hale Pohaku follows:

> "The vegetation of Hale Pohaku is composed of an open mamane (Sophora chrysophylla) forest with scattered native shrubs and sparse ground cover dominated by endemic and introduced grasses. Two subspecies of mamane were observed in the area: S. chrysophylla subsp. glabrata var. ovata f. maunakeaensis and S. chrysophylla subsp. and var. circularis, a candidate for endangered status. Hinahina (Geranium cuneatum var. holoeucum) and 'aheahea (Chenopodium oahuense), two endemic shrubs of occasional occurance, generally grow in the proximity of mamane trees. The hinahina, a low rounded shrub with silvery leaves, is listed as a candidate endangered taxon. Four different taxa of native mint vines were frequently seen growing under mamane trees and often climbing into their canopies; these are Stenogyne microphylla, S. diffusa var. glabra, S. rugosa subsp. subulata var. nov., and S. rugosa. The first three of these mints are candidates for listing as endangered species. Grasses are an important component of the ground cover of this forest with the endemic bunchgrasses Deschampsia australis and Trisetum glomeratum and the exotic Stipa cernua most numerous. Other grasses and forbs of frequent occurrence are Kentucky bluegrass (Poa pratensis), hairy oatgrass (Danthonia pilosa),

ripgutgrass (Bromus rigidus), and sheep sorrel (Rumex acetosella); these exotics are commonly found beneath mamane trees. Another prominent component of the ground cover is the common mullein (Verbascum thapsus), an introduced rosette-shaped plant which grows in bare soil throughout the site.

Tentative identifications of the rare plant sightings include 5 taxa listed in the 15 December 1980 Federal Register as candidates under the review for threatened or endangered protective status, and an additional taxon which may prove to be rare pending further identification. A list of the taxa, their status, and the approximate number of individuals or patches follows:

Geranium cuneatum var. *hololeucum*	Listed	19 individuals
Sophora chrysophylla subsp. *circularis* var. *circularis*	Listed	61 individuals
Stenogyne diffusa var. *glabra*	Listed	15 patches
Stenogyne microphllya	Listed	76 patches
Stenogyne rugosa subsp. subulata var. nov.	Listed	123 patches
Stenogyne rugosa	Not listed	15 patches

Mamane is the major food source of a number of bird species, including the endangered Palila. The clumps of mamane are also important because they act as fog interceptors to provide themselves, and other species associated with them, with the small amounts of moisture they need for survival. In addition, the Sophora clumps help prevent the ash soil under them from being carried away by winter storms.

Over a century and a half of grazing and browsing by feral animals has resulted in the substraction of species from the "sophora parkland" community. This historical excessive disturbance to vegetation and soil has resulted in increased evapo-transpiration, causing a change in the understory conditions at Hale Pohaku from moderately moist to deficient in moisture. Increased and continued human activity at Hale Pohaku in recent years and programs to eradicate the animals has brought about a decline in feral animal pressure and consequently the mamane in the area are rejuvenating. Regeneration of mamane at Hale Pohaku could be described as "fair to good".

The reader is also referred to a botanical survey of Hale Pohaku, conducted by Grant Gerrish, which was included in Appendix B of the Hale Pohaku Mid-Elevation Facilities Master Plan Revised Environmental Impact Statement (February 1980).

1.3 Permanent Powerline

Descriptions of the vegetation in alternative powerline corridors, based on the U. S. Fish and Wildlife Service preliminary draft vegetation distribution maps, are found in PART VIII.

2.0 Fauna

2.1 Summit

Recent biological investigations of the summit area have resulted in the identification of a neogeoaeolian ecosystem (an aeolian ecosystem on young, unvegetated lava flows) on Mauna Kea. One true bug, a highly aberrant new species of the world wide genus Nysius, was recently discovered at the summit. The habitat of this new bug is most commonly found under large boulders and among cinders. Dr. Francis G. Howarth of the Bishop Museum, conducted a general zoological inventory of the area within the Mauna Kea Science Reserve (Appendix H). The major component of the fauna of the aeolian ecosystem on the summit is composed of arthropods such as spiders, moths, mites, springtails, centipedes, booklice, barklice, and true bugs. There are no officially designated endangered species of arthropod fauna present at the summit.

Dr. Howarth reported the following findings in his preliminary draft report (August 1982); since this section of the EIS was written before receiving his final report, the information listed below may be incomplete.

ACARI (mites)
- Species a: family Anystidae
- Species b: family Eupodidae
- Species c: family Phytoseidae
- Species d: family Laelapidae
- Species e: unknown family

ARANAE (spiders)
- Erigone species A: family Linyphiidae
- Erigone species B: family Linyphiidae
- species ?: family Linyphiidae
- Lycosa species: family Lycosidae

CHILOPODA (centipdes)
- Lithobius species: family Lithobiidae

COLLEMBOLA (springtails)
- Two of the species are Entomobryoides, the third species has not been identified.

PSOCOPTERA (booklice and barklice)
- Species undetermined:

HEMIPTERA (true bugs)
- Nysius species: family Lygaeidae
- Species Geocoris pallens: family Lygaeidae

LEPIDOPTERA (moths)
- Archanarta species: family Noctuidae

2.2 Hale Pohaku and Lower Slopes

Passerine Birds: An avian survey of Hale Pohaku, conducted in July 1979 by Maile Stemmerman, was included in its entirety as Appendix C of the Hale Pohaku Mid-Elevation Facilities Master Plan Revised Environmental Impact Statement. Nine bird species were seen at Hale Pohaku or in the immediate vicinity during the two-day survey; these included:

Francolinus erckelii	Erckel's Francolin
Lophortyx californicus	California Quail
Zosterops japonicia	White eye
Leiothrix lutea	Red-Billed Leiothrix
Loxops virens	'Amakihi
Himatione sanuinea	'Apapane
Carpodacus mexicanus	House Finch
Passer domesticus	House sparrow

All but two of the species were exotic. Several species were absent in spite of their known presence in the area. There are three major reasons for this:

a) Many species (including the Palila) are less vocal and less obvious during the breeding season;

b) Breeding activity affects the distributions of some species as well as their detectability; and,

c) Some species (such as the Apapane Himatione sanguinea, 'I'iwi Vestiaria coccinea, and, Palila Psittirostra bailleui) are more specialized in their food source than others and may be expected to leave an area when plants no longer supply adequate amounts of their preferred foods. For instance, the site did not have significant amounts of blooming or seeding mamane, the preferred food source of the 'I'iwi and the Palila.

The Palila (Psittirostra bailleui) is a small bird of the Hawaiian honeycreeper family (Drepanididae), and was listed as a endangered species since 1966. Mamane trees provides most of the food, shelter and nest sites for the Palila. Because this endangered species is dependent on the green pods and flowers of the mamane, and because the mamane flowers sporadically on the mountain slopes, it was necessary to include, within this habitat, forest land that encompasses most of the Palila's known historic range on Mauna Kea. Over 30,000 acres of the Mamane/Naio forest area of the mountain have been designated as the critical habitat of the endangered Palila encompassing Hale Pohaku and extending above it to the 10,000-foot level. This designated area was established on August 11, 1977 because its habitat was being adversely modified by the browsing of feral sheep on mamane trees. The nesting season for the bird usually starts in the late spring and lasts from five to six months.

While there are very few published sightings of the Palila at Hale Pohaku, it does not mean that the species does not feed or breed there. Human habitation at Hale Pohaku discourages the browsing of feral animals, which is proven by the strong, healthy condition of the mamane trees nearby. This would make Hale Pohaku a potentially excellent habitat for the Palila, however, since the species is so rare, very few nest have ever been found anywhere within its habitat.

Another species or subspecies currently on the Federal List of endangered species that is presumed to inhabit the area is the 'Ua'u. The Hawaiian Dark-Rumped Petrel or 'Ua'u (Pterodroma phaeopygia sandwichensis) is an endangered endemic subspecies which was recently rediscovered at Haleakala, Maui and on Lanai. The 'Ua'u is historically endemic to the major Hawaiian Islands. No essential habitat has been designated for this bird.[15] Earlier reported to nest between 1,500 and 5,000 feet on Mauna Kea, it now appears that the 'Ua'u only digs its burrows at higher sites where the predator population is less dense. However, none were sighted in the course of a U.S. Fish and Wildlife Service terrestial bird survey or during a specific one-day survey for the 'Ua'u conducted on Mauna Kea. A draft of a Recovery Plan for the "Hawaiian Dark-Rumped Petrel and Newell's Shearwater",[16] is in the process of agency review. Preliminary recommendations note predator control as the key to removing the species from endangered status.

Game Birds: Hunters and State Fish and Game officials report that the chukar partridge, Alectoris chukar, and the california quail inhabit the area. The primary habitat of the chuckar partridge is at tree line and higher, on bare rocky slopes. The chukar feeds primarily on gosmore, ohelo and pukiawe. The california quail feeds on seeds from sweet vernal grass, common thistle, gosmore, sheep sorrel and mamane.

Mammals: The Hawaiian Hoary Bat (Lasiurus cinereus semotus) is an endangered species (Federally-listed) that exists primarily on the island of Hawaii. The bat is the only land mammal indigenous to the Hawaiian Islands. Sightings have also been reported on Oahu, Maui, and Kauai. The bats apparently prefer habitats of open or mixed character and venture consistently out over the open ocean. Bats have been most commonly seen from sea level to 4,000 feet.[17] None have been observed in the summit area.

The area is inhabited by feral pigs (Sus scrofa), cattle, mouflon sheep (Ovis musimon), and possibly small numbers of feral sheep (Ovis aires) and feral goats (Capra hircus). It is presumed that other small mammals such as the house mouse (Mus musculus), black rat (Rattus rattus) and mongoose (Herpeste auropunctatus) also inhabit the area.

D. NATURAL AND ARCHAEOLOGICAL FEATURES

1.0 National Natural Landmark

Mauna Kea has been designated as a National Natural Landmark and is listed in the National Registry of Natural Landmarks. In spite of the listing, Mauna Kea, among other landmarks also designated, is not a registered landmark, since the Board of Land and Natural Resources has not officially agreed to that designation.

2.0 Mauna Kea Ice Age Natural Area Reserve

The Mauna Kea Ice Age Natural Area Reserve is located between the elevations of 10,400 and 13,200 feet (Figure 3). It extends into a portion of the summit area that is leased to the University of Hawaii as the Mauna Kea Science Reserve. The Natural Area Reserve designated for the area described was approved by the Board of Land and Natural Resources on November 9, 1978. A Conservation District Use Application permit for the area was approved by the Board in 1981. On November 16, 1981, the Governor signed an Executive Order establishing the Mauna Kea Ice Age Natural Area Reserve.[18]

The main ice age features located in the reserve are Pohakuloa Gulch (formed by glacial meltwater), glacial moraine and meltwater deposits of fine sediments (present down to the 10,500 foot elevation), and the glacially sculptured features of cinder cones and lava flows. Lake Waiau, one of the highest lakes in the United States, and the Keanakakoi Adz Quarry, an ancient Hawaiian Historic Place, are other features of the Reserve.

The Keanakakoi Adze Quarry is located within the Natural Area Reserve at the 12,400 foot elevation. The quarry site is listed on the National Register of Historic Places. There are a variety of ancient Hawaiian culture remains, dating back to about 1,000 A.D., that are scattered throughout this quarry. These include religious shrines and rock shelters of different types, which were established in conjunction with a series of adze (tool) quarries and workshops.[19]

"The Mauna Kea Adze Quarry is probably one of the nation's least known but most important National Historic Landmarks, from both a research and interpretive point of view. It is the only landmark of its kind in the United States. Moreover, it is probably one of the largest and most complex stone tool quarries in the world." (McCoy 1976)

The site was a very important and extensive center of Hawaiian adze manufacturing. Scientists at the Bishop Museum have been collecting information about the process of obtaining raw material and of the manufacture of this important class of stone tools. During their survey, excavations, and analysis of the Quarry they found the first evidence of Hawaiian rock art on the upper slopes of the volcano. There was also evidence of intermittent, short-term habitation in the numerous rockshelters including artifacts and well preserved food remains.[20]

3.0 Archaeology

3.1 Summit

An archaeological survey was conducted by Dr. Patrick McCoy of the Bishop Museum during 1982 within the Science Reserve. This reconnaissance survey covered the areas identified as potential siting areas for astronomical developments to the year 2000, including approximately 1000 acres of land on the summit and north slope of the mountain, down to the 13,000-foot contour. The archaeological survey is incorporated in this EIS as Appendix A.

A total of 22 archaeological sites were recorded in the survey. All but two of the total 22 sites are located on the north slope below the summit cones. All but one site, an open air shelter, were classified as "shrines", as a convenient term to designate a simple altar without a prepared court. They are characterized by the presence of one or more upright stones. In a number of instances they were simply set up on the surface of an outcrop and are braced by a few stones. The platforms and cairns are distinguished by stack-stoned construction. In contrast to the structures found at the Keanakakoi Adze Quarry, the functions of the 21 shrine(s) is unknown. No offerings were found at any of the 21 sites.

3.2 Hale Pohaku and Lower Slopes

Archaeological reconnaissance surveys of Hale Pohaku, Humuulu, and a site on Hawaiian Homelands just below the forest reserve were conducted by Dr. McCoy in conjunction with the Hale Pohaku Master Plan. He found no archaeological or historic sites at any of the locations. He stated that the high elevations and moderately arid environment were minimally exploited by pre-contact Hawaiians. This was probably due to the lack of adze-quality basalt and the absence of other apparent resources that would have required the establishment of camps for short periods of resource exploitation.[21] Further archaeological studies will be conducted when the powerline corridor alignment from the Saddle Road to Hale Pohaku is finally chosen.

E. EXISTING USES OF THE PROJECT AREAS

1.0 Summit

1.1 Astronomy

"The entire area leased as the Mauna Kea Science Reserve will be used primarily for scientific research, in accordance with lease arrangements with the University of Hawaii." (DLNR 1977 Mauna Kea Plan).[7] There are six telescopes in operation at the summit at the present time. The principal characteristics of the telescopes, as described by the University of Hawaii Institute for Astronomy, are:

Two small (0.61 meter) instruments, provided to UH by the U.S. Air Force and by NASA in the late 1960s, are used by faculty and students in a variety of programs where the light-gathering power of the larger telescopes is not necessary;

The UH 2.2-meter telescope, the primary instrument available to University of Hawaii faculty and students. It was constructed, and is now operated, with State and Federal funds;

The Canada-France-Hawaii 3.6-meter Telescope (CFHT) which serves as the principal telescope for ground-based astronomers in Canada and France; and also plays an important role in the UH research and graduate training program through the University's membership in the CFHT Corporation. Eighty-eight percent of the operating costs are shared equally between Canada and France, who paid for the total cost of construction of the facility. The University is responsible for the remaining 12 percent of the operating costs. Use of the telescope is shared in the same proportion as the contributions towards the operating costs; and,

The two infrared telescopes, the 3.0-meter NASA-funded Infrared Telescope Facility (IRTF), and the 3.8-meter United Kingdom Infrared Telescope (UKIRT), are designed for studies of cooler celestial objects such as planets and stars in the process of formation. The cost of IRTF's construction and operation were and are funded entirely by NASA. The University's Institute for Astronomy managed the telescope construction under contract to NASA, and now operates the telescope as a nationally-available facility with 25 percent of the observing time being granted to UH astronomers. The UKIRT is funded entirely by the British government; under the terms of the agreement UH scientists receive 15 percent of the UKIRT observing time.

1.2 Skiing and Snow Play

Many island residents and visitors participate in snow activities during the winter season. The Ski Association of Hawaii works closely with the Institute for Astronomy in order to make certain that skiing is compatible with astronomical observation.

1.3 Hiking, Sightseeing and Photography

Hiking, sightseeing and photography are among some of the other uses for the summit area. Joyriding has become increasingly popular and the use of "off-road" vehicles has left scars up the cinder slopes and cones.

1.4 Other Scientific Research

Mauna Kea has a number of natural resources which make it a laboratory of particular interest to scientists from various disciplines. The Kitt Peak National Observatory (KPNO) and the University of Hawaii are presently conducting a site survey of Mauna Kea. Climatological and astronomical data will be collected over a three year period. Identical surveys are being carried out simultaneously at other stations in the United States. Geologists are interested in its unique volcanic and glacial history. Its altitude, weather and atmosphere make it an interesting laboratory for the study of meteorology. As the highest insular volcano in the world, Mauna Kea with its remnant endemic ecosystems represents a unique research environment for biologists and botanists.

1.5 Concrete Batch Plant

In the past, projects requiring space for a temporary concrete batching plant have used a site commonly referred to as the "skiers' parking lot" located at the 12,500-foot elevation.

1.6 Transmitter/Receivers

There are presently four transmitters on the summit of Mauna Kea. Two National Weather Service transmitters are located at the Planetary Patrol building. The transmitters are a part of the

Tsunami Warning System and are used primarily for transmitting weather information on a 24-hour basis from Hilo up to Mauna Kea and then to Haleakala, Maui and Ewa Beach, Oahu. Two transmitter/receivers are located at the brick power building, one is used by the Division of Forestry and the other by the Volcano Observatory. The Forestry transmitter is for use in case of forest fires. The Volcano Observatory transmitter/receiver translator is for use in monitoring the Kilauea and Mauna Loa volcanoes. Under agreements with Board of Land and Natural Resources, these transmitters are allowed until they interfere with astronomical observations and telescope functions.

2.0 Powerline Corridors

Description of the existing uses of the area where the proposed powerline will be constructed is found in PART VIII.

3.0 Hale Pohaku

3.1 Astronomy Facilities

Construction of a permanent University of Hawaii, Institute for Astronomy, Mid-Elevation Facility at Hale Pohaku began in May 1982. The new buildings will replace the temporary structures which are now being used by astronomy personnel for sleeping, eating, and telescope-related research activities.

A mid-level facility is required so that astronomy personnel who work in the rarefied atmosphere of the 13,796-foot summit can remain acclimatized during their on-duty periods. The elevation of Hale Pohaku, 9,200 feet, was determined to be the most suitable altitude for the purpose of acclimatization. Recent studies being conducted by the United Kingdom have verified this fact. Acclimatization is important because individuals going directly from sea level to nearly 14,000 feet can suffer from mountain sickness (Serouche), loss of mental acuity, and difficulty in concentration. These effects could result in reduction of capability to function effectively at the high elevations.

The new facility will consist of sleeping areas which will accommodate 59 persons; a common area which will contain dining, lounging, kitchen and other facilities shared by all users; a research support area with offices and preparation areas to facilitate functions that must be performed during telescope operations; and a maintenance area which will house the generator and provide space for minor equipment repairs and other repair and maintenance functions. Other more extensive and elaborate facilties for the research program are provided at UH Manoa and the base support facilities at Hilo and Waimea.

3.2 Recreational Facilities

A 1,200-square-foot visitor reception area and Information Station is being constructed as part of the permanent mid-level facility at Hale Pohaku. Restroom facilities for visitors are also located in this building. A parking area for 25 cars is adjacent to it. The station will provide the public with information about natural and man-made features which are located at the summit and elsewhere on Mauna Kea. Warnings will be posted at the station about the dangers of the high altitude and cold and the risks of driving to the summit in other than four-wheel drive vehicles.

There are two stone cabins and one stone restroom located at Hale Pohaku. The large stone cabin is now being used by the University of Hawaii Institute for Astronomy. The smaller cabin is rarely used except by the Ski Patrol for overnight accommodations during weekends of heavy snowfall and for storage of equipment during the off-season. The stone restroom is for use by the general public.

4.0 Base Support Facilities

Many activities required to support astronomical research programs do not require summit or mid-level locations. These functions, which include administration, major computer processing operations, and extensive research and laboratory analysis, can be accomplished elsewhere. The UKIRT is presently in the process of designing an office building, on land leased by the University of Hawaii, adjacent to the University's Hilo campus. The UK/NL and Caltech are planning to locate their sea-level offices there. The Mauna Kea Support Services office (MKSS) is also located in Hilo, it is anticipated that it will either rent space in the UKIRT building when it is completed or use space on UH land.

The CFHT corporation completed construction of an office/laboratory facility in Waimea in October 1982. Vacant land adjacent to this building is suitable for construction of facilities to support future telescopes on the mountain.The Canada-France-Hawaii Telescope Base Support Facility is located in Waimea. The UKIRT (and the proposed UK/NL MT) base support services are located in Hilo. The NASA funded IRTF and the UH 88-inch facility are operated by the University of Hawaii Institute for Astronomy located in Honolulu.

F. INFRASTRUCTURE AND SERVICES

1.0 Access

Access to the telescopes is from Saddle Road, Route 20, which connects Hilo to Mamalahoa Highway, Route 19. From Saddle Road at Puu Huluhulu, a paved County road extends approximately six miles to Hale Pohaku. This paved road was constructed about 10 years ago but is still in excellent condition. An 8.3 mile, unpaved, 15-foot wide road extends from Hale Pohaku to the summit. The University of Hawaii maintains the unpaved road. It was completed in January 1976 but since the work consisted primarily of grading and partially realigning an existing jeep trail it does not satisfactorily serve present needs for access to the summit. It remains rough and dangerous, lacking safety features, shoulders, gutters, and on the upper section there are no drainage culverts. The road is steep in places with grades in excess of 15 percent. Repair work was done in 1980, however, constant maintenance of the road surface with a road grader is required due to the "wash-boarding" of the loose gravel surface, particularly on the steeper slopes and curves. Washouts are frequent due to the unstable nature of the volcanic ash and the lack of paved gutters and drainage culverts. Vehicle maintenance costs are higher than necessary due to the rough road surface.

When weather conditions are favorable, the driving time from Hale Pohaku to the summit is approximately 20 minutes. Since the distance is approximately 8.3 miles, this represents an average speed of 25 miles per hour. The descent from the summit to Hale Pohaku under similar conditions generally takes about 17 minutes (30 MPH) and is considered more dangerous than the ascent. Snow, fog, washouts and the rough unpaved road surface materially increase the possibility of accidents and discomfort as well as travel time. Accidents attributable to the summit road include:

1973 - A construction truck turned over and the crew sustained serious injuries.

1978 - A vehicle going down the mountain fishtailed and rolled over; two persons were hurt and hospitalized.

1979 - A car rolled over; and the occupants were hospitalized for two days.

In addition, an astronomer sustained a cracked vertebrae by hitting the ceiling of the cab while driving over rough road surface. The astronomer is still bothered by the injury.[22]

Regulations issued by the State Department of Land and Natural Resources prohibit travel on the road from Hale Pohaku to the summit by other than four-wheel drive vehicles. However, these regulations are not strictly enforced and some two-wheeled vehicles occasionally travel the road. Traffic generally consist of four-wheel vehicles, trucks for hauling fuel oil, water supplies or construction equipment. The high altitude adversely affects the performance of vehicles which have not been tuned for the decrease in oxygen. While snow removal service is provided by the University of Hawaii, overnight snowfall and adverse weather frequently interfere with the flow of traffic.

Roads within the Science Reserve are also unpaved. Dust generated by vehicles using the unpaved roads also has an adverse affect on the quality of astronomical observations. The sites for the Caltech telescope and the proposed UK/NL MT are adjacent to an existing unpaved road. There is no access road to UC's proposed site. At the summit there are a number of unpaved roads or jeep trails leading to various skiing areas and features of geologic or historical interest. In addition, the summit area has been scarred by the indiscriminate use of off-road vehicles.

2.0 Power

Presently, commercial power is not available to Hale Pohaku or the summit. HELCo's 69KV overhead line with suspension insulators runs approximately parallel to the Saddle Road at about the 6,000-foot elevation, from Hilo to Humuula Sheep Station and continues to Pohakuloa and the Keamoku "wye" station to serve West Hawaii. (Figure 11).

2.1 Summit

Power at the summit is supplied by an 850-KW generator located at the base of the north side of Puu Hau Kea at the 13,200 foot elevation (Figure 6). Two 12-KV underground power lines run from the generator to the summit area. At the summit, the distribution transformer is mounted on a concrete pad next to the utility building near the UH 88-inch telescope. The power is distributed through underground conduits to each telescope building. The diesel fuel for the generator is stored in a 11,000 gallon tank which is filled every ten to fifteen days by a tanker from Hilo.[23]

2.2 Hale Pohaku

The current electrical power demands at Hale Pohaku are being met by three diesel generators of 150 KW, 105 KW, and 60 KW respectively. The 150 KW and the 105 KW generators are operated in rotation for 500 hours each. The 60 KW generator is only operated in the summer, when heaters are not being used, as it does not have sufficient capacity to satisfy user needs during winter months.

Each existing generator, when in use, runs 24 hours a day and uses 6 gallons of diesel fuel per hour. No special trips are made to Hale Pohaku from Hilo to deliver diesel fuel. Whenever diesel fuel is needed at the summit, the fuel trucks stop at Hale Pohaku and top off the fuel storage tanks.

Power from the generators is distributed through an underground network of cables to the various facilities at Hale Pohaku. The maximum length of power distribution cable is approximately 400 feet.

Construction has begun on a new permanent mid-level facility at Hale Pohaku. The existing generators will be replaced by a 250 KW diesel generator which will be located in the maintenance area of the astronomy complex. An additional 250 KW generator will be required for backup. The 250 KW capacity is needed because the high (9,000+ foot) elevation reduces generator efficiency by approximately 25 percent.

The new generator will consume 12-15 gallons of diesel fuel per hour and will be run 24 hours a day. Power will be distributed throughout the mid-elevation facility via the existing and extended underground direct-burial cables and concealed conduits and wire systems. Power to the Visitor Information Station will be distributed via underground wire from the astronomy complex.

3.0 Communications

At the present time data and voice communication between the summit and Hilo is accomplished by a microwave link from a four-foot diameter dish located on the UH-88 inch telescope building to a similar dish located in Hilo. This antenna, is mounted atop a six foot pole which in turn is mounted on a 40 foot building. The electronics for the system are located on the first floor of the 88-inch telescope building. Conduits containing the telephone lines are buried in the same trench as the power conduits.Communication between Hale Pohaku and the summit and Hale Pohaku and Hilo is via two VHF mobile two-way radio systems with five assigned frequencies.

4.0 Water

Water must be trucked to the summit from Hilo. Each telescope has its own water storage tank and distribution system. The various tanks require approximately three trips a week by a 5,000 gallon water tanker to keep them filled.

The mid-level facility at Hale Pohaku, currently under construction, will have two 40,000-gallon steel water storage tanks. The tanks will be kept filled by daily truck trips from Hilo.

5.0 Sewage Disposal

Each of the four large existing telescopes has its own septic tank. The two smaller UH telescopes share the UH 88" septic tank. Cesspools are the means of sewage disposal at Hale Pohaku; each building in the permanent mid-level facility will have their own cesspool.

6.0 Solid Waste

The solid waste generated at the summit is carried down to Hale Pohaku by the scientists. From there, the solid waste from both the summit and Hale Pohaku is trucked daily to a dumpster located at the Mauna Kea Support Services headquarters in Hilo.

7.0 Protective Services

7.1 Fire Protection

At the summit, large portable fire extinguishers and fire escape plans are available in each telescope building. Personnel at the individual telescopes are responsible for fire protection at their respective facilities.

At the permanent mid-level facilities, fire hose cabinets will be placed strategically throughout the astronomy buildings and appropriate individuals will be trained in proper fire fighting procedures. A backup system of portable fire extinguishers will also be available in the area for extinguishing minor fires. A fire hose cabinet and portable fire extinguishers will also be located in the park area. A fire plan for Hale Pohaku is currently being prepared. The new mid-level facility will have water reserves for "fire-flow".

7.2 Health and Safety

The nearest medical facilities are located in Hilo, approximately 34 miles from Hale Pohaku, and 42 miles from the summit telescopes. Because response time for these services is longer than one hour, observatory personnel are currently rendering volunteer emergency service to both visitors and staff. An emergency room has been designed as a part of the commons area within Hale Pohaku to provide space for the treatment of injuries and illnesses. An ambulence, equipped with a stretcher and first aid supplies, oxygen, and a two-way radio for contacting the County rescue squad is parked between the UKIRT and 88-inch buildings. It is available in case of emergencies at the summit. All MKSS personnel are trained in advanced first aid and cardio-pulmonary resuscitation.

7.3 Security

Each telescope is responsible for the security of its facility. The Natural Area Reserves Commission is responsible for the security of the Natural Area Reserve and DLNR personnel are present from time to time to enforce their regulations. The University of Hawaii, Institute for Astronomy, is responsible for the security at Hale Pohaku and the safety of astronomy personnel.

G. SOCIO-ECONOMIC FACTORS

The estimated Big Island population supported directly by the current level of astronomical development is 328 persons. This estimate is derived from the number of direct Mauna Kea-related Big Island jobs multiplied by the County's average household size of 3.09 persons (i.e. 106 x 3.09 = 328).

Estimated in-migration to the state which has resulted as a result of the current level of research activity on Mauna Kea is 117 individuals (i.e. 38 jobs taken by non-residents x 3.09 average household size = 117). The actual in-migrated population may be less since not all in-migrated individuals employed necessarily have families.

Current facilities	# of jobs	Non-resident	State Residents
UH & IRTF	20	1	19
CFHT	39	19	20
UKIRT	29	18	11
Mauna Kea Support Services	18	0	18
TOTAL	106	38	68

Estimated in-migration to Hawaii County is slightly higher than 117 due to a small amount of intra-state migration of employees. Of the 68 jobs currently held by State residents, 64 are held by residents originally from Hawaii County while 4 jobs have been filled by State residents from other counties. In-migration to Hawaii County, thus, is estimated at 130 individuals, 13 of whom are from other counties in the State, and 117 from out-of-state. The regional impact of the Mauna Kea-related population is more pronounced since the majority of the employed population and their famalies tend to reside in either Hilo or Waimea where the existing base support facilities are located. Of these two areas, Hilo has received the greatest influx since only the Canada-France-Hawaii telescope group has a support facility in Waimea.

Astronomy research on the Big Island has thus far generated over $52 million in capital investments from outside Hawaii, numerous short-term construction jobs, a current total of 106 full-time jobs, and an estimated infusion of $6.9 million in 1981 personal income to Hawaii residents.

As previously discussed, 64 of the 106 Mauna Kea -related job opportunities in Hawaii County have been filled by Big Island residents. These jobs have added not only to the total employment base in the county, but to a variety of employment opportunities as well. The types of employment made possible by the establishment of astronomy facilities on Mauna Kea include jobs for astronomers, engineers, electronics technicians, instrumentation technicians, precision machinists, and mechanical designers. *In addition to these high technology types of employment*, direct jobs have been created for administrative, maintenance and support personnel.

An assessment of the economic impact of the existing and proposed astronomy facilities at Mauna Kea is presented in Appendix I.

The presence of the existing telescopes on Mauna Kea has benefited the University of Hawaii at Hilo (UHH) and high schools on the island of Hawaii. The CFHT and UKIRT observatories are providing research opportunities each summer for to selected participants in the NSF-Student Science Training Program at UHH. The UHH, the Hawaii Preparatory Academy (Waimea) and other learning institutions have also called upon astronomers for lectures, seminars and informal workshops and interaction with their students. Public lecture programs on science and astronomy are being presented island-wide by CFHT, UKIRT and UH staff astronomers.The proximity of the research facility has enabled students and citizens of the Big Island to receive first-hand exposure to advanced research.

PART VI: TELESCOPE DEVELOPMENT

A. INTRODUCTION

One of the objectives of the CDP is to evaluate possible telescope development to the year 2000. The University of Hawaii Institute for Astronomy has determined that the most probable estimate for the year 2000 would be a total of 13 telescopes, including the six existing facilities. From proposals received and an analysis of future world-wide demand for certain types of telescopes, it was estimated that future installations would probably include three millimeter-wave, including the proposed Caltech and UK/NL telescopes, and four optical/infrared telescopes, including the UC TMT.

Optical/infrared and millimeter-wave telescopes have different locational requirements within the summit area. Optical/infrared telescopes must be placed where local topographic conditions promote laminar (as opposed to turbulent) flow of air when the wind is blowing from its average direction at an average speed. Turbulence has the effect of producing rapid motion and/or enlargement of the image of a star or other astronomical object being observed with the telescope. Turbulence and shaking due to wind compromise optical and infrared telescopes by causing the light or radiation to be spread out in constantly changing patterns instead of focused to a steady point. This type of telescope should be sited where the laminar air flow is not disturbed by turbulence generated by nearby cinder cones or other telescope domes.

The receiving dishes used by millimeter wave telescopes currently range in size from 10 meters to 25 meters or more in diameter. This generally larger sized dish provides greater wind loading. Radio- or millimeter-wave telescopes are sensitive to wind shake and should, therefore, be located where natural topography provides a shield against the wind.

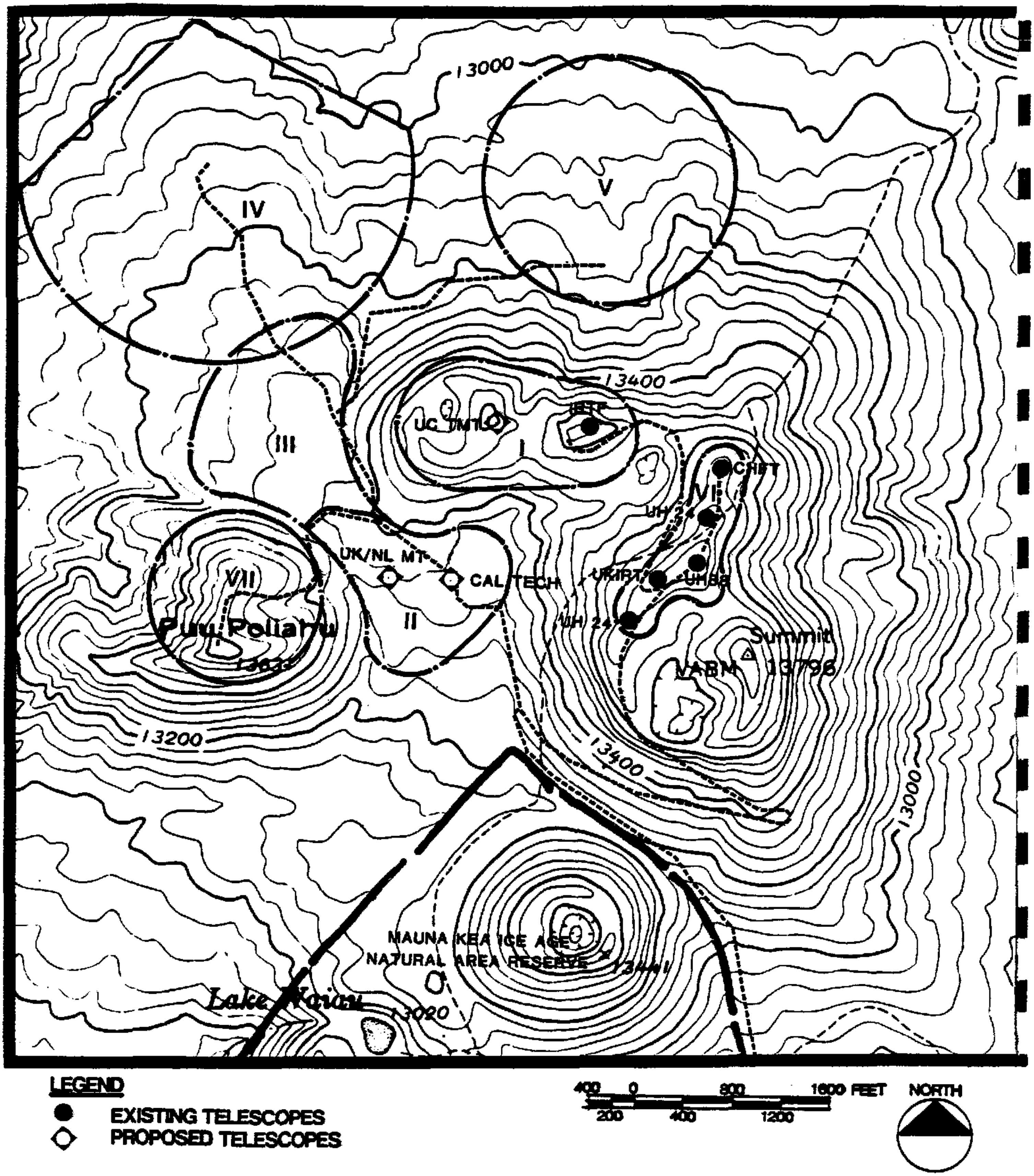
Taking the general locational characteristics of each type of telescope into consideration, the study area (Figure 2) was categorized into seven areas for further analysis. (Figure 16). The methodology employed to evaluate each analysis area involved four major screens: (1) technical - which evaluated involved variables such as wind direction and horizon obscuration; (2) environmental/physical attributes including slope and geological analysis, biological resources, archaeological sites, and visual analyses, (3) recreational uses such as skiing; and (4) future infrastructure requirements and costs of development. (Descriptions of each analysis area and illustrations of each screen are incorporated in Appendix J.)

As a result of these analyses, the boundaries of certain analysis areas were modified and recommended areas for future telescopes were designated. (Figure 7).

B. *FIRST PHASE DEVELOPMENT (1980's)*

1.0 Introduction

Three new facilities are planned for construction during the 1980's. They are: the California Institute of Technology (Caltech) telescope for submillimeter astronomy; the United Kingdom/Netherlands millimeter-wave telescope (UK/NL MT); and the University of California ten meter optical/infrared telescope (UC TMT). The EIS for the Caltech facility was accepted in August 1982. Environmental impact analyses of the UK/NL MT and UC TMT telescopes follow:



ANALYSIS AREAS

MAUNA KEA SCIENCE RESERVE CDP – FIG.16

2.0 University of California 10-Meter Telescope

2.1 Description of the Construction Phase

Because the project is still in the planning and preliminary design phase of its development, only generalized descriptions of construction activities are possible. An attempt was made, therefore, to identify and assess all actions that could possibly be undertaken in the construction of the facility that might have the potential of disturbing the environment. Early assessment will enable UC to incorporate mitigating measures into the project design so that most environmental impacts can be eliminated or minimized before they occur. Construction activities which have the potential of disturbing the localized environment are:

(1) On-site presence of construction equipment, construction vehicles, construction materials, a temporary construction field office, and an auxiliary generator;

(2) Use of an existing trail as a temporary access road to bring earth-moving equipment to the site;

(3) Excavation, grading and removal of approximately 20-feet of earth from the top of the site to provide a 60,000-square foot area for a building pad; a 10,000-gallon water tank; and a 2,000-gallon diesel fuel storage tank;

(4) Excavation of a new trench, approximately 850 feet long, following the alignment of the proposed access road, from the nearest connection of the existing utility trench at IRTF to the proposed telescope site, and possible excavation of an existing trench from the distribution transformer located near the UH 88-inch telescope to the site, for installation of telephone and powerline conduits; construction of handholes at 400 foot intervals along the new trench; and, filling all trenches with selected excavated material after the lines have been installed;

(5) Pouring of an as yet undertermined amount of concrete for footings and foundation pad; transferring an unknown number of truck loads of dry concrete mix from Hilo to the summit; and the occasional use of the site commonly referred to as the "skier's parking lot" as a temporary concrete batching plant;

(6) Paving of a parking area for approximately 8 vehicles and truck access on the 60,000 square foot pad; construction of a road, approximately 850-feet in length, following the high points of a depression between cinder cones, from a point slightly to the southeast of IRTF to the telescope site (Figure 9); placing fill (consisting of material excavated during preperation of the telescope site) in the proposed road alignment to lessen grade differentials; paving of the new road with asphaltic concrete over an aggregate base material; and, construction of drainage improvements at the telescope site and along the proposed access road;

(7) Construction of a 60 to 70-inch diameter underground exhaust tunnel from the telescope building to a point approximately 130 feet north of the site; and,

(8) Removal of equipment, temporary field office, and temporary generator from the site upon completion of construction.

2.2 Potential Environmental Impacts During the Construction Phase

Erosion: Site preparation for the proposed project may necessitate the removal of approximately 20 feet of earth from the highest point of the site to provide a level graded area of approximately 60,000-feet. The earth removed is planned to be used to balance the site and to fill the depression between the IRTF and the proposed UC TMT site in order to reduce grades along the proposed access road alignment. New slopes in soil areas (mainly volcanic cinders) will be graded as flat as possible (2:1 or flatter for fills and 1.5:1 for cuts) in order to minimize erosion. If cuts for the roadways have to be steeper than 1.5:1 some ravelling/erosion will result. Construction plans should specify that fills should be compacted to a minimum of 90 percent of the maximum dry density, as determined by ASTM Test D-1557 for non-structural fills. Structural fills should be specified as least as dense.

Because the soils in the project area are highly erodable, grading for the access road and telescope site will be designed so that surface runoff is not concentrated and is allowed to percolate into the ground. In problem areas, such as steep grades, drainage improvements, such as paved ditches and dry wells under catch basins, will be constructed.

A temporary access road may be needed to bring earth-moving equipment to the telescope site. An existing trail between the cinder cones may be used for this purpose; no grading, cuts or fills will be required. Because site excavation activities will be initiated and completed in dry months, no drainage improvements will be required. Water sprinkling of exposed surfaces may be necessary to control dust. Upon completion of excavation activities on the telescope site, after fill has been placed in the depression between the cinder cones, a permanent road will be constructed as shown on Figure 9. When the permanent road is completed (but prior to paving) the temporary road alignment will be abandoned and restored to its natural condition.

Dust: Heavy construction equipment operations and increased traffic along unpaved access roads will lead to the temporary generation of small dust particles. In addition, dust will be generated by the abrasive action of construction equipment on rocks. Dust control during construction may be accomplished by: exposing the smallest area possible at any time; water sprinkling exposed surfaces; and/or halting construction until the weather improves.

Traffic: There will be increased truck traffic between Hilo and the summit during the snow-free months of the three-year construction period. If feasible, certain structures will be partially assembled at sea level and then delivered to the site. Although trucks will carry dry-mix concrete from Hilo during the construction of the foundation, most heavy construction equipment used in site preparation will be stored on the site for the duration of the construction period. Because of the preliminary nature of the proposed telescope plans, the exact number of truck trips generated by construction activities cannot be estimated. All trips of heavy trucks up the mountain will be scheduled during off-peak hours so as not to interfere with normal traffic flow in Hilo or along the Saddle Road.

Biology: Consultants' reports concerning the vegetation and fauna in the vicinity of the project site and surrounding areas were prepared for this EIS by Bishop Museum scientists. These reports are incorporated as appendices G and H of this document. The reader is referred to the appendices for each consultant's assessment of the possible positive and negative impacts of the proposed action on his particular area of expertise.

Vegetation: The construction of the telescope facility may destroy flora on the site. The Bishop Museum Department of Botany, however, has stated that "The cinder cones had the poorest flora both in diversity and cover. . .Cinder and tephritic rocks were never colonized by fruticose or foliose species." Paving of parking areas and driveways may be beneficial to flora in the long-run by eliminating sources of dust which is harmful to vegetation.

Arthropods (Bugs): The proposed UC TMT site is not located in a prime habitat for the Lycosa. It is, however, a prime habitat for the Nysius. Construction activities will destroy a portion of this habitat. In addition, the telescope building could change the pattern of snowdrifts, snow melt, and aeolian fallout in the area, and these changes may affect the bugs. Construction activities will be restricted to specific areas so as to minimize the extent of the disturbed area and reduce the amount of aeolian habitat which may be destroyed.

As a further precaution, the inspection of telescope packing operations by qualified plant and animal quarantine officials may be undertaken in order to prevent the introduction of pests from the mainland, which may adversely impact the resident arthropods in the area.

Avifauna: The Hawaiian Dark-Rumped Petrel or 'Ua'u (Pterodroma Phaeopygia sandwichensis) is the only endangered endemic subspecies known to be present at high altitudes of Mauna Kea. At the present time a critical habitat has not been defined for the 'Ua'u.

The U.S. Fish and Wildlife service has been consulted informally and they have stated that no 'Ua'u have were observed in the Science Reserve during the course of a terrestial bird survey and during a one-day survey specifically for the species.[24] No impacts are expected and no mitigating measures are anticipated to be necessary. If, during construction, it appears that some of these species might be disturbed, the appropriate Fish and Wildlife officials will be notified so that appropriate measures can be taken to protect the bird.

Due to the limited amount of vegetation at the summit, few birds have been observed in the Science Reserve Area. The chukar partridge (exotic) inhabits bare and rocky slopes at timberline and higher elevations. It is possible that this game bird transits the summit area.

Mammals: The Hawaiian Hoary Bat (Lasiurus cinereus semotus) inhabits the island of Hawaii. Although they have been observed at elevations as high as 13,200 feet they are most commonly observed at sea level to 4,000 feet. None have been observed in the vicinity of the project site. Should any of the species be inhabiting the project site, they would normally relocate to more suitable environs on the large expanses of adjacent undeveloped lands. No mitigating measures are considered to be necessary in relation to this endangered species.

Although mouflon and some feral sheep are known to be present at lower elevations of the Science Reserve, none have been reported above the 13,000-foot elevation in the summit area.

Natural and Archaeological Features: An archaeological survey of the summit area was conducted by Dr. Patrick McCoy of the Bishop Museum during the summer of 1982. This reconnaissance survey covered most of the areas identified as probable sites for astronomical developments to the year 2000 and included the UC TMT site. Dr. McCoy did not find any features of archaeological or historical interest on the proposed UC TMT site.

Economic: Of the estimated $62 million in construction costs for the UC TMT, about one-third is expected to be expended on the island of Hawaii. Approximately 50 full-time equivalent construction jobs may be created annually through the three-year construction period. Local construction labor will be used wherever feasible.

Visual: During construction, there will be the presence of construction equipment, construction materials and temporary structures on-site. This impact on the visual quality of the area will be temporary since these items will be removed when the project is completed.

Concrete Batching: Most of the concrete used in construction will be trucked in from Hilo directly to the site. Occasionally, when continuous pours are required, a temporary concrete batching plant will be required. An approximately 10,000 to 20,000 square-foot area, within a 30,000 square-foot site, at the 12,700-foot contour (known as the "skier's parking lot"), is proposed for use as a temporary concrete batching plant. (Figure 13). This parking lot has been used on previous occasions for this purpose and additional disturbance to the environment is not expected. During these large pours, aggregate and sacks of cement will be hauled to the proposed batching plant site. The concrete will be mixed there and then transferred in ready mix trucks to the telescope site. Because batching will not occur when snow is present, there will be no impact on recreation users of the area.

No permanent batching facilities will be constructed, although gravel may be stockpiled in the area between pours. After this phase of the construction process is completed, all equipment and materials will be removed and the site restored to its original condition. All equipment used in mixing will have self-contained power (gasoline and diesel).

2.3 Description of the Operations Phase

Actions to be taken upon completion of the telescope which may affect and/or modify the local environment are:

(1) The presence of a 105-foot diameter white or silver dome, paved parking area, and an average of twelve to fourteen people per day in two shifts per day;

(2) Consumption of 150 to 300 gallons of water per day for heating, cooling and domestic consumption;

(3) Disposal of 100 to 200 gallons per day of liquid sewage;

(4) Generation and disposal of solid waste;

(5) Six to seven vehicle trips per day for personnel and service vehicles from Hilo and Hale Pohaku to the telescope; and,

(6) An unknown number of additional vehicle trips by visitors who wish to view the telescope.

2.4 Impacts During the Operations Phase

Visual: A visibility analysis of the proposed telescope was undertaken to determine what areas on the Big Island would be able to see the domes. (Appendix J). The results of this analysis indicates that the telescope will not be visible from the Hilo area. It will, however be visible from parts of Waimea and possibly from dome locations within Hawaii Volcanoes National Park.

Traffic: The impact of the six to seven vehicle trips per day, generated by the proposed project, on the traffic of the summit road is expected to be minimal. It is anticipated that there will be additional vehicle trips by visitors interested in viewing the telescope. The management and monitoring plan addresses control of visitor traffic from Hale Pohaku to the upper slopes of Mauna Kea.

Air Quality: The air quality of the summit is primarily affected by dust and the amount of exhaust generated by internal combustion engines (automobiles, diesel generating plant) above the 7,000-foot level. Paving the parking areas and driveway will serve to reduce dust, which can get into the inner workings of the instruments and on the mirrors. It also has an adverse effect on the biota of the summit. The diesel generator, which may cause pollution, will be removed when a permanent connection to HELCo transmission lines is completed.

Additional traffic generated by the proposed telescope is not expected to appreciably increase the amount of pollution in the air. The prevailing summit winds are expected to disperse these pollutants before their concentration exceeds ambient air quality standards. Although air pollution can affect telescope operations, most vehicle traffic will occur during daylight hours, whereas, the telescope will be operated at night.

Water: It is estimated that water consumption at the telescope will be approximately 150 to 300 gallons per day. UC's proposed 10,000 gallon water tank will require two water tanker trips to fill it initially. It will then need replenishment every four to six weeks. If necessary, the number of water tanker trips to the summit, 3 to 4 times a week at present, can be increased. The slight increase in demand should have no noticeable effect on the island's water supply. Water saving toilets and other plumbing may be incorporated in the facility design.

Sewage: Approximately 100 to 200 gallons per day of liquid sewage will be generated by the facility. This will be disposed of by means of a cesspool or a septic tank and leaching field. No significant environmental impacts are expected from sewage discharge because there is no water table beneath the telescope site at depths that could be affected by effluent; in addition, volcanic ash material is highly permeable so that effluent from installations on top of cinder cones will tend to disperse downward in all directions and dissipate rapidly.

The exact method of sewage disposal will be based on results of a soils investigation at the site and will be subject to approval by the Department of Health. All State and County requirements concerning individual waste disposal systems will be adhered to.

Solid Waste: Solid waste generated by the facilities is primarily composed of waste paper, spent containers and very limited amounts of waste food. Solid waste generated by staff and visitors to the observatory will be collected on-site and taken to Hale Pohaku for eventual disposal at Hilo.

Vegetation: Visitors and scientists may inadvertently transport new exotic flora from lower elevations to the summit. These introduced species may adversely effect the native biota of the area. All telescope personnel will abide by the terms of the General

Lease No. S-4191 between UH and BLNR which states that "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".

Arthopods (Bugs): Dr. Frank L. Howarth, Bishop Museum entomologist, (Appendix H) states that the evidence to date indicates that the arthropods present in the aeolian ecosystem are sensitive to disturbance of the surface, destruction of the frozen ground beneath the surface, dust, petroleum products, and other toxic environmental pollutants. Paving of the access road will alleviate the long-term dust problem. Other mitigating measures that may be taken to minimize the potential adverse impact of telescope operations on resident arthropods are:

(a) Insuring that waste oil from machinery and telescope mountings will not drip on bare ground; and,

(b) strict control of solid waste disposal so that colonization by exotic scavengers will be prevented.

Natural and Archaeological Features: The presence of the proposed telescope may generate increased visitor traffic to the summit area, therefore, there may be indirect impacts on the archaeological and natural features of the area. The Department of Land and Natural Resources has adopted rules regulating activities within Natural Area Reserves (NARS). These regulations (Subtitle 9, Chapter 209 of Title 13) specify permitted and prohibited activities within NARS, including the adze quarry and Lake Waiau, and provide for issuance of permits and penalties for violations (Appendix F). The Management Plan of the SRCDP, Part IV, addresses control of visitor access to the summit area.

Other Users: Operation of the proposed telescope and the presence of additional personnel at the summit of Mauna Kea can have both positive and negative effects on other users of the summit area. Some of these users are: other astronomers; scientists from other disciplines; lay people with an interest in the various natural and biological features of the summit area of the mountain and other visitors; hunters; skiers and snow-play participants. Some potential impacts and mitigating actions to be taken are:

(a) Impacts on existing observatory operations at the summit are long-term and positive. Its operation will not interfere with the operations of the existing telescopes, nor will its location obscure the "seeing" of the existing telescopes.

(b) The proposed project will not affect hunting on the mountain. Most hunting takes place at lower elevations of the Mauna Kea Science Reserve.

(c) The proposed access road between the IRTF and UC TMT sites will have a positive impact on skiing activities. Skiers will be permitted to use the spur road to the UC TMT site which will give them easier access to the "Alii" and "Warrior" runs. (Appendix J).

Related Facilities: Because the new Hale Pohaku Mid-Level Facility was planned and designed to support the existing six telescopes on the summit, it has a capacity of 59 people at 100% occupancy. By the mid-1980s, UC will require 12-14 additional rooms. Resolution of these needs at the mid-level requires construction of new accommodations. Expansion of Hale Pohaku is addressed in Part 1, of this EIS.

Establishment of base support facilities at Hilo, Waimea or Kona is expected to be a long-term positive benefit to one of these communities.

Socio-Economic: Funding for the UC TMT's capital expenditures will be from University of California sources. Total operating expendures are estimated to be 8% to 10% of capital expenditures. Operating expenditures on the Big Island are estimated at $2.3 million per year, including $1.1 million in personnel costs. Hilo industrial and business facilities will be used. About 200 people per year will travel to the island from the mainland and foreign countries. The number of personnel to be based in Hawaii is estimated at 36, with 14 working primarily at the summit and 22 at a base support facility. A minimum of one-third of total personnel will be hired on the Big Island.

Impacts of the proposed telescope on the University of Hawaii (UH) will be long-term and positive. The major benefit of the proposed telescope for the UH will be the scientific interaction with the astronomical research program at UH Manoa and the availability of observing time on the telescope through an anticipated agreement with the UC. Interactions between scientists and the staff and students of the UH Hilo will also be welcomed. The Mauna Kea Observatory and the Institute for Astronomy at Manoa will benefit by the steady passage of visiting astronomers from all over the world. Some students may find employment at the new facilities and some employees may be part-time students at UHH.

2.10 Alternative Worldwide Optical/Infrared Telescope Sites

The decision to site the UC TMT at Mauna Kea was based on the evaluation of a number of sites worldwide. Seeing qualities of different sites were measured on a uniform system of Polar star trail measurements (Harlan and Walker, 1965; Walker, 1970; Walker, 1971; McInnes and Walker, 1974; and McInnes and Walker [unpublished data]). Table 2 lists the sites investigated by this method together with the percentages of nights with different qualities of seeing for each location.

In addition to seeing, the percentage of clear hours and the wind velocity were considered. The yearly averages of these factors for selected sites are presented in the table which shows the percentage of photometric hours (defined as hours with zero cloud cover above 10° to 15° altitude, depending on the site[25]) and spectroscopic hours (defined as hours with 60% cloud cover above the same altitude limit) and the percentage of nights on which the wind velocity was constantly less than 25 mph during the entire night.

Table 2 Summary of Alternate Observatory Locations for UC TMT

Characteristic	Fuente Nueva	Encumeada Alta, Madeira	Junipero Serra Peak)	White Mountain (California, USA)	Mauna Kea (Hawaii, USA)
Latitude	29°N	43°N	36°N	38°N	20°N
Altitude (meters)	2,366	1,784	1,787	3,975	4,205
Cloud Cover (Average for Entire Year)					
a. Photometric	65.5	41.8	47.5	42	55.8
b. Spectroscopic	81.0	53.9	72.9	66	74.9
Wind Velocity (Average for Entire Year)	16.9	1.3	5.8	19.9	11.3
Temperature °C (Lowest Nightime Minimum)	-4	-2	-8	-19	-9
Percentage					
a. Photometric	17	15	12	8	12
b. Spectroscopic	21	19	19	12	16

The ideal observatory site can be inferred from the study findings to be at the top of a conical peak rising out of the ocean. The conical shape presents a convex profile to the wind in any direction and allows the airflow to divide and go around the sides of the peak, rather than having it forced up over the top. This minimizes the disturbance of the airflow over the site.

Of all sites tested, Fuente Nueva, Canary Islands, Encumeada Alta, Madeira, Junipero Serra, California, White Mountain, California, and Mauna Kea, Hawaii were the most promising.

2.11 The Rationale for Selecting Mauna Kea as the Site for the UC TMT

Mauna Kea was selected for the following reasons:

1. It has few nights with seeing images greater than 5";

2. Seventy percent of the clear nights have images of 2" or smaller;

3. The wind velocities are generally quite low;

4. The precipitable water is relatively low;

5. The skies are photometric almost 50% of the time (spectroscopically clear nearly 75% of the time) and,

6. While Mauna Kea and White Mountain have the lowest amount of water vapor during the summer, the optimum season for galactic astronomy, White Mountain's more northerly location results in a lesser amount of time to view the galactic center. In addition, White Mountain is undeveloped whereas Mauna Kea has an existing infrastructure in place.

3.0 United Kingdom/Netherlands 15-Meter Millimeter-Wave Telescope

3.1 Description of the Construction Phase

Specific actions to be taken in the construction of the UK/NL telescope which may disturb the localized environment and/or modify or change the environment of the area are:

(1) On-site presence of an average of 12 construction workers during each phase of the construction process, construction equipment, construction vehicles, construction materials, a temporary construction field office, and an auxiliary generator;

(2) Grading of the ± 2 acre site; excavation of five-feet of gravel and loose cinders from the surface of the site where foundations will be placed; and, construction of concrete footings, telescope pad, 1,000-1,500 gallon watertank, and a 850-gallon septic tank;

(3) Construction of an access road approximately 200-300 feet in length from the existing spur road to the telescope site;

(4) Excavation of a new trench on-site, approximately 200 to 300-feet long, from the proposed telescope site, following the alignment of the proposed access road, to the existing spur road; installation of telephone and power lines in the trench; construction of a handhole at the telescope site, and filling the trench when utility line installation is complete;

(5) Excavation of a new trench (in conjunction with Caltech), approximately 3,000-to-3,500 feet long, from the intersection of the existing spur road and the proposed driveway, to the generator; installation of telephone and power lines in the trench; construction of handholes at 400 foot intervals along this trench, and filling trenches when utility line installation is complete;

(6) Pouring of approximately 950-to-1,000 cubic yards of concrete for footings and foundation pad; transferring an undetermine number of truck loads of dry concrete mix from Hilo to the summit, and the use the skier's parking lot as a temporary concrete batch plant during large pours;

(7) Assembling the dome and telescope on-site;

(8) Construction of a 500 square-foot paved parking area and truck access; and possible construction of drainage improvements on the site and along the access road;

(9) Removal of equipment, temporary field office, temporary batch plant, and temporary generator from the site upon completion of construction.

3.2 Impacts During the Construction Phase

Traffic: There will be increased truck traffic between Hilo and the summit during the construction period. It is not known whether sea containers containing diassembled telescope and carousel parts will be delivered directly to the observatory site or whether the structures will be assembled partially at sea level and then delivered to the site. Most heavy construction equipment will be stored on the site for the duration of the construction period. Therefore, the exact number of truck trips generated by these types of construction activities cannot be determined.

All trips of heavy trucks up the mountain will be scheduled during off-peak hours so as not to interfere with normal traffic flow in Hilo or along the Saddle Road. No improvements to the road will be required in order to bring construction equipment and personnel to the site.

Dust: Although the ±2 acre site selected for this telescope is essentially level, excavation and grading will be necessary to prepare the site. Most of the excavated material will be used as fill or for balancing the site. Excavation and grading will generate dust. Fine dust commonly occurs in the interstices of the volcanic rocks on Mauna Kea. Heavy construction equipment operations at the site and increased traffic along access roads will lead to the temporary generation of small dust particles. In addition, dust will be generated by the abrasive action of construction equipment on rocks. Dust mitigation measures such as water truck spraying of the construction area will be undertaken if necessary. During high winds and storms, materials will be covered and construction will cease until the weather improves.

Visual Quality: Impacts on the appearance of the area can be anticipated as a result of excavation of trenches and laying of utility lines. In order to minimize these impacts UK/NL intends to:

(1) Excavate the utility trench from the generator pad to the telescope site alongside the existing unpaved spur road in order to minimize scarring of undisturbed areas; and,

(2) Utilize the existing trench from the UH 88-inch telescope to the generator pad for communication cables so as not to further scar the summit cinder cone.

To protect the powerline and communications cable from damage, select backfill material may be used instead of the excavated material which may contain rocks several inches in diameter. Although "handholes" will be required along both trenches to allow access to the conduits, those on the summit cinder cone will be constructed adjacent to the existing boxes so that visual impact is minimized.

Biology: Consultants' reports concerning the vegetation and fauna in the vicinity of the project site and surrounding areas were prepared for this EIS. They are incorporated as appendices G and H of this report. The reader is referred to the appendices for each consultant's assessment of the possible positive and negative impacts of the proposed action on his particular area of expertise.

Vegetation: The construction of the telescope facility and the paving of the parking areas and driveways will adversely impact the flora of the site. The Bishop Museum Department of Botany has concluded that, "From a bryological viewpoint, the mosses and suitable niches are widely dispersed over the summit area, sufficiently so, that the proposed construction above 13,000 feet will not endanger any of the species now present, nor their habitats." In addition, the botanical report states that areas to the west of the major cinder cones support a low density and diversity of lichens. Although there is a general homogeneity of lichen communities over most of the summit area, in the saddle area between Puu Hai Oki, Puu Poliahu, and Puu Haw Kea there is a distinct paucity of species.

Arthopods (Bugs): The proposed UK/NL MT site is not located in a prime habitat for the Nysius. The Lycosa are common in the area. Precautions will be taken to minimize the amount of area to be disturbed by this project. The cables for electrical power and communications, for example, will be buried in the same corridor as the summit access road from the generator to the telescope site.

In addition, telescope packing operations at the laboratories may be inspected by a qualified plant and animal quarantine official in order to prevent the introduction of pests from England, Netherlands and the mainland.

Avifauna: The Hawaiian Dark-Rumped Petrel or 'Ua'u (Pterodroma Phaeopygia sandwichensis) is the only endangered endemic subspecies known to be present at high altitudes of Mauna Kea. At the present time a critical habitat has not been defined for the 'Ua'u.

The U.S. Fish and Wildlife service has been consulted informally and they have stated that no 'Ua'u were observed in the Science Reserve during the course of a terrestial bird survey and during a one-day survey specifically for the species.[26] No mitigating measures are anticipated to be necessary at this time. If, during construction, it appears that some of these species might be disturbed, the appropriate Fish and Wildlife officials will be notified so that appropriate measures can be taken to protect the bird.

Mammals: The Hawaiian Hoary Bat (Lasiurus cinereus semotus) inhabits the island of Hawaii. Although they have been observed at elevations as high as 13,200 feet they are most commonly observed at sea level to 4,000 feet. None have been observed in the vicinity of the project site. Should any of the species be inhabiting the project site, they would normally relocate to more suitable environs on the large expanses of adjacent undeveloped lands. No mitigating measures are considered to be necessary in relation to this endangered species.

Mouflon and feral sheep occasionally frequent the lower elevations of the Science Reserve but, to any knowledge, have never been reported in the summit area.

Natural and Archaeological Features: An archaeological survey of the summit area was conducted by Dr. Patrick McCoy of the Bishop Museum during the summer of 1982. This reconnaissance survey covered most of the areas identified as probable sites for astronomical developments by the year 2000 and included the UK/NL MT site. Dr. McCoy did not find any features of archaeological or historical interest on the project site.

Economic: Construction of the telescope is estimated to coast approximately $15 million, of which approximately $4 million is expected to be expended in Hawaii. It is anticipated that approximately 8 full-time equivalent construction jobs will be created annually during the construction period. Local construction labor will be used wherever feasible.

Concrete Batching: Approximately 950-to-1,000 cubic yards of concrete will be used in the construction of the UK/NL MT. While most of the concrete will be mixed in Hilo and trucked directly to the site, on the few occasions when several large continuous pours are required, a temporary concrete batching plant will be needed. 10,000 to 20,000 square-feet of a 30,000 square-foot site, at the 12,700-foot contour (known as the "skier's parking lot"), is proposed for use as a temporary concrete batching plant. This parking lot has been used on previous occasions for this purpose (Figure 13), therefore, no additional damage to he environment is expected. During these large "pours", aggregate and sacks of cement will be hauled to the proposed batching plant site. Gravel and sand may be stockpiled on site. The concrete will be mixed there and then transferred in ready mix trucks to the telescope site. Although the site to be used for batching should be available for approximately four and a half months, each usage should not exceed one day.

Batching activities will not be undertaken during the winter months, when weather and ground conditions preclude such operations. There will be no impact on the recreational resources of the area.

No permanent batching facilities will be constructed. After this phase of the construction process is completed, all equipment will be removed and the site restored to its original condition. All equipment utilized in mixing will have self-contained power (gasoline and diesel).

3.3 Description of the Operations Phase

Actions to be taken upon completion of the telescope which may affect and/or modify the local environment are:

(1) The presence of a 92-foot diameter telescope enclosure, paved parking area, and an average of three persons on site per shift for two shifts per day;

(2) Consumption of 60-120 gallons per day of water for heating, cooling and domestic consumption;

(3) Disposal of 40-80 gallons per day of liquid sewage;

(4) Generation and disposal of solid waste; and

(5) Three to four vehicle trips per day for personnel and service vehicles from Hale Pohaku to the UK/NL MT and UKIRT telescopes.

3.4 Impacts During the Operations Phase

Visual: Because the dome of the UK/NL MT will be 400 feet lower than the peak of Puu Poliahu, the proposed telescope will not be visible from populated areas of the island outside of the Science Reserve.

Traffic: The impact of approximately 3-to-4 vehicle trips per day on the traffic of the summit road is expected to be minimal.

Air Quality: The air quality of the summit is primarily affected by dust and the amount of exhaust generated by internal combustion engines (automobiles, diesel generating plant) above the 7,000-foot level. Paving the parking areas and driveway will serve to reduce dust, which has an adverse effect on astronomical observing and the biota of the summit. The additional traffic generated by the proposed telescope (3-to-4 vehicle trips) is not expected to increase the amount of air pollution significantly. The prevailing summit winds are expected to disperse these pollutants before their concentration exceeds ambient air quality standards.

Initially, the power needs of the UK/NL MT will be met by the existing 850 KW generator, located nearby at the 13,000 foot elevation. The increased load on the generator necessary to meet UK/NL MT's power demands will increase the fuel consumption of the generator by approximately 20 gallons per hour. Because the increase in full consumption is minimal, no significant increase in pollutants emitted by the generator is expected. Eventually, power is expected to be supplied from a proposed HELCo transmission line via underground conduit from the 13,040 foot handhole to the site.

Water: Water consumption is expected to average 60-120 gallons per day. UK/NL's 1,000-1,500-gallon water tank will require replenishment every two to four weeks. The additional water demand can probably be accommodated in the normal delivery schedule of water to the summit, no additional truck trips should be necessary. The slight increase in demand should have no noticeable effect on the island's water supply.

Sewage: Sewage disposal will be accomplished by either a septic tank with a leaching field or a cesspool. The existing physical conditions of the environment at the summit were evaluated and it was determined that no adverse impacts on the hydrology of the area and on Lake Waiau are expected because: (1) residual effluent flow from leaching fields are subject to rapid purification due to filtering within the underlying lava rock on the summit; (2) the amounts of effluent will be very small; 40 to 80 gallons per day are estimated for the UK/NL MT, 40 to 80 gallons per day for the Caltech installation.

Effluent in the subsurface will tend to flow parallel to the surface drainage pattern. The surface drainage from the UK/NL MT site turns westward in a depression north of Lake Waiau and then gradually turns gradually turns south to the west of the lake; therefore, the path for any subsurface effluent flow does not approach Lake Waiau. (Appendix E).

The exact method of sewage disposal will be based on results of a soils investigation at the site and will be subject to approval by the Department of Health. All State and County requirements concerning individual waste disposal systems will be adhered to.

Solid Waste: Solid waste generated by the facilities is primarily composed of waste paper, spent food containers and very limited amounts of waste food. Solid waste generated by staff and visitors to the observatory will be collected on-site and taken to Hale Pohaku for eventual disposal at Hilo.

Vegetation: Minimal and insignificant in this area. (See Appendix C).

Arthopods (Bugs): Measures that may be implemented in order to minimize the potential adverse impact of the construction and operation of telescopes are: (1) insuring that waste oil from machinery and telescope mountings will not drip on bare ground; and, (2) strict control of solid waste disposal so that colonization by exotic scavengers such as ants and mice will be prevented.

Other Users: Operation of the proposed telescope and the presence of additional personnel at the summit of Mauna Kea can have both positive and negative effects on other users of the summit area. Some of these users are: other astronomers; scientists from other disciplines; lay people with an interest in the various natural and biological features of the summit area of the mountain and other visitors; hunters; skiers and snow-play participants. Some potential impacts and mitigating actions to be taken follow:

(a) Impacts on existing observatory operations at the summit are long-term and positive. The proposed telescope will complement other research on the mountain. Its operation will not interfere with the operations of the existing telescopes, nor will its location cause any physical disturbances, such as wind deflection, that might disturb the "seeing" of the existing telescopes.

(b) The telescope will have minimal inpact on the research possibilities for other scientific disciplines.

(c) The proposed project will not affect hunting on the mountain. Hunting usually takes place at lower elevations of the Mauna Kea Science Reserve.

(d) Skiers do not normally use the UK/NL telescope site, because the base of Puu Poliahu is a flat, rough area, not suitable for skiing. When snow is heavy, however, such as in 1981-1982, skiers use all areas of the summit. Skiers will be permitted to continue to use the spur road from the main summit access road to the UK/NL observatory site and on towards Honokaa as they have in the past.

Related Facilities: No impacts to the mid-level facilities at Hale Pohaku are expected. When the telescope is completed it will be turned over to UKIRT for operation out of Hilo. Remote monitoring and operating techniques and the joint operation with UKIRT will keep the number of people on the mountain from both facilities to no more than nine at any one time. For these reasons it is anticipated that there will be sufficient dormitory space alloted to UKIRT at the Hale Pohaku mid-level facilities to accomodate the astronomers that will be associated with UK/NL MT project.

Establishment of base support facilities at Hilo is expected to be of long-term positive benefit to the County. The UKIRT is in process of designing an office building on UH land adjacent to UH Hilo. The UK/NL staff will share space in the building. In addition Hilo's infrastructure has unused capacity so that the additional requirements of future UK/NL personnel can easily be absorbed. UKIRT personnel and their families who have immigrated to the Hilo area have been assimilated into the community. It is expected that UK/NL personnel will do the same.

Socio-Economic: Approximately $1 million per year are expected to be expanded for operations in Hawaii. In addition, most of UK/NL salaries, estimated at $500,000 per annum, will be expended on the Big Island. Direct employment generated by the operation of the proposed project will total 20 jobs. Approximately thirteen of these positions will go to non-residents and seven to State residents. Three to four scientists may immigrate to the Big Island to live; other scientists and personnel will only stay for short periods of time.

Impacts of the proposed telescope on the University of Hawaii (UH) will be long-term and positive. The major benefit of the proposed telescope for the UH will be the scientific interaction with the astronomical research program at UH Manoa and the availability of observing time on the telescope through an anticipated agreement with the UH. Interactions between scientists and the staff and students of the UH Hilo will also be welcomed. The Mauna Kea Observatory and the Institute for Astronomy at Manoa will benefit by the steady passage of visiting astronomers from all over the world. Some students may find employment at the new facilities and some employees may be part-time students at UHH.

Electronic Interference: The relevant frequencies at which the proposed telescope would operate would not be affected by those used by conventional radio operators, as public use of frequencies in the 150 to 1,000 gigahertz range is currently uncommon; therefore no limitations on conventional radio operators is expected.

In the event that there are incompatible uses of radio frequencies, "coordination zones" can be created. In this case, each user applies for frequency assignments in bands assigned to that particular use, including that for radio astronomy. The "Manual of Regulations and Procedures for Federal Frequency Management" describes these "coordination zones".[27]

A powerful radio transmitter constructed on Mauna Loa in direct line-of-site to the UK/NL MT, could adversely affect the telescope's operation. If such a transmitter is proposed, the UK would request consultation with the sponsoring agencies morder to mitigate potential adverse impacts.

3.10 Alternate Observatory Locations For UK/NL MT

Pico Veleta, Spain; the Plateau de Bure, France; Tenerife and La Palma, Canary Islands; White Mountain, California; and Mauna Kea, Hawaii, are five sites which were considered for the UK/NL MT. Each site was evaluated using criteria based on amounts of water vapor in the atmosphere (summer and winter conditions), latitude, longitude, altitude, clear days/year, clear nights/year, meterology (including average summer and winter wind speeds, and snowfall), development of the site as an astronomical center, and travel time from the United Kingdom. Table 3 summarizes the evaluation of each site based on these criteria.

3.11 The Rationale for Selecting Mauna Kea as the Site for the UK/NL MT

The Mauna Kea site was selected for the following reasons:

1. Mauna Kea's dry atmosphere yields superior transmissions of infrared and millimeter wave radiation. The ability to study the galactic center is of paramount importance. The tropical latitude of Mauna Kea enables astronomers to study such important areas of the sky under better conditions and for longer periods of time than would be possible with telescopes located at more northerly latitudes. At Mauna Kea, the best weather occurs during spring and summer, the optimum season for galactic astronomy;

2. Although sites in the Canary Islands are more accessible to British astronomers than Mauna Kea, conditions at Mauna Kea allow the telescope to be used for research programs which are far superior in acquiring scientific knowledge than is possible at any other site.

3. Mauna Kea's accessibility is good, especially when compared to the difficult access of White Mountain and Plateau de Bure;

4. Mauna Kea possesses the necessary level of logistical support, including the existing staff for the UKIRT; and,

5. Mauna Kea's location on the island of Hawaii assures the presence of competent labor and supporting industries necessary to the efficient operation of the facility.

Table 3 Summary of Alternate Observatory Locations for UK/NL MT

Characteristic	Pico Veleta (Sierra Nevada, Spain)	Plateau de (Hautes Alpes, France)	Tenerife and (Canary Islands, Spain)	White Mountain (California, USA)	Mauna Kea (Hawaii, USA)
Atmospheric water vapor (mm)					
a. Summer	3.2*	4.8	4.2*+	1.2	1.4
b. Winter	1.9*	1.8	2.5*+	0.7	1.1
Latitude	37^{O}N	44^{O}N	28^{O}N	38^{O}N	20^{O}N
Longitude	3^{O}W	6^{O}E	17^{O}W	118^{O}W	155^{O}W
Altitude (m)	3,400	2,500	2,400	4,300	4,200
Clear days/year	100	100	230	230	230
Clear nights/year	170	135	185	205	205
Meteorology:					
a. Wind Speed (m/s)					
i. Average Summer	10	8	7	5	7
ii. Average Winter	10	8	9	11	9
b. Snow	Nov/May Substantial	Oct/April Substantial	Dec/Mar Occasional	Nov/May Moderate	Dec/Mar Moderate
State of Development	30mm telescope under const.	mm array fully approved	IR telescope existing NHO under construction	Existing research stn.	Existing observatory
Trip time (approx. hrs.)	5	5	6	30	36

*No on-site measurements. Water vapor data inferred from ionosonde measurements at Madeira and Gibraltar.
+Measurements have now been made. There is considerable variability but the values given are reasonably representative though conditions do occur.

C. FUTURE TELESCOPE DEVELOPMENT (1990s)

1.0 Introduction

Evaluation of the environmental impacts of future telescope development is based on the following assumptions:

a. The telescopes will locate in the areas recommended by this Plan;

b. A permanent powerline from a HELCO source will be constructed and operational;

c. The road from Hale Pohaku to the summit and the roads to all existing plus first phase development facilities will be improved and paved; and

d. The estimates of number of personnel associated with each future facility are reasonably accurate.

Impact assessment of future telescopes is, by necessity, general at this time. This section (C) will address the potential environmental impacts of locating individual telescope facilities within certain areas of the Science Reserve. Cumulative impacts of total development by the year 2000 will be addressed in Section D. Site specific impacts will be addressed in the future, as part of the CDUA process for each new facility.

2.0 Future Optical/Infrared Telescopes (Including the NNTT)

Areas I, IV and VI are recommended as siting areas for future optical/infrared telescopes. Areas V and VII, are less suitable for development, based on criteria evaluated during the planning process. These secondary areas should only be considered if technical characteristics of specific telescopes preclude siting in the recommended areas. (Figure 7).

2.1 Area I, Puu Hau Oki

This area encompasses the top of the cinder cone. The IRTF and the proposed UC TMT site are located in this area.

Environmental impacts of locating another telescope in Area I would be similar to those anticipated by the UC TMT. Grading and excavation would be required and an access road from the UC TMT to the new telescope would have to be constructed. The amount of grading and excavation required and the alignment of the access road would be dependent upon the telescope design and the actual site.

The cinder cones are composed of volcanic ash and cinder; competent rock may exist at depths shallow enough to provide support for deep foundations. Cinder cone material is readily excavatable by standard earth moving equipment. Since the density of the material frequently is rather low, foundation loads on this material also need to be low to avoid significant amounts of settlement.

Volcanic ash is highly erodable when subjected to concentrated runoff. Any construction in areas of volcanic ash needs to avoid concentrating runoff. Runoff can be dissipated by capitalizing on the high permeability of volcanic ash and its ability to absorb water. Major drainage improvements may have to be constructed of minimize roasion if cuts for roadways into sides of cinder cones have to be steeper than 1.5:1.

There are no known archaeological sites in Area I. The impact of telescopes in the area on flora would be minimal, because cinder cones have the poorest flora, both in diversity and cover. The area has been identified as habitat for the Nysius bug and construction of telescopes and access roads might destroy a portion of this habitat.

Depending upon the actual site chosen for development, and the height of the dome that is constructed, a telescope sited in this area would probably not be visible from Hilo. Telescopes constructed in this area would most likely be visible from portions of Waimea, South Kohala, and certain locations within Hawaii Volcanoes National Park.

Sewage disposal from telescopes located in Area I would not adversely impact groundwater tables or surface water in the summit area. Groundwater tables, if present, are at too great of a depth to be affected by discharge from the top of cinder cones; and, the volcanic ash material is highly permeable so that effluent from installations on top of cinder cones will tend to disperse downwards in all directions and dissipate rapidly. There is no possibility of effluent discharge from telescopes in Area I reaching Lake Waiau. (Appendix E).

One advantage of locating telescopes in this area is its close proximity to other development. This would facilitate the extension of existing infrastructure systems and reduce the cost of these installations.

2.2 Area IV

This area is located on lava flows in the north shield area of the summit, approximately 2,000 feet from the existing telescopes at its nearest edge. The prevailing easterly winds provide a laminar flow and sites within the area will experience no obscuration of the horizon from topographical features of the mountain. There are several relatively flat sites within this area which appear suitable for telescope development. An unimproved road provides access at the present time.

Excavation on lava flows may require blasting. Unless it is crushed, it will be difficult to use excavated lava flow material for fill because of the very coarse and blocky nature of the material. Accordingly, any embankments required in lava flow areas may have to use material imported from outside the area or any surface soils that may exist in the area.

The lava flows will provide excellent foundation support, with the rock being able to support any loads likely to be imposed by telescopes. The lava flows are not affected by surface runoff, but may tend to concentrate runoff because of the density and general impermeability of the rock. Earthwork in the lava flow areas should produce relatively small quantities of dust, as the rock will not tend to breakdown into dust particles.

In order to develop telescopes in Area IV, the access road would have to be improved from the UK/NL MT site to specific locations within the area. The existing alignment would be utilized in order to minimize disturbance to the surrounding terrain. Extensions of power and communication conduits would buried along the road alignment.

There are two archaeological sites located in Area IV. It is probable that telescopes can be sited to avoid them. Additional archaeological mitigating measures could be undertaken if it appears that development might disturb these sites.

The flora of Area IV is characterized by the presence of <u>Pseudephebe pubescens</u>, an "unusual, interesting" lichen. Four foliose species were also found there, <u>Umbilicaria magnussonii</u>, <u>u. hawaiiense</u>, <u>u. pacifica</u>, and <u>Physcia dubia</u>. <u>Pseudphebe pubescens</u>, and <u>Physcia dubia</u>, were new records for the Hawaiian Islands. (Appendix G describes the botanical reconnaissance survey of the summit area in detail).

If telescopes are constructed in the area, certain members of these lichen communities may be destroyed. Precautions will be taken to minimize the area affected by telescope construction. Utility lines should be installed in disturbed areas next to the existing road. Even if three telescopes were to be constructed in area IV, fewer than 10 acres would need to be disturbed. When, and if, specific telescope sites are proposed for the area, arrangements can be made in conjunction and in coordination with the Forestry Division of DLNR for botanical mitigation.

The area is not a prime habitat for the Nysius and no specific mitigating measures are proposed. Lycosa spiders and other arthropods are common in the area.

Telescopes constructed in Area IV would be visible from Waimea and certain areas of South Kohala.

Sewage disposal from telescopes located in Area IV would not impact the hydrology of the summit area, as effluent would flow northward, away from Lake Waiau.

One disadvantage of locating telescopes in Area IV is its distance from the existing facilities. Infrastructure costs will, accordingly, be greater than for areas closer to existing development.

2.2 Area VI - the summit ridge

This area, where three large and two small telescopes are now located, is considered to be the most desirable location for telescopes on the mountain. Space for additional telescopes may be made available by moving one or both of the small 24" telescopes to other locations; this would require a CDUA. Environmental impacts of locating on the summit ridge, a disturbed area, would be minimal; the major impact would be increased visibility from Hilo. The available sites are already improved. Infrastructure is available and no new access roads would have to be constructed.

3.0 Future Millimeter-Wave Telescopes

Area II is the recommended location for future millimeter telescopes. The UK/NL MT and Caltech 10-meter telescopes are proposed for that area. There are no archaeological sites in the area north of this UK/NL MT site (where future telescopes would probably locate). Construction in Area II would require extension of the access road improvements which are now proposed to terminate near the UK/NL MT site. Power and communication conduits could also be extended along this road.

Effluent from sewage disposal at telescope sites would not impact Lake Waiau. Available siting locations in Area II are on the north side of the summit. Effluent from them would tend to flow northward away from Lake Waiau. Refer to Appendix E.

Impact to botanical and biological resources would be minimal and similar to those described for the UK/NL MT site. There are no archaeological sites in the area which would be affected by future telescope construction.

Telescopes constructed in Area II would not be visible from any developed areas outside of the summit of Mauna Kea.

D. THE CUMULATIVE IMPACTS OF ASTRONOMICAL DEVELOPMENT ON MAUNA KEA - PLANNED DEVELOPMENT TO THE YEAR 2000

1.0 Direct Impacts

Visual: The presence of a total of thirteen telescopes at the summit will change the visual appearance of the area. Two to three millimeter-wave telescopes will probably be located in the presently undeveloped plateau area between the major summit cinder cones, and one or more additional telescopes could be located on Puu Hau Oki. It is possible that the North shield area will also contain telescopes by the year 2000.

Some of the new telescopes may also be visible from populated areas on the Island of Hawaii, although the appearance of the mountain, as seen from Hilo, is not expected to change significantly from present conditions. (Any new telescopes on the summit ridge would probably replace one of the smaller facilities that are already located there). New optical/infrared telescopes will probably be visible from Waimea, Kawaiahae, and some locations in the vicinity of Hawaii Volcanoes National Park if they are sited in Area I and IV. Millimeter-wave telescopes located in Area II will only be visible within the Science Reserve.

Judgements as to whether the presence of the telescopes will enhance or despoil the appearance of Mauna Kea will, of necessity, be subjective. To some people, the telescopes represent an important scientific resource and a clean industry which is bringing world-wide recognition to the Island of Hawaii; to others, each additional telescope is a structure which detracts from the natural beauty of the mountain. The reviewer of this EIS must use his/her judgement in deciding whether the impact of telescopes on the visual appearance of the mountain is positive or negative.

Water Consumption: Water consumption at full development will be approximately 1,300-to-2,600 gallons per day. Because water storage tanks at each telescope will differ in capacity, the number of tanker-truck trips to fill these tanks cannot be precisely determined. It is possible that the number of tanker trips may have to be increased from 3-to-4 trips per week to daily deliveries. The additional amount of water needed at the summit will not affect the County of Hawaii water supply.

Sewage Disposal: Effluent discharge in the summit area is expected to average 910-1,820 gallons per day by the year 2000. (This is comparable to the average daily discharge from 3-to-5 single-family residencesL). Groundwater tables in the summit area, if present, are too deep to be affected by effluent discharged into cesspools and septic tanks. The only groundwater known to exist consists of perched water in the center of some of the cones, including the area immediately east of Lake Waiau. Borings for existing telescopes have not encountered ground water.

Pohakuloa Springs are a series of springs about one mile long ranging in altitude from 8,600 to 10,400 feet in small gulches west of Pohakuloa Gulch. The proposed sewage effluent discharge from the Science Reserve Area would be much too small and far away to have any impact on the springs. (Appendix E).

In regards to impacts on Lake Waiau, many of the proposed telescopes will be located in siting areas on the north side of the summit; effluent from them will tend to flow northward away from Lake Waiau. Effluent from installations on top of cinder cones will tend to disperse downward in all directions, dissipating rapidly.

Only the Caltech and UK/NL telescopes in Area II are close enough to cause concern. (Additional telescopes in Area II will most probably be located on the north side of the summit, where effluent would flow away from Lake Waiau), however, effluent in the subsurface from these facilities will tend to percolate downward, and any lateral flow will tend to flow parallel to the surface drainage pattern. The surface drainage in the vicinity of the Caltech and UK/NL MT sites turns westward in a depression north of Lake Waiau and gradually turns south, well to the west of the Lake. Therefore, the logical path for any subsurface effluent flow does not approach Lake Waiau. Based on professional geologic opinion, there is no possibility of sewage effluent from the proposed telescopes reaching Lake Waiau, and therefore, there would be no impact on the Lake. (Appendix E).

Vegetation: If roads are paved, and the recommendations set forth in the Management Plan are implemented, there should be minimal impact to the botanical resources of the summit as a result of telescope development to the year 2000. There may be localized impacts to certain species of flora if telescopes are located in sensitive areas. (Appendix G). If future construction is proposed for these sensitive areas (primarily Area IV), the Forestry Division of DLNR will be consulted.

Fauna: The major impacts on fauna of the area will be on various species of resident arthropods. Most of the direct impacts will be localized and related to specific telescopes sites. (Area I, the location of the proposed UC TMT, has been identified as a prime habitat of the Nysius). Impacts on these species can be minimized by keeping all construction activities within the minimum possible defined area; preventing cinders or debris from falling downslope on the cones; insuring that wind will not disperse trash and other material outside of construction areas, keeping new road alignments to a minimum size and length; and taking precautions to prevent oilspills and. Impacts on fauna related to increased public usage of the summit area will be mitigated by implementation of the Management Plan (Part IV).

Archaeological Sites: The archaeological reconnissance survey for the area revealed that the number and density of archaeological remains on the north slope of Mauna Kea above the 13,000-foot elevation exceeded previous expectations. The construction and operation of new telescopes have the potential of adversely affecting these features. In order to protect those sites, the following mitigating measures may be taken:

a. An intensive archaeological survey may be undertaken if it appears that one of the sites might be affected by telescope construction;

b. Wherever possible, construction and related activities on or in proximity to known archaeological sites will be avoided;

c. Consultation with the State Historic Preservation Office will be undertaken prior to any telescope construction in areas of known sites;

Impacts on these resources that are the result of increased public usage of the summit area and provisions to enforce protection of these resources are addressed in the Management Plan. The Management Plan will conform to DLNR Regulation 2 relating to Historic and Archaeological Sites. (This regulation is reproduced in Appendix K). If Federal funds are involved in any future telescope activities, compliance with Section 106 of the National Historic Preservation Act of 1966, as amended, will be required.

Other Users of the Electromagnetic Spectrum: There is no impact expected on ham operators or other users of the electromagnetic spectrum from the operation of telescope at the summit of Mauna Kea. The telescopes planned for the summit of Mauna Kea would be used to receive radiation at frequencies above 75 GHz. At such high frequencies there is very little use of the spectrum for transmitting. Harmonics and other unwanted emissions from lower frequency transmitters located outside the Science Reserve on Mauna Kea might become a problem only when they are emitted from high powered transmitters, such as radar or radio and television broadcasting antennas, or from satellite transmitters. In addition, if a high powered transmitter should be located on Mauna Loa in direct line-of-sight to a millimeter-wave telescope, some problems could occur. These problems could probably be solved by discussions among the affected agencies and a slight modification in transmitter location.

There is a real potential for electromagnetic interference to sensitive digital equipment at optical, infrared, and radio telescopes and to the intermediate frequency systems of the infrared and radio telescopes from transmitters located within the Mauna Kea Science Reserve. The lease between BLNR and UH specifically provides for a buffer zone to prevent the intrusion of activities inimical to observatory operations such as certain types of electric or electronic installations. (Letters concerning this problem from Dr. T.G. Phillips, Caltech, and Dr. Vernon L. Pankonin, Electromagnetic Spectrum Manager, National Science Foundation, are incorporated in Appendix L).

Protective Services of the County of Hawaii: There will be minimal impact on the County of Hawaii protective services as the result of telescope development on the mountain. Each telescope building will have a chemical fire extinguisher; a communications link between existing telescope buildings has already been established to summon a volunteer brigade in the event of a large fire. Each new telescope facility will be incorporated into this system. The UH is also proposing to acquire a fire engine which will be based at Hale Pohaku. This engine can be sent to the summit area in case of emergency. The County of Hawaii Fire Department has indicated that they will be willing to train MKSS personnel in fire fighting techniques.

Because the response time from Hilo to the summit is nearly two hours, an ambulance is stationed on the summit ridge between the UKIRT and UH 88-inch telescopes. This ambulance is supplied with first aid equipment and supplies, oxygen, and a two-way mobile radio to summon the Hawaii County Fire Department emergency service. MKSS personnel are trained in advanced first aid procedures and cardio-pulmonary resuscitation techniques.

Security at the summit is the responsibility of the UH. The Management Plan discusses this in detail.

Economic: An economic impact study of telescope development at the summit was prepared for the SRCDP by Daly & Associates, Inc. (Appendix I). A summary of the economic impacts of telescope development at the summit follows:

	Phase I	Phase II
Additional number of telescopes added:	3	4
Additional Mauna Kea-supported population:	229	525
Housing unit demand over the entire Phase:	50	119
Construction expenditures in Hawaii during each Phase:	$39m	$47m
Average number of Direct annual construction jobs generated:	41	50
Additional annual operating expenditures:	$9.8m	$13.8m
Number of additional Direct, permanent operating jobs:	74	170
Number of additional full-time jobs[1] generated during the complete phase:	189	462
Additional annual personal income generated[2] by additional annual operating expenditures:	$7.2m	$10.1m
Additional annual economic output generated[3] by additional annual operating expenditures:	$21.0m	$29.5m

[1]Includes Direct, Indirect and Induced Jobs generated as a result of bothconstruction and operations.

[2]Includes DIrect, Indirect and Induces personal income generated as a result of annual operating expenditures only.

[3]Includes Direct, Indirect and Induced economic output generated as a result of annual operating expenditures only.

In addition, telescope development will:

o Enhance Hawaii's position and reputation as the hub of ground-based astronomy and improve its ability to attract and retain research and development oriented ventures as well as garner federal funds.

o Raise the quality of instructional/educational programs provided by the University of Hawaii as a result of cooperative relationships with each new facility. For example, each of the new users will help to fund a research position in astronomy at the University of Hawaii.

o Provide a growing number of diverse job opportunities in the expanding fields of science, engineering and electronics for graduates of the University of Hawaii, many of whom must now leave the State to find employment.

- Create a more-or-less steady stream of construction employment for Hawaii County residents as a result of the phased development structure, possibly beginning as early as 1983 with the initiation of the Caltech facility. This is in contrast to a "boom-bust" employment situation wherein outside workers, who are often attracted to areas experiencing major new construction, ultimately become an economic liability to the County once the proejct is completed.

- Provide a number of professional, technical, administrative, clerical and maintenance jobs, thereby benefiting a broad spectrum of Hawaii County's resident population.

- Raise the overall standard of living within the County as a result of increased economic out put and personal income.

2.0 Secondary Impacts

Impacts to other features of the mountain that might be generated by the presence of the telescopes and/or increased usage of the area are addressed in the Management Plan. Impacts on Hale Pohaku are described in Part IX.

E. ALTERNATIVES TO THE PROPOSED ACTION

1.0 Alternative Means of Obtaining Astronomical Information

Astronomers launch observatories in space in an attempt to avoid some of the restrictions imposed by the earth's atmosphere. Balloons, rockets, satellites, space probes and the Space Shuttle have all carried astronomical instruments.

Some future space projects which will include telescopes are:

1.1 Infrared Astronomy Satellite (IRAS)

The infrared astronomy satellite, a major NASA astronomy effort, is planned to be launched in December 1982. It is designed to survey the entire sky at wavelengths of 12, 24, 60 and 100 microns. Its functions will be supportive of submillimeter telescopes, but it will not be capable of duplicating the work for which ground-based telescopes are designed. The satellite will survey the entire sky, whereas ground-based telescopes will be used to study elements of the survey in greater depth.

1.2 Space Telescope

The Space Telescope, a 2.4-meter (94-inch) telescope of ultra-high precision, will be placed in orbit in 1985. Because it will be above the earth's atmosphere, it will be especially effective when working in the ultraviolet and infrared parts of the spectrum; it will also provide unparalleled resolution. The telescope will be managed and operated by scientists at the Space Telescope Science Institute at John Hopkins University. It will open new areas of astronomical science, which, in turn, will give basis for further investigation from ground-based telescopes.

1.3 Large Far-Infrared Space Telescope

A large far-infrared space telescope has been suggested as a possible part of future space shuttle flights. Development of this telescope is not expected before the year 2000; its optimum use will depend on less expensive ground-based studies which will both precede it and be carried-out in conjunction with the space observations.

2.0 Alternative Locations for Telescopes Worldwide

2.1 Introduction

Currently, two broad classes of telescopes can be used to best advantage on Mauna Kea: optical/infrared telescopes and millimeter-wave telescopes.

Optical and infrared telescopes collect radiation with a conventional mirror which focuses radiation from a star or other astronomical object onto a sensitive detector which records the strength and other characteristics of the radiation. Telescopes used for infrared studies require a dry site to minimize absorption of infrared radiation. In addition, this class of telescope is compromised by the effects of atmospheric turbulence and shaking (generally due to wind), by dust and other adverse local environmental factors.

Millimeter-wave telescopes are also sensitive to water vapor in the atmosphere and can therefore be used most effectively only at the driest sites. They are not, however, as sensitive to atmospheric turbulence and extraneous light (e.g., artificial illumination from Hilo) as are optical telescopes. Their generally larger size results in greater wind loading and therefore they need to be located in sheltered sites; on Mauna Kea, this would imply sites located at the base of cinder cones. They are sensitive to interference from natural or man-made sources of radiation, such as commerical radio transmitters, and must be located in areas having intrinsically low levels of high-frequency radio noise.

2.2 Location Requirements

In general, all ground-based telescopes (optical, infrared or millimeter-wave), have the common need for the following:

a. Accessibility: The telescope site should be within 50 miles of an established community which could serve as a base for the observing station. Because different parts of the sky become available for observing during different seasons, all-year accessibility is important. Travel time to the site from the nearest major airport should not exceed 3-4 hours, with less than 2 hours being preferable.

b. Development of Site as Astronomical Center: A telescope site needs a broad range of logistical support, such as access roads, reliable utilities and, if necessary, a mid-level accommodation for acclimatization. The number and type of telescopes already present also influence the quality of an observatory.

c. Availability of Nearby Electronics and Construction Industries: The telescope site should have existing electronic and construction industries in order to construct and maintain telescopes. If a number of telescopes are already present at the site, it can be assumed that the locally-based contractors have some previous experience with telescope facilities.

2.3 Location Criteria For Optical/Infrared Telescopes

a. Obscuration: The most obvious source of seeing interference are structures or topographic features intruding into the line of sight of the telescopes.

b. Frequency of clear weather: Cloud cover, or even very light haze, can significantly reduce the transparency of the atmosphere for observational purposes. Since observation time (or the usefulness) of a telescope is inversely proportional to the average number of cloudy nights, it is important to choose an area with minimum cloud cover. Minimum cloud cover occurs at about 10^{o} or 40^{o} N latitude and 0^{o} or 10^{o} to 35^{o} or 40^{o} S latitude, depending on the longitude.

c. Atmosphere free from aerosols: Dust and smog constitute the primary factors which reduce the transparency of the atmosphere. Consequently, this criterion eliminates from consideration all areas immediately next to or downwind from major cities or other sources of atmospheric aerosols, and may affect sites located in deserts. This criterion reinforces the advantage of a site on an island or along a coast with an onshore wind and a site above a temperature inversion layer, since air which has traveled a long distance over an ocean has a much lower aerosol content than air which has traveled over a continent, and smog and aerosols are usually trapped below such inversion layers. The temperature inversion limits the vertical convection transport of aerosols (particulates, including dust, salt particles, water droplets, and man-made pollutants) from the earth's surface in the general vicinity of the observing site.

d. Minimum atmospheric turbulence: Atmospheric turbulence has the effect of producing rapid motion and/or enlargement of the image of a star or other astronomical object being observed with the telescope. Atmospheric turbulence and shaking due to wind compromise optical and infrared telescopes by causing the light or radiation to be spread out instead of focused to a point. The result is the reduction of the resolution of the image, and by increasing its size, render it difficult to detect the faint object against the background luminosity of the night sky. This optical atmospheric turbulence is called "seeing" by astronomers, and for an optimum observing site, minimum turbulence (or good "seeing") is essential; the better the "seeing", the better the site.

Two major site characteristics contribute to the minimization of atmospheric turbulence; one is climatological and the other, topographical:

1. Areas of minimum atmospheric turbulence are found where a cold ocean current flowing under the eastern edge of a Maritime Tropical Stable (MTS) air mass causes subsidence of the air mass and the consequent formation of a temperature inversion layer. These inversion layers, forming at altitudes of from 7,000 to 9,000 feet, effectively isolate the smooth laminar airflow above these elevations from the turbulent, sometimes polluted, layers of atmosphere under the inversion.

2. Optical/infrared telescopes must be placed where local topographic conditions promote a laminar (as opposed to turbulent) flow of air when the wind is blowing from its average direction at an average speed. Observatory sites should be located preferably on the top of an isolated peak rising well above the atmospheric inversion layer. The peak must be isolated so that adjacent mountains do not disturb the laminar air flow. The peak should, if possible, be cone-shaped so that the laminar air flow is not disturbed by the peak itself before reaching the telescope.

e. Sky brightness: For the purpose of site selection, the criterion of dark sky has two major attributes:

1. As one goes north or south from the equator, both the total number of dark hours in the year and the length of nights diminish. At the equator, the total number of dark hours per year is about 3,460, while at latitude 31° it is 3,300 hours, at 40°, 3,080 hours, and at 50°, 2,600 hours. The total number of dark hours begins to drop rapidly for locations above 40° N and S latitude. In addition, the summer nights become so short as to severely handicap observing programs requiring dark skies. This consideration thus indicates that the ideal site should be located between about 40° N and S latitude.

2. Light from large urban areas is scattered by the atmosphere and finds its way into telescopes, thus limiting the sensitivity achievable in astronomical observations. Such scattered light, by raising the brightness of the night sky, limits the telescope's ability to detect extremely

faint astronomical objects, such as the most distant galaxies. As detectors become more and more sensitive, the darkness of the night sky becomes increasingly significant in determining the quality of astronomical site. Therefore, a dark sky observatory should be sited as far as possible from current and foreseeable sources of artificial illumination.

f. <u>Freedom from radio/microwave interference</u>: Radio frequency electromagnetic interference is undesirable wherever electronic instruments are used. Shielding can reduce such interference, but is not wholly effective. Radio frequency field strength should be less than 25 millivolts/meter (1.6×10^{-13} watts/meter^2) at the observatory site. Conditions required to avoid surpassing this limit are complex, involving the type of terrain and the particular radio frequency being emitted. Microwave transmitters and directional radio transmitters would not adversely affect observing instrumentation unless directed at the observatory domes.

2.4 Location Criteria for Millimeter-Wave Telescopes

a. <u>Uniformly dry atmospheric conditions</u>: Because the water vapor in the earth's atmosphere absorbs radiation from space, millimeter and submillimeter telescopes must be located in an area dry enough to ensure maximum practical usefulness. The earth-based astronomer must concentrate his observations in a number of spacific atmospheric "windows" located between the oxygen and water absorption features. The transmission and to some extent the width of these windows depends upon the site altitude and the amount of water vapor above that site.[7] Elevation should be greater than 9,000 feet above sea level. Lower elevations are inferior from the standpoint of water vapor.

At 1.5 mm or less preciptable water vapor, all of the atmospheric "windows" are available for study by a submillimeter telescope. Consistently dry air with a minimum of "pockets" of moisture enables astronomers to study the full range of the millimeter and submillimeter waves for which these telescopes are designed. Because each different part of the sky is available for observation only at its own corresponding season, the atmosphere should be <u>uniformly</u> dry, without major seasonal variations.

b. <u>Low latitude</u>: Latitude should be less than 37° N since more northerly sites would unduly restrict observing in the southern part of the sky. It is advantageous to locate millimeter telescopes at low latitudes, since the nucleus and inner part of our galaxy both lie below the celestial equator. Latitude is usually evaluated in terms of the altitude, in degrees, at which the Galactic Center transits. Altitudes less than about 45° rapidly become less useful, both because of the greater amount of (water-containing) atmosphere in the line of sight, and because a lower altitude of transit implies a shorter observing time available. Latitude position also determines the fraction of the total sky available at the site.

c. Electromagnetic (Radio Frequency) Interference: Much of today's astronomical instrumentation is based on photoelectric detection techniques through which light is converted into electrical signals. These signals are characteristically so extremely weak that they can easily be confused by spurious signals induced by T.V. and radio transmission; this is especially troublesome in the FM 9100 MHz range. Millimeter-wave telescopes are especially sensitive to radio interference and must be located in areas of intrinsically low levels of radio noise.

d. Wind: The receiving dish used by millimeter wave telescopes generally ranges in size from 10 meters to as much as 25 meters in diameter. This relatively large-sized dish characteristically draws greater wind loading. Radio or millimeter-wave telescopes are sensitive to shaking and consequently should be located where natural topography provides a shield from the wind. Millimeter-wave telescopes can be located downwind of optical telescope installations, but the reverse is not true unless the spacing between the telescopes exceeds approximately 1,000 to 1,500 feet.

2.5 Summary

Because of the heavy capital investment which is required to construct and operate a telescope, sites for new facilities are not chosen capriciously. In most cases sponsoring agencies spend several years testing and evaluating various mountains before making their location decision. By the time application is made, the agencies are usually convinced that Mauna Kea is the best site for the proposed telescope.

Appendix M describes selected alternative locations world-wide for optical/infrared and millimeter-wave telescopes. Several major locations are mentioned in terms of their suitability for optical/infrared and millimeter-wave observations. No comparative evaluation of the sites has been attempted, however, because each agency will weight the criteria according to their own specific requirements. Because siting requirements differ among telescopes, to a greater or lesser degree, different sites are tested at different times for different purposes. In addition, one site may be chosen over another for political, or other reasons unrelated to the specific criteria.

Mauna Kea has been described by many as being a superior site for infrared and millimeter-wave astronomy. It is the responsibility of each proposing agency to justify that Mauna Kea is the best site for a given proposed telescope. (Mauna Kea Plan)

PART VII: ROAD IMPROVEMENTS

A. DESCRIPTION OF THE PROPOSED ACTION

1.0 Description of the Construction Phase

Because road improvements are only in the preliminary planning phase, only generalized descriptions of construction activities are possible. An attempt was made, however, to identify and assess all actions that could be undertaken during the construction period that might have the potential of disturbing the environment. Early assessment will enable UH and the D.O.T. to incorporate mitigating measures into the project design so that most environmental impacts can be eliminated or minimized before they occur. Construction activities which have the potential of disturbing the localized environment are:

(1) On-site presence of construction equipment, construction vehicles, construction materials, a temporary construction field office, and an auxiliary generator;

(2) Excavation and grading of a new road bed to provide for a 15-foot to 20-foot travel surface with a 5-7-foot gutter/shoulder; construction of retaining walls where necessary;

(3) Modification of the existing alignment where grades exceed 15 percent;

(4) Construction of gutters and culverts for drainage;

(5) Installation of guard rails on posts and signs for traffic safety;

(6) Construction of parking areas at five locations along the road;

(7) Paving of the new road; and,

(8) Removal of equipment, temporary field office, and temporary generator from the site upon completion of construction.

2.0 Description of the Operations Phase

Actions to be taken upon completion of the summit road which may affect and/or modify the local environment are:

(1) An estimated 300 vehicle trips per day during the weekdays, and up to 500 vehicle trips per day on weekends with heavy snowfall; and,

(2) Snow removal and general maintenance of the road.

B. ANTICIPATED ENVIRONMENTAL IMPACTS AND PROPOSED MITIGATION MEASURES

1.0 Direct Impacts During the Construction Phase

Alteration of the Landform: Because most of the improvements will probably occur along the existing road alignment, it is not expected that the landform of the area will be altered significantly from its present condition, except where the proposed widening requires cutting into the mountain and where it is necessary to reduce grades to less than 15 percent. (Figure 10).

Erosion and Drainage: Natural erosion caused by wind and storms is prevalent on the mountain, causing material to sluff down on the road. Erosion is also being caused by the unpaved road. Paving will alleviate road bed erosion; care should be taken in improving the road to insure that erosion from embankments does not occur. Mitigating measures to prevent this impact include:

1. Limiting cuts into slopes to no deeper than would be naturally stable (unless a retaining wall is added);

2. construction of riprap over the slope;

3. locating a diversionary or interceptor ditch at the top of the slope;

4. slope benching and/or;

5. construction of slope drains.

Some of these measures will be effective only in the short term (during construction), while others may serve as long-term erosion control measures.

The general drainage pattern in the project area consists largely of sheet flow surface runoff which collects into local gullies. The access road grading should be designed so as not to collect or concentrate runoff.

Paving of the road should not significantly change existing drainage patterns. Drainage improvements should be constructed to keep water off the surface of the proposed paved road. Paved gutters, where necessary, should be placed in the typical roadway section; gutter flow should either be released into existing gullies or into energy dissipation structures, such as riprap basins, in order to lessen potential downslope damage. On long grades, provision for drainage may include cross ditches to channel runoff to the downslope side of the road, rather than carrying it to a point where the water has sufficient quantity and velocity to erode the road base or downslope areas.

It is expected that construction of roadside swales or paved gutters will eliminate the soil erosion presently occurring in the existing right-of-way. Other measures to lessen erosion and control sediment transport include: (1) constructing the culverts simultaneously with the road improvement and paving so that completed drainage facilities will be immediately available to handle runoff from the paved road surface; (2) placement of sediment traps at intervals along diversion ditches or gutters and at ends of drainageways; and, (3) installation of pervious dikes and energy dissipators at culverts or where a drainageway crosses the alignment.

Dust: Airborne particulates or dust can also be generated by wind erosion. Fine dust commonly occurs in the interstices of the volcanic rocks on Mauna Kea. Heavy construction equipment operations at the road and increased traffic along access roads will lead to the temporary generation of small dust particles. In addition, dust will be generated by the abrasive action of construction equipment on rocks. Dust control during construction will be maintained by: exposing the smallest area possible at any time; applying asphalt or chemical binders in spray form; and, halting construction until the weather improves. Water sprinkling of exposed surfaces will only be undertaken in extreme cases, when unexpected high winds occur.

Air Quality: Increased traffic and the use of heavy construction equipment will lead to the temporary generation of emissions from internal combustion engines. Proposed measures to mitigate the adverse effects to the air quality by the unavoidable generation of emissions include minimizing the number of equipment and vehicles to only those required, and maintaining both vehicles and equipment in good operating condition. Emissions from road construction-related vehicles and equipment will cease when construction of the road is completed.

Biological Impacts: Except for short stretches where a new alignment must be followed due to grade restrictions, the proposed construction should have only minimal effect on the flora and fauna in the area since it will occur within disturbed areas. If, after the road is designed, it appears that diversions from the existing alignment could affect undisturbed areas nearby, arrangements will be made in conjunction and in coordination with the DLNR Forestry Division for biological mitigation.

Natural and Archaeological Features: There are no known sites of historic or natural interest within the road alignment; the area is already disturbed. If major diversions from the existing alignment become necessary, arrangements will be made in conjunction and in coordination with the Historic Sites Section of the State Historic Preservation Office for archaeological mitigation.

Socio-Economic: It is anticipated that construction will take twelve to eighteen months, depending upon the weather and phasing of improvements. No permanent construction support facilities or concrete batch plant will be constructed. After the construction process is completed, all equipment will be removed and the site restored to its original condition.

2.0 Direct Impacts During the Operation Phase

Traffic: It is estimated that by the year 2000 traffic over the summit roads could approximate 300 vehicle trips per day during the weekdays and 500 vehicle trips during weekends with heavy snowfall. The management and monitoring plan addresses control of traffic from Hale Pohaku to the upper slopes of Mauna Kea. Implementation of this management plan will serve to mitigate potential adverse impacts that might occur with the anticipated increase of vehicles on the road.

Dust: Paving of the summit access road will act to minimize dust and will have positive long-term impacts on the air quality of the summit as the improved road surface will be less susceptible to erosion by wind than the existing surface. Dust adversely affects astronomical observations. Dust contamination reduces the reflectivity of optical surfaces, causing some corrosion and reducing the life of the coating of the optical surfaces. These effects in turn result in increased "down" time in order to remove the mirrors for cleaning and re-application of the coating. If mirrors are damaged, this could cause a telescope to be inoperative for a minimum of two years. In addition, dust can enter the mechanical parts of a telescope to cause wear of, or interference with, measurement and drive systems; this can reduce telescope performance and force a shutdown.

Air Quality: The expected increase in the number of vehicle trips attributable to the improvement of the road will generate a corresponding rise in automobile emissions. Because traffic will generally be intermittent and will be restricted to daylight hours, the increase in pollutants from this source will not be isignificant and will not impact observatory operations at night. Prevailing winds are expected to dissipate the pollutants before ambient air quality standards are exceeded.

Biological Impacts: Paving the road will be a positive impact to the biota of the area Paving will minimize the problem of dust generated by vehicles traveling over the existing unpaved roads.

Maintenance Activities: Road improvements and paving will generate positive impacts to MKSS personnel because it will minimize maintenance; facilitate snow removal; and facilitate de-icing activities such as placing cinders on the road.

Impacts on Other Users: Safety improvements and paving of roads to and within the summit will be beneficial to the users and visitors of the area and to telescope operations. Scenic and recreational areas presently used by skiers and other visitors will be made more accessible.

Paving of the road and construction of parking areas will facilitate enforcement of regulations forbidding "off-road" vehicles.

Natural and Archaeological Features: Paving of the access road could generate an increase in the number of visitors to the mountain which could result in adverse impacts to the natural and archaeological features of the area. Implementation of the management plan, including monitoring and enforcement of regulations, will mitigate potential adverse impacts.

Socio-Economic Impacts: It is anticipated that the construction of a paved road will result in safer travel for astronomers and those employed in support services to the various existing and proposed telescopes at the summit. The proposed road improvements will improve work productivity and enhance the attractiveness of Mauna Kea to the international astronomical community. The improved road will have a beneficial effect in lowering cost for travel time and for the transportation of supplies and equipment to the observatories. A positive short-term impact will be the number of island residents employed during the construction period.

C. ALTERNATIVES TO THE PROPOSED ACTION

1.0 No Action

The no action alternative means that the road will remain unimproved and unpaved. Serious dust problems caused by travel of observatory personnel and visitors over the unpaved roads within the Science Reserve will continue. Dust not only disturbs astronomical observations but also adversely affects the flora and fauna of the area.

If unimproved, the road will remain rough, dangerous, and lacking safety features, shoulders, gutters, and drainage culverts on the upper section. In addition, constant maintenance of the road surface with a road grader will be required due to the "wash-boarding" of the loose gravel surface, particularly on the steeper slopes and curves. Frequent washouts will continue due to the unstable nature of the volcanic ash and the lack of paved gutters and drainage culverts. The condition of the rough unpaved road surface willcontinue to contribute to accidents which not occur along the road. Vehicle maintenance costs will remain higher than necessary due to the rough road surface.

2.0 Alternative Level of Road Improvements

An alternative to the proposed 15-foot paved surface is the improvement of the road to to meet Hawaii County standards for paved rural roads. This alternative could involve the same level of road improvements as the proposed action, however, this alternative involves widening of the existing road to 26 feet (20-foot road with 3-foot shoulders). This alternative would also generally follow the present alignment. The intent of this alternative is to improve the existing road for eventual dedication to the County. Implementation of this alternative might involve constructing more retaining walls in order to prevent erosion.

3.0 Road Alignment Alternatives

The alignment of the existing road was selected after numerous studies were performed, for example: (1) "Mauna Kea Observatory Access Road, Island of Hawaii, Southern Slope Alignments," Tudor Engineering Company, 12 June 1970; and, (2) "Mauna Kea Observatory Access Road, Island of Hawaii, Western Slope Alignment," Tudor Engineering Company, 30 July 1970. A preliminary study of the summit access road by Sam Hirota, Inc., indicates that given the proposed level of improvements, there will be no need to seek a major alternate alignment. The construction of a new road alignment will create new scars on the summit's surface.

4.0 Minor Road Improvements

Implementation of this alternative would involve making only minor improvements to the existing road such as lessening grade differentials. While this might reduce the likelihood of traffic accidents, it would not solve basic maintenance, safety, erosion and dust problems.

PART VIII: PERMANENT POWERLINE

A. POWERLINE FROM SADDLE ROAD TO HALE POHAKU

1.0 General Description of the Environment

Topography: Between Hale Pohaku and the southern boundary of the Forest Reserve, the area is rough and rocky, with numerous cinder cones, aa lava flows and gulches. The topography increases sharply, at a rate of approximately 1,000 feet per mile. Below Hale Pohaku to the Saddle Road, the aa flows are locally overlain by tephra. There are also postglacial stream sediments, largely gravelly sand or sandy gravel with a variable composition that reflects local bedrock. There are no permanent streams within the area, although gulches do fill with water during periods of heavy rainfall.

Vegetation: The area between the Saddle Road to the Forest Reserve boundary can be generally described as rolling grasslands. The vegetation in the open pastures is mostly comprised of introduced grasses and forbs including orchid grass (*Dactylis glomerata*), Kentucky bluegrass (*Poa pratensis*), kikiyu (*Pennisetum clandestinum*), mullein (*Verbascum thapsus*), sweet vernal (*Anthoxanthum odoratum*), wallaby grass (*Danthonia semiannularis*), velvet grass (*Holcus lanatus*), sheep sorrel (*Rumex acetosella*), and gosmore (*Hypochaeris radicata*). The area within the Forest Reserve is wooded zone containing mostly native mamane (*Sophora chrysophylla*) up to the timber line near Hale Pohaku, at approximately the 9,500-foot elevation. Scattered pilo (*Coprosma sp.*), sandlewood (*Santalum sp.*), naio (*Myoporum sandwicense*) and akoko (*Euphorbia sp.*) trees contribute some variety, but are nowhere as abundant as the mamane. Understory vegetation includes most of the herbaceous species already mentioned along with two common native grasses, *Trisetum glomeratum* and *Deschampsia nubigena*. Pukiawe (*Styphelia tameiameiae*), kupaoa (*Railliardia sp.*) and ohelo (*Vaccinium sp.*) are shrub-like plants found at higher elevations and often extends a short distance above treeline.[28]

Mamane is the major food source of a number of bird species, including the endangered Palila. The clumps of mamane are also important because they act as fog interceptors to provide themselves, and other species associated with them, with the small amounts of moisture they need for survival. In addition, the *Sophora* clumps help prevent the ash soil under them from being carried away by winter storms.

Avifauna: Table 4 provides a species list of the birds of Mauna Kea. Of the species or subspecies currently on the Federal list of endangered species that have been sighted in the area or presumed to inhabit the area are the Palila and the 'Ua'u. The Palila (*Psittirostra bailleui*) is a small bird of the Hawaiian honeycreeper family (Drepanididae), and was listed as a endangered species since 1966. The nesting season for the bird usually starts in the late spring and lasts from five to six months.

TABLE 4

CHECKLIST OF THE BIRDS OF MAUNA KEA, ISLAND OF HAWAII

SPECIES	COMMON NAME	HAWAIIAN NAME	STATUS*
Family PROCELLARIIDAE (Petrels & Shearwaters)			
Pterodroma phaeopygia sandwichensis	Hawaiian Petrel	'Ua'u	Bis (E)**
Family ANATIDAE (Ducks & Geese)			
Branta sandvicensis	Hawaiian Goose	Nēnē	Re (E)**
Family ACCIPITRIDAE (Hawks, Eagles)			
Buteo solitarius	Hawaiian Hawk	'Io	Re (E)**
Family PHASIANIDAE (Quails, Pheasants & Francolins)			
Lophortyx californicus	California Quail		Fl
Alectoris chukar	Chukar		Fl
Francolinus pondicerianus	Gray Francolin		Fn
F. francolinus	Black Francolin		Fn
F. erckelii	Erckel Francolin		Fn
Coturnix coturnix	Japanese Quail		Fl
Lophura levcomelana	Kalij Pheasant		Fn
Phasianus colchicus	Ring-necked Pheasant		Fl
Family CHARADRIIDAE (Plovers)			
Pluvialis dominica	American Golden Plover	Kōlea	Vr

TABLE 4

CHECKLIST OF THE BIRDS OF MAUNA KEA, ISLAND OF HAWAII
(Continued)

SPECIES	COMMON NAME	HAWAIIAN NAME	STATUS*
Family COLUMBIDAE (Doves)			
Columba livia	Feral pigeon, Rock dove		Fl
Zenaidura macroura	Mourning Dove		Fn
Streptopelia chinensis	Spotted dove		Fl
Geopelia striata	Barred dove		Fl
Family TYTONIDAE (Barn owls)			
Tyto alba	Barn owl		Fn
Family STRIGIDAE (Typical Owls)			
Asio flammeus sandwichensis	Hawaiian owl	Pueo	Ris
Family ALAUDIDAE (Larks)			
Alaudia arvensis	European Skylark		Vs, Fl
Family TIMALIIDAE (Babblers)			
Garrulax Canorus	Melodius Laughing-Thrush, Hwa-mei		Fl
Leiothrix lutea	Red-billed Leiothrix, Japanese Hill Robin		Fl
Family MUSICAPIDAE (Old World Flycatchers)			
Chasiempis sandwichensis sandwichensis	Hawaii 'Elepaio	Hawaii 'Elepaio	Re
Family ZOSTEROPIDAE (White Eyes)			
Zosterops japonica	Japanese White Eye		Fl

TABLE 4

CHECKLIST OF THE BIRDS OF MAUNA KEA, ISLAND OF HAWAII
(Continued)

SPECIES	COMMON NAME	HAWAIIAN NAME	STATUS*
Family STURNIDAE			
(Mynas)			
Acridotheres tristis	Common Mynah		Fl
Family DREPANIDIDAE			
(Hawaiian Honeycreepers)			
Loxops virens virens	Hawaii 'Amakini	'Amakini	Re
Loxops maculata mana	Hawaii Creeper		Re (E)**
Loxops coccinea coccinea	Hawaii 'Ākepa	'Akankane, Hawaii 'Ākepa	Re (E)**
Hemingnathus wilsoni		'Akiapola'au	Re (E)**
Psittirostra bailleui	Palila	Palila	Re (E)**
Himatione sanguinea sanguinea	'Apapane	'Apapane	Re
Vestiaria coccinea	'I'iwi	'I'iwi	Re
Family PLOCEIDAE			
(Waxbills, Munias, Weaver Finches)			
Lonchura malabarica	Warbling Silverbill		Fn
Passer domesticus	House sparrow		Fl
Family FRINGILLIDAE			
(Cardinals, finches)			
Cardinalis cardinalis	Northern Cardinal		Fl
Carpodacus mexicanus	House Finch		Fl

SOURCE: Mailc Stemmerman, Ornithologist

*Status symbols follow Pyle (1977), Preliminary List of the Birds of Hawaii, 'Elepaio 37(10):110-121,as below:

- Re = Resident; endemic at species level
- Fl = Foreign; long established & breeding for more than 25 years
- Fn = Foreign, new introduction; apparently established, but for less than 25 years
- Ris = Resident; indigenous species - Hawaiian subspecies is endemic
- Vr= Visitor, regular migrant to Hawaii
- Vs= Visitor, accidental straggles to Hawaii

**... = designated species or subspecies currently on the Federal list of endangered species.

Mamane trees provides most of the food, shelter and nest sites for the Palila. Because this endangered species is dependent on the green pods and flowers of the mamane, and because the mamane flowers sporadically on the mountain slopes, it was necessary to include, within this habitat, forest land that encompasses most of the Palila's known historic range on Mauna Kea. Over 30,000 acres of the Mamane/Naio forest area of the mountain have been designated as the critical habitat of the endangered Palila, encompassing Hale Pohaku and extending above it to the 10,000-foot level (Figure 3). This designated area was established on August 11, 1977 (Federal Register, August, 1977) because its habitat was being adversely modified by the browsing of feral sheep on mamane trees. The Mauna Kea Plan states that: "In accordance with the rules and regulations established in the Federal Endangered Species Act of 1973, and pursuant to Act 65 of the 1975 State Legislature, this area [the Mamane/Naio Forest] will be managed primarily to maintain and improve the native Hawaiian Ecosystem and the threatened and endangered species found therein."[29]

The Hawaiian Dark-Rumped Petrel or 'Ua'u (Pterodroma phaeopygia sandwichensis) is an endangered endemic subspecies which was recently rediscovered at Haleakala, Maui and on Lanai. The 'Ua'u is historically endemic to the major Hawaiian Islands. No essential habitat has been designated for this bird. Earlier reported to nest between 1,500 and 5,000 feet on Mauna Kea, it now appears that the 'Ua'u only digs its burrows at higher sites where the predator population is less dense. However, none were sighted in the course of a U.S. Fish and Wildlife Service terrestial bird survey or during a specific one-day survey for the 'Ua'u conducted on Mauna Kea. A draft of a Recovery Plan for the "Hawaiian Dark-Rumped Petrel and Newell's Shearwater" by Thomas Telfer is in the process of agency review. Preliminary recommendations note predator control as the key to removing the species from endangered status.

Other birds that inhabit the area that are of particular interest are game birds. Hunters and State Fish and Game officials report that the chukar partridge (Alectoris chukar), and the california quail (Lophortyx californicus) inhabit the area. The primary habitat of the chuckar partridge is at tree line and higher, on bare rocky slopes. The chukar feeds primarily on gosmore, ohelo and pukiawe. The california quail feeds on seeds from sweet vernal grass, common thistle, gosmore, sheep sorrel and mamane.

Mammals: The Hawaiian Hoary Bat (Lasiurus cinereus semotus) is an endangered species (Federally-listed) that exists primarily on the island of Hawaii. The bat is the only land mammal indigenous to the Hawaiian Islands. Sightings have also been reported on Oahu, Maui, and Kauai. ? The bats apparently prefer habitats of open or mixed character and venture consistently out over the open ocean. Bats have been most commonly seen from sea level to 4,000 feet.[30]

The area is inhabited by feral pigs (Sus scrofa), cattle, mouflon sheep (Ovis musimon), and possibly small numbers of feral sheep (Ovis aires) and feral goats (Capra hircus). It is presumed that other small mammals such as the house mouse (Mus musculus), black rat (Rattus rattus) and mongoose (Herpeste auropunctatus) also inhabit the area.

As reported in the Ecology of the Feral Pig on the Island of Hawaii, Final Report, prepared by the Department of Land and Natural Resources: "Pigs are abundant in the semi-open mamane woodlands of Mauna Kea to an elevation of 9,000 feet. In this mountain-pasture habitat, pig density reaches a maximum of perhaps 100 pigs per square mile in the best portions although lower densities are more common for the range as a whole."[31] For pigs in the mountain-pasture habitat of Mauna Kea, the most important species eaten by volume are grasses, gosmore (*Hypochoeris radicata*), and bracken fern. "Bracken fern roots are dug up and eaten in quantity where they occur; the search for these roots is responsible for much of the pasture damage in this area."[32]

Large numbers of cattle (Herefords) can be found on the Humuula section of Parker Ranch. The effects of cattle grazing, on the forests of Mauna Kea have been considerable. "Vast areas of mamane forest have been converted to pasture by these large herbivores. The resulting grasslands are well suited for domestic livestock, but provide poor habitat for wild game and endemic bird life."[33]

The Department of Land and Natural Resources', Ecology of the Mouflon Sheep on Mauna Kea, stated that: "Mauna Kea mouflon exhibit a limited distribution pattern. Herds of pure-bred ancestry are restricted primarily to the eastern slopes of the mountain. The primary range lies between the summit highway and Puu Kaaliali. Vertical distribution extends from approximately 6,400 to 11,000 feet elevation (Figure 11). Small herds have been founded outside the primary range at Puu Mali and Kemole, but sightings are infrequent."[34]

Because browsing of the mouflon sheep has had a destructive effect on the critical habitat of the Palila, the Hawai'i Audobon Society (HAS) is asking the court to rule that the mouflon sheep is incompatible with the critical habitat of the Palila and find that the DLNR is in violation of the national Endangered Species Act by continuing to maintain these game animals there.[35] Earlier, in a decision rendered 6 June 1979 (U.S. District Court for the District of Hawaii), the court found that the DLNR was in violation of the Endangered Species Act by maintaining feral sheep and goats in the Palila's critical habitat. The court also ordered the DLNR to adopt a program at state expense to eradicate feral sheep and goats from the critical habitat or to refrain from taking any action which has the effect of increasing or maintaining the existing population of feral sheep and goats.

Archaeological/Historical Features: The areas which might be affected by the project have not been surveyed for archaeological/historical features. Arrangements will be made in conjunction and in coordination with the Historic Sites Section of State Historic Preservation Office for archaeological mitigation when a corridor and alignment are selected.

Uses of the Area: Portions of all the alternative powerline corridors are located within the Mauna Kea Forest Reserve and Game Management Area. A 52-mile long stock-proof fence surrounds most of the boundary of the Forest Reserve. Hunting is a traditional use within and on the perimeter of the Reserve. Ten species of birds also inhabit the area which are available for hunting. Hiking, sightseeing and photography are also popular uses of the Forest Reserve.

2.0 Alternative Powerline Corridors from Saddle Road to Hale Pohaku

Four alternative corridors for powerlines, from the HELCo 69 KV line near the Saddle Road to Hale Pohaku, are currently being considered. Both underground and overhead powerlines are being evaluated for alternatives "A", "C" and "D". (Figure 11).

2.1 General Description of Corridor "A"

A switching station is proposed to be located where the corridor begins at approximately the 6,800-foot contour. The corridor runs northwest of and parallel to the border of the Hamakua/North Hilo district boundary. The ground rises gradually, except for a very steep climb near Hale Pohaku. The growth of trees is light to medium. The corridor proceeds northeast towards Hale Pohaku going between Puu Haiwahine and Puu Kalepeamoa. The length of this corridor is approximately 3.8 miles. The proposed site for a substation is located in the saddle between Puu Kalepeamoa and the hill just north of it. The estimated cost of placing the powerline underground in this corridor is $6,500,000; overhead construction is estimated to be approximately $950,000.

There are existing jeep trails for most of the corridor which may provide access for the construction and maintenance of the powerline. In the areas where the terrain is difficult to traverse or no jeep trails exist, construction of service roads may be required in order to bring construction equipment and personnel to the site. A short access road may have to be constructed to the switching station site.

Vegetation: The beginning of this corridor and the switching station would be located in lands with mamane and naio trees of moderate stature, 5-10 meters tall, with some or no interlocking crowns. As the corridor nears the site of the substation on the north saddle of Puu Kalepeamoa, there is little or no naio trees, and the mamane trees are significantly shorter, ranging from 2-5 meters high. The site of the substation has no trees, and the ground cover is sparse with mixed native-exotic grasses, sedges, rushes and native shrubs.

Fauna: All of this corridor is located within the Mamane/Naio Forest and the critical habitat of the palila, an endangered species.

Uses of the Corridor: The entire length of this corridor is located on State lands, managed by the Department of Land and Natural Resources. The Pohakuloa Training Area encompasses a small portion of the lower slopes of the mountain below the Mamane/Naio forest and is used primarily for military training operations in accordance with lease arrangements between the Army and the Board of Land and Natural Resources. Permission will have to be obtained from the Army because the switching station and a small portion of this corridor traverses through the notheastern corner of these lands. Informal contact with the Army indicates that there will be no objection to locating the switching station and powerline in this area. According to representatives of the Sportsmen of Hawaii, the area to the west of this corridor is used for hunting.

2.2 General Description of Corridor "B"

The switching station and the beginning of this corridor would be the same as corridor "A". An overhead line would follow an existing fence line beginning at the intersection of the Forest Reserve boundary and the Hamakua/North Hilo district boundary at the 6,960-foot contour, until it rejoins the Forest Reserve boundary at the 7,780-foot elevation. The powerline would then run parallel and just north of the fence line which delineates the Game Management Area boundary from this point until it intersects the County road. A substation, hidden from the road, would be located at this point. From the substation, a 12KV powerline would be placed underground, following the alignment of the County road to service both Hale Pohaku and the summit. The length of this corridor is approximately 5.87 miles. The estimated cost of the 69KV overhead line following the Forest Reserve fence is $890,000. The estimated cost for the underground 12KV lines from the substation to Hale Pohaku along the County road is $1,220,000.

Since the lower portion of the corridor will follow an existing fence line to the county road, access to the line for construction and maintenance will probably by use of the cleared corridor used to maintain the fence. In the portion of the corridor above the Forest Reserve boundary, construction of an access road will not be necessary as County road to Hale Pohaku can be used. A road may have to be constructed to the switching station site.

Vegetation: The beginning of this corridor and the switching station would be located in lands with mamane and naio trees of moderate stature, 5-10 meters tall, with some or no interlocking crowns. The portion of the corridor below the Forest Reserve Boundary passes through areas of scattered mamane and naio trees of moderate stature and through areas of very scattered, low, mamane trees. The understory is composed of exotic grasses, sedges and rushes. The vegetation of the corridor within the Forest Reserve Boundaries is composed of little or no naio trees, mamane trees, 2-5 meters high and understory composed of mixed native-exotic grasses, sedges, rushes and native shrubs.

Fauna: All of this corridor would be located within the Mamane/Naio Forest, the critical habitat of the palila, and endangered bird.

Uses of the Corridor: The Pohakuloa Training Area encompasses a small portion of the lower slopes of the mountain below the Mamane/Naio forest and is used primarily for military training purposes in accordance with lease arrangements between the Army and the Board of Land and Natural Resources. Permission will have to be obtained from the Army because the switching station and a small portion of this corridor traverses through the notheastern corner of these lands. Informal contact with the Army indicates that there will be little no objections to siting the switching station and powerline in this area.

The portion of the corridor below the Forest Reserve is located within lands of the Department of Hawaiian Homes Lands (DHHL), whose policy is not to grant long term leases of a duration required by HELCo for easements. The land is currently leased to Richard Smart (Parker Ranch) and is used for cattle grazing.

2.3 General Description of Corridor "C"

This corridor essentially follows the direction of the County road from the Saddle Road to Hale Pohaku while maintaining as straight a line as possible. The corridor at times may be as much as 2,000 feet from the roadway and is approximately 4.53 miles long. The slope in the portion of the corridor below the Forest Reserve boundary is gradual. The switching station would be located at the Humuula Sheep Station, the substation at Hale Pohaku. The switching station will be visible from the road but the substation will be located behind a knoll, out of sight from Hale Pohaku. The estimated cost of placing the powerline underground in this corridor is $9,500,000, overhead, $1,200,000.

An alternative to the general alignment of "C", is "C1". "C1" shares the same corridor and location for the switching station as alternative "C" up to the Forest Reserve boundary, where the corridor shares the same alignment as the County road onward to Hale Pohaku. This alternative envisions an overhead line to the Forest Reserve Boundary, a substation at this point, and an underground 12KV line from the substation to Hale Pohaku. The intent of this alternative is that the line would be kept underground in the Forest Reserve. The estimated cost of this alternative is $2,000,000.

The terrain in the portion of corridors "C" and "C1" below the Forest Reserve boundary is sparsely vegetated, with gradual slopes and easily traversible, therefore, the construction of a road for the construction and maintenance of the powerline will not be necessary. In the portion of corridor "C" within the Forest Reserve where the terrain is difficult to traverse or no jeep trails exist, construction of roads may be required in order to bring construction equipment and personnel to the site. Preliminary analysis indicates that a road may have to be constructed to the proposed substation site for corridor "C1". In the portion of corridor "C1" within the Forest Reserve, the existing County road will be used in order to bring equipment and personnel to construct and maintain the powerline.

Vegetation: The beginning of corridors "C" and "C1" and the switching station would be located in lands with very scattered koa and mamane trees, 5-10 meters tall. The portions of the corridors below the Forest Reserve Boundary pass through areas of scattered mamane and naio trees of moderate stature and through areas of very scattered, low, mamane trees. The understory of both areas are composed of exotic grasses, sedges and rushes. The vegetation of the portions of the corridors within the Forest Reserve is composed of little or no naio trees, mamane trees, 2-5 meters high and understory composed of mixed native-exotic grasses, sedges, rushes and native shrubs.

Fauna: Portions of both corridors would be located within the Mamane/Naio Forest and the critical habitat of the palila, an endangered species.

Uses of the Corridors: Portions of both corridors below the Forest Reserve are located within lands of the Department of Hawaiian Homes Lands (DHHL), whose policy is not to grant long term leases of a duration required by HELCo for easements. The land is currently leased to Richard Smart (Parker Ranch) and is used for cattle grazing.

2.4 General Description of Corridor Alternative "D"

The beginning of this corridor and the site of the switching station is located approximately 5,000 feet to the east of the junction of County road and the Saddle Road at the 6,500-foot elevation. The powerline would head towards the west side of Puu Huikau. The line would then proceed in a northeast direction to a point at the 7,040-foot contour, northeast of the small hill directly north of Puu Huikau. From this point, the line would head directly towards Hale Pohaku. The length of this corridor is approximately 5.07 miles. The substation would be located so that it would not be readily visible from Hale Pohaku. Placement of the lines underground in this corridor is estimated at $8,600,000, overhead lines $1,250,000.

The terrain in the portion of the corridor below the Forest Reserve boundary is sparsely vegetated, with gradual slopes and easily traversible, therefore, the construction of roads for the construction and maintenance of the powerline, will not be required. The portion of the corridor within the Forest Reserve is rocky, deeply eroded and difficult to traverse and lacking in extensive jeep trails, therefore, construction of access roads will be necessary in order to bring construction equipment and personnel to the site.

Vegetation: The beginning of this corridor and the switching station would be located in lands with very scattered koa and mamane trees, 5-10 meters tall. The portion of the corridor below the Forest Reserve Boundary passes through areas of scattered mamane and naio trees of moderate stature. The understory for the entire corridor below the Forest Reserve Boundary is composed of exotic grasses, sedges and rushes. The portion of the corridor above the Forest Reserve Boundary passes through: areas of little or no naio trees, 2-5 meters high mamane trees and understory composed of mixed native-exotic grasses, sedges, rushes and native shrubs; areas of very scattered 2-5 meters high mamane trees, and, areas where the ground is either bare or covered with native shrubs.

Fauna: A portion of this corridor would be located within the Mamane/Naio Forest and the critical habitat of the palila, an endangered species.

Uses of the Corridor: Nearly all of the corridor is located within lands of the Department of Hawaiian Homes Lands (DHHL), whose policy is not to grant long term leases of a duration required by HELCo for easements. The land is currently leased to Richard Smart (Parker Ranch) and is used for cattle grazing.

3.0 Description and Anticipated Impacts of the Construction of the Powerline

3.1 General Actions

General actions to be taken in the construction of the powerline overhead which may disturb the localized environment and/or modify or change the environment of the area are:

1. On-site presence of construction equipment, construction vehicles, materials, a temporary construction field office, and an auxiliary generator;

2. Construction of a switching station at the connection of the existing 69KV overhead line; installation of a 69KV line from source to the proposed substation;

3. Construction of service roads where there are no existing jeep trails or the terrain is relatively difficult to traverse, for construction and maintenance of the line;

4. Construction of a substation, with transformers and appurtenances, on a 25' x 25' concrete pad, in a 10,000 square foot site, fenced with 6-foot high chain link, topped with barbed wire; and,

5. Removal of equipment, vehicles, materials, construction field office, and auxiliary generator from the site upon completion of construction.

3.2 Environmental Impacts

Traffic: There will be increased truck traffic between Hilo and Hale Pohaku during the construction period. Most construction equipment and materials will be stored on the site for the duration of the construction period.

Dust: Heavy construction equipment operations at the site and increased traffic along access roads will lead to the temporary generation of small dust particles. However, due to small number of construction vehicles involved, dust mitigation measures such as water truck spraying of equipment routes during construction are not likely to be necessary.

Fauna: The U.S. Department of the Interior, Fish and Wildlife Service has been consulted in an advisory capacity concerning the proposed powerline corridors. The Fish and Wildlife Service stated that overhead or underground lines would have the least impact on the palila if the lines were located in a corridor closely adjacent to currently used roadways. Existing roadways are already disturbed, and additional minor disturbances on easements along the County road to Hale Pohaku would have minimal impact on the palila. They further stated the destruction of trees within the palila habitat should be avoided as much as possible. Their preliminary opinion is incorporated in Appendix D.

Some measures that will be taken to minimize disturbance of the existing flora and fauna and improve the avian habitat are:

(a) As few mamane trees as possible will be removed or transplanted from the site; and,

(b) Construction will not be initiated during the palila beeding season unless birds are discouraged from nesting in the construction area, prior to and continuing into the nest site selection, pairing and breeding/rearing season.

Socio-Economic: A positive short-term impact will be the number of island residents employed during the construction period.

It is anticipated that during construction, the large game mammals (e.g., mouflon sheep), will move away from construction sites to other areas within the Forest Reserve. This may affect hunting activities in the area.

There are existing jeep trails that can be utilized during construction and maintenance of the line in corridor "A", however, it should be noted that the State Conservation and Resources Enforcement Division is planning to close the trails to discourage poaching. In order to utilize the road, without faciliating poaching activities, it is proposed that the jeep roads will be closed to the general public in the manner used to restrict access to roads through ranch lands or to utilities in rural areas.

Visual: During construction there will be the presence of construction equipment, construction materials and temporary structures. This impact on the visual quality of the area will be temporary since these items will be removed when the project is completed.

The proposed switching stations for corridor alternatives "A", "B" and "D" will not be visible from either the Saddle Road or the County road to Hale Pohaku. The proposed switching station for corridor alternative "C" will be visible from the Saddle Road and the County road to Hale Pohaku. The proposed substations for all four corridor alternatives will be sited so as not to be visible from the Saddle Road, County road to Hale Pohaku or Hale Pohaku.

3.3 Placement of the Powerline Underground

Specific actions to be taken in the construction of the powerline underground which may disturb the localized environment and/or modify or change the environment of the area are:

1. Clearing a straight, 20-foot wide corridor free of vegetation, from the switching station up to the substation, to allow backhoe and other construction related equipment to work at the site;

2. Excavation of a 4-foot wide by 5-foot deep trench for the 69 KV underground ductline from the switching station to the substation; installation of nine 5-inch ducts encased in concrete with 6-foot by 11-foot handholes spaced approximately 450 feet on centers; and,

3. Installation of two 69 KV cables and spliced at each handhole; filling trenches when the utility line is complete.

3.4 Environmental Impacts

Dust: The excavation of a 4-foot wide by 5-foot deep trench to house a 69 KV line will generate dust. However, for alternatives "B" and "C1", in the portions of corridors within the Forest Reserve where the powerline (12 KV) goes underground, it will only be necessary to excavate a 4-foot wide by 4-foot deep trench and 5-foot by 7-foot handholes. During high winds and storms, materials will be covered and construction will cease until the weather improves.

Vegetation: Construction of underground lines will require the removal of all vegetation in a 20-foot wide path. The removal of understory will expose the underlying soil to wind and water erosion. The impact of removing or trimming mamane trees within this 20-foot wide path will be severe, as the plant communities beneath the trees are dependent on the fog drip from the mamane.

Fauna: The removal of the mamane trees in order to provide a path for the construction of the powerline underground will remove a portion of the food supply of the endangered Palila.

Visual: While it will be necessary to remove all vegetation that lies within a 20-foot wide path, corridors "A" and "B" are located out of sight from the Saddle Road and the County road to Hale Pohaku. The vegetation in the portion of corridors "C" and "D" below the Forest Reserve is mostly comprised of exotic grasses and therefore the visual impact of clearing will be minimal. During construction, the portion of the cleared path within the Forest Reserve for underground lines in corridors "C" and "D" may be visible from the Saddle Road. Upon completion of construction, the cleared corridor will eventually be overgrown with mostly exotic vegetation, except where handholes are located.

3.5 Construction of the Powerline Overhead

Actions to be taken in the construction of the powerline overhead which may disturb the localized environment and/or modify or change the environment of the area are:

1. Construction of access roads to pole sites where there are no existing jeep trails or the terrain is relatively difficult to traverse, for construction and maintenance of the line;

2. Excavation of holes 7- to $7^1/_2$-feet deep for the installation of wooden poles 60, 65 and 70 feet long, spaced approximately 450 feet apart, with horizontal gray-colored insulators arranged in a triangular or vertical configuration and with aluminum conductors; and,

3. Installation of an overhead 69KV line from the switching station to the substation.

3.6 Environmental Impacts

Dust: The only excavation that will be necessary for overhead lines in corridor alternatives "A", "C" and "D" and in the portions of corridors "B" and "C1" below the intersection of the County road to Hale Pohaku and the Forest Reserve boundary are holes 7- to $7^1/_2$-feet deep, spaced approximately 450 feet apart. The dust generated during this phase of construction will be minimal. During high winds and storms, materials will be covered and construction will cease until the weather improves.

Fauna: The Fish and Wildlife Service has stated that, if a final corridor is chosen which does not follow the alignment of the County road (corridor alternatives "A", "C", "D" and the lower portion of "B"), then overhead transmission lines would have less impact on the palila than underground lines. As long as the poles are spaced approximately ±450 feet apart, the poles can be sited to avoid the removal of most of the trees.

Visual: Generally, the visual impact of constructing overhead lines in the portion of corridors "A", "C" and "D" within the Forest Reserve is less than that generated by the cleared 20-foot wide path required for the underground line. Although the cleared path will eventually be overgrown with vegetation, it is expected that since mamane regeneration is relatively slow, this path will be highly visible for a number of years.

4.0 Summary and Evaluation

The alternatives of constructing the powerline underground and overhead are being evaluated on the basis of impacts on vegetation and visual quality. As previously mentioned, the U.S. Fish and Wildlife Service has stated that if a final corridor is chosen which does not follow the alignment of the County road, then overhead transmission lines which only require holes 7- to $7^1/_2$-feet deep, spaced approximately 450 feet apart, would have less impact on the palila than underground lines which require clearing a straight, 20-foot wide path free of vegetation, and excavation of a 4-foot wide by 5-foot deep trench and 6-foot by 11-foot handholes spaced approximately 450 feet on centers. Also, the visual impact of constructing overhead lines in the forested portion of the corridors would be less than that generated by a cleared 20-foot wide path required for underground lines.

Assuming that the alternative of overhead lines is the more environmentally sound solution, the evaluation of a corridor for overhead line can be largely limited to its visibility from highly traveled areas.

Based on preliminary analyses, it is felt that overhead construction in Corridor A would be the most environmentally suitable route. Because of its distance from both Saddle Road and the County road to Hale Pohaku, overhead powerlines in this corridor will barely be visible from either location. There are existing jeep trails that can be utilized during construction and for maintaining the line, however, it should be noted that the State Conservation and Resources Enforcement Division is planning to close the roads to discourage poaching. In order to mitigate this problem, it is proposed that the access roads will be closed to the general public in the manner used to restrict access to roads through ranch lands or to utilities in rural areas.

The proposed switching station for corridor alternative "B" will not be visible from either the Saddle Road or the County road to Hale Pohaku. The substation will not be visible from the County road to Hale Pohaku or from Hale Pohaku. The overhead powerline will not be visible until it reaches the County road. The switching station for corridor alternatives "C" and "C1" will be visible from the County road to Hale Pohaku. The proposed substation for corridor "C" will be sited so that it will not be visible from Hale Pohaku. Overhead powerlines in this corridor will be highly visible as the corridor is located closest to the County road to Hale Pohaku. The substation for corridor "C1" will be sited so that it will not be visible from County road. Overhead powerlines in the portion of the corridor below the Forest Reserve boundary will be highly visible as the corridor is located closest to the County road to Hale Pohaku. The switching station for alternative "D" will not be visible from the Saddle Road or the the County road. The substation will be sited so that it will not be visible from Hale Pohaku. Overhead lines in corridor "D" will not be as visible as corridor "C".

B. DESCRIPTION OF THE UNDERGROUND POWERLINE FROM HALE POHAKU TO THE SUMMIT

1.0 General Description of the Environment

Biota: The area above the tree line is characterized as an alpine desert; bryophytes and lichens are the principal components of the flora at higher elevations. The climatic conditions at that altitude tend to be so severe as to exclude most higher plants. Based on the preliminary draft vegetation distribution maps compiled by the U. S. Fish and Wildlife Service, the beginning of the summit road and the 12 KV line near Hale Pohaku can be described as being mostly dry, non-forest land with more than 50 percent rock outcrop. The sparse vegetation consists of mixed native-exotic grasses, sedges or shrubs. In the higher elevations, much of it is bare ground with no plant cover.

Hunters and State Fish and Game officials report that the chukar partridge (*Alectoris chukar*) and the mouflon sheep (*Ovis musimon*) sometimes transit the area above the tree line.

Archaeological/Historical Features: The area has not been surveyed for archaeological/historical features.

2.0 Powerline Corridor from Hale Pohaku to the Summit

The general alignment for the underground powerline from Hale Pohaku to the summit is shown on Figure 11 as corridor "E". This powerline corridor follows the same alignment as the existing road to the summit. The estimated length for this corridor is 6.82 miles and the cost, $5,500,000. Alternative powerline alignments from Hale Pohaku to the summit are also shown on Figure 11.

2.1 Alternative Powerline Alignments from Hale Pohaku to the Summit

General Description of Alternative Alignment "1": This alternative involves the possibility of using a section of the Humuula trail that runs from Hale Pohaku to the summit (segment "Ela", Figure 11) to avoid the first eastern switchback at the beginning of the existing summit road, meeting the first western switchback of the existing summit road at the 10,040-foot contour. From this point the alignment would follow the existing summit road to the handhole at the 13,040-foot elevation. The estimated length of this corridor is 6.17 miles and the cost, $4,300,000. Construction would require approximately 163 days.

General Description of Alternative Alignment "2": This alignment follows segment "Ela" to the first western switchback of the existing summit road at the 10,040-foot contour. From this switchback, this alignment would follow the existing summit road to the 10,240-foot elevation, where it would follow the old road alignment to the second western switchback of the existing summit road at the 10,880-foot elevation (segment "E2a", Figure 11). From this point the alignment would follow the existing summit road to the handhole at the 13,040-foot elevation. The estimated length of this corridor is 5.17 miles and the cost, $3,620,000. Construction would require approximately approximately 136.5 days.

Segment "E2a" of this alignment are presently located within the Mauna Kea Ice Age Natural Area Reserve (NAR). A permit to construct powerline conduits within the NAR would be required.

General Description of Alternative "3": This alignment follows segments "Ela" and "E2a" to the second western switchback of the existing summit road at the 10,880-foot elevation. From this point it would follow the old road alignment, bypassing the third eastern switchback of the existing summit road, and then follow the existing summit road from the 11,280-foot elevation (segment "E2b", Figure 11). to the handhole at the 13,040-foot elevation. The estimated length of this corridor is 4.89 miles and the cost, $3,440,000. Construction would require approximately 129 days.

Segments "E2a" and "E2b" of this alignment are presently located within the Mauna Kea Ice Age Natural Area Reserve. A permit to construct powerline conduits within the NAR would be required.

General Description of Alternative "4"

This alignment follows segment "Ela" to the first western switchback of the existing summit road at the 10,040-foot contour. From there it would follow the Humuula trail to the 11,600-foot elevation where a short segment across undisturbed ground would need to be constructed in order to join the existing summit road at the 11,800-foot contour (segment "Elb", Figure 11). From this point, the alignment would follow the existing summit road to the handhole at the 13,040-foot elevation. The estimated length of this corridor is 4.77 miles and the cost, $3,400,000. Construction would require approximately 126 days.

Segment "Ela" of this alignment is presently located within the Mauna Kea Ice Age Natural Area Reserves. A permit to construct powerline conduits within the NAR would be required.

3.0 Description and Anticipated Impacts of the Construction of the Powerline

3.1 Description of the Action

Actions to be taken in the construction of the 12 KV powerline which may disturb the localized environment and/or modify or change the environment of the area are:

1. On-site presence of construction equipment, construction vehicles, materials, a temporary construction field office, and an auxiliary generator;

2. Widening the Humuula trail or the old summit road alignment to a 20-foot wide corridor (4-foot wide trench, 8-foot wide area for the storage of excavated material and 8 feet for travel surface) where necessary, to allow for backhoe and other construction-related equipment to work at the site;

3. Excavation of a 4-foot wide by 4-foot deep trench for the 12 KV underground ductline from a substation near Hale Pohaku to the handhole at the 13,040-foot elevation; installation of three 4-inch ducts with 5-foot by 7-foot handholes spaced approximately 450 feet on centers;

3. Installation of two sets of 12 KV lines and spliced at each handhole; installation of a conduit for future hardline communications link (e.g., fiber optics); filling trenches with excavated material when the utility line is complete;

5. Removal of equipment, vehicles, materials, construction field office, and an auxiliary generator from the site upon completion of construction.

3.2 Environmental Impacts

Traffic: There will be increased truck traffic between Hilo and the summit during the construction period. It is expected that most construction equipment and materials will be stored on the site for the duration of the construction period.

Dust: The excavation of a 4-foot wide by 4-foot deep trench will generate dust. Fine dust commonly occurs in the interstices of the volcanic rocks on Mauna Kea. In addition, dust will be generated by the abrasive action of construction equipment on rocks. Dust control during construction will be maintained by: exposing the smallest area possible at any time; water sprinkling exposed surfaces; and, halting construction during high winds and storms when materials will be covered and construction will cease until the weather improves.

Heavy construction equipment operations at the site and increased traffic along access roads will lead to the temporary generation of small dust particles. However, due to the small number of construction vehicles involved, dust mitigation measures such as water truck spraying of equipment routes during construction are not likely to be necessary.

Biology: Arrangements will be made in conjunction and in coordination with the State of Hawaii Department of Land and Natural Resources, Division of Fish and Wildlife for biological mitigation if the final alignment is located away from previously disturbed areas.

Archaeological/Historical Features: Arrangements will be made in conjunction and in coordination with the Historic Sites Section of State Historic Preservation Office for archaeological mitigation if the final alignment is located away from previously disturbed areas.

Socio-Economic: A positive short-term impact will be the number of island residents employed during the construction period.

During construction there will be the presence of construction equipment, construction materials and temporary structures. This impact on the visual quality of the area will be temporary since these items will be removed when the project is completed.

The use of the permanent powerline will eliminate the need to use the 850 KW generator, and therefore exhaust fumes will no longer be generated into the air. This should result in improving the astronomical observing conditions at the summit.

4.0 Summary and Evaluation

The SRCDP recommends that the powerline follow alternative "3" (following the old Humuula jeep trail [segment E1A] to the first switchback on the access road and then follow the old road alignment [segments E2A and E2B] up to approximately the 11,200 foot elevation, and then proceed along the existing summit access road).

Segments E2A and E2B are presently located within the Mauna Kea Ice Age Natural Area Reserve (NAR). The SRCDP recommends that the NARS commission consider adjusting the eastern boundary of this reserve to remove this powerline corridor from within its boundaries (Figure 5).

C. ALTERNATIVES TO THE PROPOSED ACTION

1.0 No Action

This alternative implies that power will continue to be provided by the 850 KW generator, and therefore the diesel engine generator will continue to generate exhaust fumes into the air, proposed telescopes will be without adequate power, and the scientific potential of the summit will be underutilized.

2.0 Additional Diesel Generators

In order to meet the estimated 3000 KW required to meet the power needs of the summit by the year 2000, an equivalent of six of the existing 850 KW generators would be required. This facility would have to be housed in a permanent rigid-frame building containing approximately 4,000 square feet. The diesel fuel for the generator would have to be stored in a 66,000 gallon tank in order to keep the present number of tanker truck trips from Hilo to once every ten to fifteen days. If the size of the fuel tank is smaller, the number of refueling trips would need to be increased. Even if space were available, increased emissions from the generator would be released into the air. These emissions could pose a threat to the biota at the summit and compromise astronomical observations.

3.0 Alternate Energy Sources

Alternate energy resources are limited to wind and solar. Although the summit has wind energy potential, there are a number of weather-related problems which make harnessing this renewable energy source difficult, among them: inherent unreliability due to wind speed variation from 0 to 120 mph; maintenance problems caused by ice formation on the blades during the winter; the high visibility of windmills and wind machines several hundred feet tall; and, noise and electronic interference generated by blade rotation.

While long-term solar insolation data for Mauna Kea is non-existent, based on data on Mauna Loa, it can be assumed that solar insolation above the 11,000-foot elevation of the summit is excellent because the inversion layer usually prevents cloud cover at the summit. Because of the excellent sunlight conditions and the uncovered terrain, a flat plate photovoltaic system has the greatest potential for Mauna Kea. It should be noted however that a 3000 kilowatt system would require over 12 acres of land.

Both of these renewable energy systems require either an immense storage capacity or a fully redundant back-up system to provide power when there is cloud cover or the wind is non-existent. The back-up system could consist of either an array of batteries (one-half day of energy would require a building sufficient to house 58,000 cubic feet of batteries) or an auxiliary electrical system (i.e. diesel units or powerline connection to the utility). A 3000 kilowatt photovoltaic system with battery storage could cost between $16 to $26 million. The development of either wind and solar energy systems is not feasible for practical and economic reasons. Appendix N describes alternative energy systems.

PART IX: EXPANSION OF MID-ELEVATION FACILITIES AT HALE POHAKU

A. ASTRONOMY FACILITIES

The area chosen for expansion is within the already disturbed area to the east of the existing UH temporary facilities, at approximately the 9,250 foot elevation (Figure 12).

Construction of the dormitories will be phased with the construction of the telescopes. The first one constructed (estimated construction, 1984 or 1985), will contain approximately 15 to 20 bedrooms. All of the area allocated for future dormitories may not be required; actual needs will be determined by each proposing agency when it applies for permission to locate its telescope on Mauna Kea. The buildings will be designed to be consistent with the permanent mid-level facility. Environmental and design criteria established in the 1980 Hale Pohaku Complex Development Plan (DLNR) will be follow, some of these criteria are:

1. Locate structures and activities so that disturbance to the Mamane/Naio forest eco-system and the critical habitat of the Palila will be minimal;

2. Insure the preservation and enhancement of the existing native eco-system;

3. Minimize the visual impact of the development on the mountain;

4. Insure that the facilities will be both water and energy efficient; and,

5. Minimize the number of acres which must be restricted from hunting.

Parking for the new domitories is available in the area currently serving the UH temporary facilities. The parking area will be paved and appropriate drainage improvements will be constructed. Utility lines will be extended from the main facility in the manner prescribed in the Hale Pohaku CDP.

1.0 Description of the Construction Phase for Each Dormitory

Specific actions which may be taken in the construction of each dormitory which may disturb the localized environment and/or modify or change the environment of the area are:

(1) On-site presence of construction equipment, construction vehicles, construction materials, and a temporary construction field office;

(2) Clearing, grading, excavation and the installation of drainage improvements on the sites designated for expansion;

(3) Excavation for concrete footings (necessary as foundations for the building piers) and 8 feet in diameter and 25-foot deep cesspool;

(4) Extension of a water line from dormitory "C" to the proposed dormitories; construction of a sewer line from the new dormitory to a proposed cesspool; and, construction of a drainage pipe to the dry well;

(5) Construction of dormitory buildings, to an ultimate capacity of 61 to 77 single-occupancy bedrooms;

(6) Landscaping; and,

(7) Removal of equipment and temporary field office from the site upon completion of construction.

2.0 Impacts During the Construction Phase

Alteration of Landform: Although new dormitories will be "site-adapted" to the existing ground contours, some clearing, grubbing, excavating, and grading will be required in the site preparation and construction phases of the project; when the space is needed for the construction of permanent dormitories, the temporary UH buildings will be returned to DLNR for removal from the area.

Erosion: The soils in the area are highly erodable. Removal of the vegetation and surface rocks at dormitory sites could cause the displacement of the fine soil material and the resulting erosion and dust problems. To minimize the problem, the following measures are proposed:

(1) minimal site clearing and grading will be undertaken and all exposed areas will be replanted with endemic ground cover;

(2) cutting "benches" for building areas will be carefully accomplished and all banks will be stabilized by plantings, retaining walls, soil cement or other suitable means;

(3) roof gutters and drains will be designed so that they will not discharge directly onto the ground surface, and other drainage improvements will be undertaken;

(4) sightly elevated walkways will be provided between buildings to discourage the creation of numerous trampled paths; and

(5) drainage swales will be lined with an environmentally suitable material.

Impacts from dust and run-offs from exposed soils generated during construction can be mitigated by building specifications in the construction contract and by strict adherance to County regulations concerning grading and excavation.

Dust: Construction activities within the project area will lead to the temporary generation of small dust particles. In addition, dust will be generated during site preparation. Airborne particulates or dust can also be generated by wind erosion. Dust control during construction will be maintained by exposing the smallest area possible at any time and halting construction until the weather improves. To a degree, water will be sprinkled on exposed surfaces to supress dust, however, as water must be hauled from Hilo, it will be used sparingly.

Traffic: There will be a slight increase in traffic between Hilo and Hale Pohaku during the construction period. There will be trucks carrying concrete during the construction of the foundation, however, most heavy construction equipment used in site preparation will be stored on the site for the duration of the construction period. The exact number of truck trips generated by these types of construction activities cannot be estimated. All trips of heavy trucks up to Hale Pohaku will be scheduled during off-peak hours so as not to interfere with normal traffic flow in Hilo or along the Saddle Road.

Biology: The State Department of Land and Natural Resources, Division of Forestry and Wildlife Endangered Species Program, conducted a botanical survey of Hale Pohaku in October 1981; the findings of this survey is included in PART VI. In addition, the reader is referred to a botanical survey conducted by Grant Garrish, and an avian survey conducted by Maile Stemmerman, which were included in the appendices of the Hale Pohaku Mid-Elevation Facilities Master Plan Revised Environmental Impact Statement. Some measures that will be taken to minimize disturbance of the existing flora and fauna and improve the avian habitat are:

Hale Pohaku is located within the boundaries of the Mamane/Naio Forest Eco-System Management Area which was established by the Mauna Kea Plan (1977). It is also within the critical habitat of the rare and endangered Palila, Psittirostra bailleui (Federal Register, August, 1977).

If a federal presence is involved in a project, development within a federally recognized critical habitat of an endangered species is subject to the rules and regulations of Section 7 of the Endangered Species Act of 1973 (U.S.C. 1536) and 1978 amendments to the Act. If federal funds are used in the construction of any new dormitory buildings, formal consultation will be initiated between the affected Federal agency and the U.S. Fish and Wildlife Service.

The U.S. Fish and Wildlife Service was contacted informally during the preparation of the EIS. Their preliminary opinion was that the proposed construction would have little impact on the Palila and the Palila Critical Habitat if mitigating measures are undertaken. (Appendix D). The following measures should be taken to protect the biota of the area:

(a) Development should be planned so as to use the land as efficiently as possible; expansion of the mid-level facilities will be confined to an area which is already disturbed;

(b) Care should be taken to not disturb existing vegetation; as few mamane trees as possible should be removed or transplanted from the site;

(c) Native plants endemic to Mauna Kea should be planted;

(d) Measures should be taken to control undergrowth in order to prevent natural fires from destroying the existing mamane and any inhabiting species, such as the Palila;

(e) Construction should not be initiated during the palila beeding season unless birds are discouraged from nesting in the construction area prior to and continuing into the nest site selection, pairing and breeding/rearing season.

Natural and Archaeological Features: An archaeological reconnaissance survey of Hale Pohaku was conducted by Dr. McCoy in conjunction with the Hale Pohaku Master Plan. He found no archaeological or historic sites in the project area. He stated that the high elevations and moderately arid environment were minimally exploited by pre-contact Hawaiians. "This was probably due to the lack of adze-quality basalt and the absence of other apparent resources that would have required the establishment of camps for short periods of resource exploitation".[36]

Social-Economics: Although some noise generated during construction can be mitigated by the use of mufflers on combustible engines, noise due to construction may affect astronomy personnel who sleep during the day. This impact will be temporary as the dormitories in the main facility have been designed to attenuate sound so the impact will not be significant.

A positive short-term impact will be the number of island residents employed during the construction period.

B. EXPANSION OF THE VISITOR INFORMATION STATION AND PARKING AREA

Construction of additional telescopes at the summit and improvement of the access road may create demand for additional facilities and/or additional parking spaces at the Information Station because Hale Pohaku has been designated as "a central point for management of the mountain, and a day-use destination point for visitors. . ." (Expansion areas for the visitor Information Station and adjacent parking area are shown on Figure 12).

1.0 Description of the Construction Phase

Specific actions which may be taken in the expansion of the visitor information station and parking area which may disturb the localized environment and/or modify or change the environment of the area are:

(1) On-site presence of construction equipment, construction vehicles and construction materials;

(2) Grading and excavation for the foundation, and construction of an addition containing approximately 550 square feet of floor area;

(3) Clearing, grading and paving of an area of approximately 7,500 square feet as an additional parking area for 28 automobiles;

(4) Possible construction of a new cesspool if it is not feasible to design the building addition to avoid the existing one;

(5) Landscaping; and,

(6) Removal of equipment and construction materials from the site upon completion of construction.

2.0 Direct Impacts During the Construction Phase

Alteration of Landform: Although the proposed additions to the visitor information station and parking area will be "site-adapted" to the existing ground contours, some clearing, excavating, and grading will be required in the site preparation and construction phases of the project.

Erosion: Removal of the vegetation and surface rocks at the site could result in displacement of the fine materials with resultant erosion and dust problems. To minimize the problem the following measures will be taken:

(1) minimal site clearing and grading will be undertaken and all exposed areas will be replanted with endemic ground cover;

(2) roof gutters and drains will be designed so that they will not discharge onto the ground and other drainage improvements will be undertaken;

(3) appropriate drainage improvements will be constructed and any drainage swales required will be lined with an environmentally suitable material.

Impacts from dust and run-offs from exposed soils generated during construction can be mitigated by incorporation of specific measures in the construction contract and by strict adherance to County regulations concerning grading, excavation, etc.

Dust: Construction activities will lead to the temporary generation of small dust particles. Dust can also be generated by wind erosion. Dust control during construction will be maintained by exposing the smallest area possible at any time and/or halting construction during high winds until the weather improves. To a degree, water will be sprinkled on exposed surfaces to supress dust, however, as water must be hauled from Hilo, it will be used sparingly.

Drainage: Serious erosion problems in the area were caused by the culverts above Hale Pohaku which were installed during the construction of the summit access road. These culverts caused rain and melting snow water run-off from the upslope to dissect the existing development into three areas. Drainage improvements are being constructed for the permanent mid-level facility which will divert the water coming down from the upper slopes to catchment areas. From there the water will be piped to a natural ponding area just below the visitor information station parking lot. These improvements will prevent further flooding and erosion of the Hale Pohaku area and allow the re-establishment of native vegetation in formerly barren areas. If required, additional drainage improvements will be incorporated into the design of the new facilities.

Biology: The reader is referred to the previous discussion on the anticipated enviromental impacts of the expansion of the astronomy facilities at Hale Pohaku. Some measures that will be taken to minimize disturbance of the existing flora and fauna and improve the avian habitat are:

(a) Mamane and other native flora will be planted along side the road fronting the information station;

(b) Measures will be taken to control undergrowth in order to prevent natural fires from destroying the existing mamane and any inhabiting species, such as the Palila; and,

(c) Placement of refuse cans at the information station and maintenance of the area by station personnel.

Natural and Archaeological Features: Archaeological reconnaissance surveys of Hale Pohaku, Humuulu, and a site on Hawaiian Homelands just below the forest reserve were conducted by Dr. McCoy in conjunction with the Hale Pohaku Master Plan. He found no archaeological or historic sites at any of the locations. He stated that the high elevations and moderately arid environment were minimally exploited by pre-contact Hawaiians. "This was probably due to the lack of adze-quality basalt and the absence of other apparent resources that would have required the establishment of camps for short periods of resource exploitation".[37]

Socio-Economic: Although some noise generated during construction can be mitigated by the use of mufflers on combustible engines, noise due to construction may affect astronomy personnel who sleep during the day. This impact will be temporary as the dormitories in the main facility have been designed to attenuate sound so the impact will not be significant.

A positive short-term impact will be the number of island residents employed during the construction period.

C. IMPACTS DURING THE OPERATIONS PHASE OF THE EXPANDED ASTRONOMY FACILITIES AND VISITOR INFORMATION STATION AT HALE POHAKU

1.0 Description of the Operations Phase

Actions to be taken upon completion of the permanent mid-level facilities at Hale Pohaku, including an additional three or four dormitory structures, an expanded visitor Information Station and parking area, which may affect and/or modify the local environment are:

(1) At the astronomy facilities, the presence of 6 to 7 dormitories to accommodate 120 to 136 astronomy personnel, service roads, and paved parking areas;

(2) The presence of a 1,750 square foot visitor information station, cesspool and parking areas for 50 cars; approximately 100-300 visitors per day on weekdays, 500 to 1,000 on weekends with heavy snowfall;

(3) Consumption of approximately 18,000-to-22,000 gallons per day of water for heating, cooling and domestic consumption;

(4) Disposal of 7,000 to 13,000 gallons per day of liquid sewage; and,

(5) Generation and disposal of solid waste.

2.0 Impacts During the Operations Phase

Traffic: An increase in the number of persons using the astronomy facility will probably result in an increase in the volume of auto traffic to and from the site. Most of this increase will probably be on the access road from Hale Pohaku to the summit because the need to remain acclimatized will discourage discretionary travel to Hilo or Waimea. It is probable that car-pooling will be used extensively. A gate will be installed across the Mauna Kea access Road. This gate will be closed at night. Only authorized personnel will be allowed to travel to the summit at night.

The presence of the Information Station may generate increased traffic to the area. It is expected, though, that the heaviest concentration of traffic will occur on weekends when there is snow in the summit area. The benefit of construction of an additional parking lot at the visitor information station is that skiers, hunters, and other visitors will be provided with a convenient rest stop area and a place to park their cars. Hikers can park their vehicles at Hale Pohaku, pick up trail information from the Information Station, and proceed to their chosen destinations.

The draft Management Plan (Part IV) describes suggested measures to control traffic from Hale Pohaku to the summit area.

Air Quality: Increased traffic to the area and may result in an increase in localized pollutants from vehicle emissions. The prevailing winds will facilitate the dispersal of these pollutants.

Paving of the parking area and landscaping at the astronomy facility and the Information Station will act to minimize dust; this will have a positive long-term impact on the air quality of the area as the improved surface will be less susceptible to erosion by wind than the existing exposed surface.

Water: The estimated water needs for a total of 120 to 136 astronomy-related personnel is 18,000-to-22,000 gallons per day. Water requirements for toilets at the Information Station have been estimated for 100 persons per day, (3,000 gallons per day). Monitoring of usage will determine if the two 40,000 gallon water tanks will be sufficient to supply the needs of the expanded facility if the number of daily water tanker trips are increased. Because the water being trucked from Hilo will serve over 25 people, the truck carrier will have to comply with the State of Hawaii Chapter 20, Title II, Administrative Rules, Section 11-20-31 on Use of trucks to deliver drinking water.

Sewage: It is anticipated that the 7,000-to-13,000 gallons of liquid sewage per day generated by the facilities will be disposed by means of cesspools. This method was approved by the Department of Health for the facility now under construction; additional cesspools will also be subject to approval by that agency. All state and county requirements concerning individual waste disposal systems will be adhered to.

No adverse impacts to the environment are expected to occur from disposal of effluent into cesspools. No water table is known to exist anywhere in the vicinity of Hale Pohaku, no groundwater supplies have been developed in the vicinity and no springs are known to occur down-slope from Hale Pohaku; therefore, because there are no known groundwater bodies or water supplies to be contaminated within many miles of the Hale Pohaku area, no adverse impacts from the cesspools can be anticipated. (Appendix E).

Solid Waste: An increase in the number of people using both the astronomy and visitor information facilities will result in more solid waste being generated. Because open rubbish and garbage bins can attract predators, such as rats and mongoose, who may also prey on the birds in the area, all rubbish containers at the astronomy facility will have tight fitting lids and will be emptied daily and driven to Hilo for disposal. Rules and regulations concerning litter will be posted at the Information Station. Rubbish cans will be located near the Information Station and in the restrooms.

Biology: The use of the Hale Pohaku area by an increased number of astronomers and visitors could adversely affect the biota of the area. Increased foot traffic in surrounding vegetated areas could result in some plants being trampled; therefore, slightly elevated board walkways will be provided in the astronomy area to discourage walking in vegetated areas. Increased traffic to and within the area also increases the chance of new exotic species being introduced into the area. This is already occuring in the area.

One potential negative effect of increased usage of the area, particularly of the Information Station, is the probability of fires. The Hale Pohaku area is very dry and the fire potential is considerable. Fire flow is being provided at the astronomy complex and will be used to extinguish fires at the Information Station in an emergency. In addition, the University is proposing to aquire a fire engine to be based in the area. A volunteer fire brigade, made up of MKSS personnel, will be trained in fire fighting techniques.

The Information Station can educate the public through displays that explain the significance of conserving and preserving the flora and fauna of the area. Personnel on duty at the Information Station can also inform visitors of the significance of protecting the environment and remind them of the regulations concerning disturbing vegetation.

Landscaping of the site will result in a long-term positive benefit to the area. A mamane replanting program is currently being undertaken to upgrade the forest to a level superior to its existing condition. Other native species, such as silversword are also being planted. Native grasses will be re-established to further control erosion.

Actions taken to improve the drainage patterns of the area and to minimize soil erosion will also benefit the mamane/naio forest by providing a more stable environment in which the mamane can grow. Setting traps for predators will help insure the safety of breeding birds and allow them to raise their young successfully.

Social: The visual impact of an expanded Information Station will be insignificant. The proposed expansion area will be a part of structure currently under construction and will be consistent with the existing design.

Construction of a parking area at alternative A (Figure 12) may produce a negative visual impact for people driving to Hale Pohaku and the summit. Planting of mamone and other appropriate vegetation now, will insure that mature vegetation will be present when the parking lot is constructed. This will serve to minimize the visibility of parked cars. Mature vegetation is already present along the western boundary of alternative B.

Paving of the County road to Hale Pohaku has greatly increased accessibility to the area. Once the summit road is improved and paved, visitors to the upper regions of Mauna Kea will increase in number. The amenities provided by the Information Station may encourage some persons, who might not otherwise be interested, to travel to Hale Pohaku and from there to the summit area. The Management Plan describes suggested measures to monitor and control access to the summit area.

The visitor Information Station can provide for the education of the public through exhibits, including automated slides and movies, pamphlets and posted notices, that can explain the archaeology, geology, flora and fauna, history of the mountain, and the scientific activities taking place on the mountain and the significance of conserving and preserving these features. Employees manning the station can answer questions and provide interested persons with copies of rules and regulations pertaining to the area. It is anticipated that many people, when informed of the possible health hazards of high altitudes, will be satisfied with the information provided at the Station and will not want to travel further up the mountain.

Day use of the visitor information station could conflict with day sleeping of the Astronomy personnel. Siting of the Astronomy and Information Station as far as possible away from each other within the constraints of the site was one means used to reduce this potential impact. In addition, astronomy dormitories were designed so that outside sounds would be attenuated.

If alternative area B is selected as the location for future parking, its proximity to the dormitories at the mid-level facilities could produce undesirable noise. Regulations regarding noise and prohibitions on vehicles who leave their motors running could help to mitigate this potential adverse effect.

Maintenance and Management: A proposal for maintenance and management of the mid-level facilities and Information Station is presented in Appendix O.

PART X: PROBABLE ADVERSE ENVIRONMENTAL EFFECTS WHICH CANNOT BE AVOIDED

A. DIRECT SHORT-TERM IMPACTS

Traffic: There will be an unavoidable increase in traffic during the construction period in order to bring construction equipment and materials to the site. This impact will be intermittent and temporary and will cease when construction is completed.

Air Quality: Increased traffic and the use of heavy construction equipment will lead to the temporary generation of emissions from internal combustion engines. Emissions from road construction-related vehicles and equipment will cease when construction of the road is completed.

Dust: Heavy construction equipment operations on-site and increased traffic along access roads will lead to the temporary generation of small dust particles. While materials will be covered and construction will cease during high wind conditions, some soils will be subject to wind erosion.

Fauna: During construction of the expansion facilities at Hale Pohaku, resident avi-fauna including the palila, may be disturbed. Mitigating measures include: as few mamane trees as possible should be removed or transplanted from the site; and, construction should not to be initiated during the palila beeding season unless birds are discouraged from nesting in the construction area prior to and continuing into the nest site selection, pairing and breeding/rearing season.

Visual: During construction there will be the presence of construction equipment, construction materials and temporary structures. Most heavy construction equipment will be stored on-site for the duration of the construction period. This impact on the visual quality of the area will be temporary since these items will be removed when the projects are completed.

B. DIRECT LONG-TERM IMPACTS

Traffic: Paving of the County road to Hale Pohaku has greatly increased accessibility to the area. Once the summit road is improved and paved, visitors to the upper regions of Mauna Kea will increase in number. The presence of the new telescopes and the Information Station may also generate traffic to the area. It is estimated that by the year 2000, traffic over the summit roads could approximate 300 vehicle trips per day during the weekdays, and over 500 vehicle trips during weekends with heavy snowfall. The draft Management Plan describes suggested measures to control traffic from Hale Pohaku to the summit area. Implementation of this management plan will serve to mitigate potential adverse impacts that might occur with the anticipated increase of vehicles on the road.

Solid Waste: Despite the provision for disposal recepticles at the Information Station and at parking areas at the summit, an increase in the number of people visiting the summit will result in more solid waste being generated. In order to mitigate this impact, strict anti-littering regulations will be enforced.

Vegetation: There may be localized impacts to certain species of flora if telescopes are located in sensitive areas. If future construction is proposed for sensitive areas, the DLNR, Division of Forestry and Wildlife will be consulted.

Construction of the powerline overhead or underground between the Saddle Road to Hale Pohaku will involve the removal of some mamane trees; a significantly larger amount of trees will be removed for underground construction of the powerline as compared to overhead construction.

The use of the summit and Hale Pohaku areas by an increased number of astronomers and visitors could adversely affect the biota of the area. Increased foot traffic in vegetated areas could result in some plants being trampled. Increased traffic to and within the area also increases the chance of new exotic species being introduced into the area.

Fauna: The major impacts on fauna of the area will be on various species of resident arthropods related to specific telescopes sites. Impacts will be minimized by keeping all construction activities within the minmum possible defined area and keeping new road alignments to a minimum size and length.

Archaeological/Historical Features: The construction of new telescopes have the potential of adversely affecting the integrity of any unknown archaeological features. In order to protect these features, the following mitigating measures may be taken:

a. An intensive archaeological survey may be undertaken if it appears that one of the sites might be affected by telescope construction;

b. Wherever possible, construction and related activities on or in proximity to known archaeological sites will be avoided; and,

c. Consultation with the State Historic Preservation Office will be undertaken prior to any telescope construction in areas of known sites.

Visual: The presence of a total of thirteen telescopes at the summit will change the visual appearance of the area. The additional telescopes may also be visible from populated areas on the island of Hawaii, although appearance of the mountain, as seen from Hilo, is not expected to change significantly from present conditions. (Any new telescope building on the summit ridge would probably replace one of the smaller domes that are already located there). Judgements as to whether the presence of the telescopes will enhance or despoil the appearance of Mauna Kea will, of necessity, be subjective. To some people, the telescopes represent an important scientific resource and a clean industry which is bringing world-wide recognition to the island of Hawaii as the location of the best site in the northern hemisphere for ground-based astronomy; to others, each additional telescope is a structure which detracts from the natural beauty of the area. The reviewer of this EIS must use his/her judgement in deciding whether the impact of telescopes on the visual appearance of the mountain is positive or negative.

PART XI: THE RELATIONSHIP BETWEEN LOCAL SHORT-TERM USES OF MAN'S ENVIRONMENT AND THE MAINTENANCE AND ENHANCEMENT OF LONG-TERM PRODUCTIVITY

The proposed project will be an important addition to Hawaii's growing research and development industry, an enviromentally "clean" industry, which can continue to provide broadened employment opportunities for State residents. The productivity of Mauna Kea's summit region, however, cannot be measured in purely traditional economic ways. Mauna Kea is a natural and scientific resource which belongs to all State residents and future generations. The use of the summit as an astronomical observatory need not be incompatible with Mauna Kea's use by biologists, skiers, snow play enthusiests, hikers and the common visitor.

Any assessment of the comparative productivity of Mauna Kea's role as an astronomical observatory, as compared to its role as a natural laboratory for other scientists, as a cultural, aesthetic or recreational resource, should take into consideration that astronomy and other activities on Mauna Kea are not mutually exclusive. If the proposed actions are implemented, it is expected that the resources of Mauna Kea can be more fully utilized by all users without serious adverse impacts to the environment and without infringing on the activites of other users.

PART XIII: AN INDICATION OF WHAT OTHER INTERESTS AND CONSIDERATIONS OF GOVERNMENT POLICIES ARE THOUGHT TO OFFSET THE ADVERSE ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTION

The purpose of the Mauna Kea Science Reserve Complex Development Plan (SRCDP) is to develop a physical plan which addresses all proposed development within the Mauna Kea Science Reserve and related facilities (as set forth in the UH RDP) to the year 2000. The overall objectives of the SRCDP are derived from the 1977 DLNR Mauna Kea Plan and the UH RDP. These objectives were summarized in PART II. Amendments to the Mauna Kea Plan will be required in order to implement some of the proposed recommendations, including: paving of the summit road, overhead powerlines below Hale Pohaku, and changing jurisdictional responsibilities within Mauna Kea. The goals, objectives and needs of each of the user groups and the goals, objectives and priority directions of the Hawaii State Plan, the County of Hawaii General Plan, and the State Higher Education Interim Guidelines were also considered in the planning process.

The Conservation District Use permit which is required before the SRCDP is implemented, will insure that all of the most important environmental aspects have been considered in the planning process and that all restrictions placed on the permit as a condition of approval will be strictly observed.

XIV: NECESSARY APPROVALS

1. Conservation District Use Permit - Board of Land and Natural Resources - UK/NL MT - Filed August 27, 1982.

2. Use Permit - NARS Commission - UK/NL MT Batch Plant site approval, currently before the Commission.

3. Department of Health - Cesspool and Septic Tank Approval - No action to date.

4. County of Hawaii Building Permits - No action to date.

5. Department of Transportation - Road Construction.

6. Other permits required will be determined during the design phase of each project.

XV: SUMMARY OF UNRESOLVED ISSUES

The SRCDP is not finalized; public input during the review process will serve to identify issues that may not have been addressed during the planning process. This may result in modifications to the Plan. Three major issues that are unresolved are:

1. Location of the Powerline Corridor from the Saddle Rode to Hale Pohaku

   The Plan recommends that the powerline go overhead along Corridor A. This action will require an amendment to the Mauna Kea Plan. In addition, if this corridor is adopted, a means must be found to insure that unauthorized personnel are not allowed to use the service road for illegal purposes such as "poaching" of game and stealing of cattle. Construction in this corridor, as well as the other that are being evaluated, will require consultation with the US Department of Interior, Fish and Wildlife service, if federal funds are involved. This action will not be initiated until all issues are resolved.

2. Paving of the Road

   Paving of the road will require an amendment to the Mauna Kea Plan. Because a CDU permit is required from the BLNR, this action cannot be initiated until this issue is resolved.

3. Management Plan

   The Management Plan is still preliminary; more public input will be required before it is finalized. Issues that must be resolved before the Plan can be implemented are:

   a. The Mauna Kea Science Reserve, Hale Pohaku, and the summit access road, including a corridor of approximately 400 yards on either side, must be taken out of the Forest Reserve. The DLNR is presently taking the necessary steps to fulfill this requirement;

   b. Jurisdiction for management, monitoring and enforcement functions within the areas designated in the Management Plan must be transferred from BLNR to UH through appropriate agreements and new regulations must be developed.

   UH and BLNR are working cooperatively to achieve an appropriate resolution of these requirements.

PART XVI: CONSULTATION AND PUBLIC REVIEW

A. AGENCIES, ORGANIZATIONS, AND INDIVIDUALS CONULTED IN THE PREPARATION OF THE SRCDP AND EIS

The following agencies, organizations and individuals were contacted for professional servies and/or specialized advise on various aspects of this EIS:

Consultants to the Project:

Dames & Moore	Soils & Geology
Sam O. Hirota, Inc.	Civil Engineering
Daly & Associates, Inc.	Ecomonic Analysis
David Rae & David Matteson	Social Issues
Bishop Museum	Cultural, Biological

State of Hawaii

Department of Land and Natural Resources

Susumu Ono	Chairman
Bill Gorst	State Parks, Outdoor Recreation and Historic Sites
Wendal Kam	
Ralston Nagata	
Roger Evans	Planning Office
Sherrie Samuels	
Liebert Langraf	Forestry
Charles Wakida	
Ron Walker	
Maurice Matsuzaki	Conservation & Resources Enforcement
James Detor	Land Management

Natural Area Reserves Commission

Robert Lee	Executive Secretary
P. Quentin Tomich	Chairman

Department of Accounting and General Services

Richard Fujita
Jerry Nishida

Department of Hawaiian Homes Lands

Jean Oshita

Office of Environmental Quality Control/Enviornmental Quality Commission

Jacqueline Parnell	Director
Roy Sakamoto	
Charlie Ice	

University of Hawaii

John Jefferies Ginger Plasch Hans Boesgaard	Institute for Astronomy
Art Seki Al Woodcock Mae Nishioka George Naito	Hawaii Natural Energy Institute Department of Oceanography (Retired) Facilities Planning
Power Sogo James Jurvick	UH Hilo

County of Hawaii

Sidney Fuke Virginia Goldstein	Planning Department
Stuart Kerns Steve Yamashiro Shozo Nagao Capt. Henriques	Research and Development County Council Fire Department

Federal Government

Department of the Army

Lawrence Hirai	Env. Mgmt., DEH
Thomas Kawahara	DEH, USASCH
Lee C. Dunlap	Tng. Div DCSOPS WESTCOM
Ronald Hopkins	AVN DIV DCSOPS WESTCOM

Department of the Interior

Pearl Tam	Water Resources Division Geological Survey
Lucian Kramer Darral Herbst Mike Scott Ernest Kosaka	Fish and Wildlife Service

Department of Commerce

Kinsell Caulson	National Oceanic & Atmospheric Administration

National Science Foundation

Vernon L. Pankonin	Division of Astronomical Sciences

Private Individuals and Organizations

Al Inouye	Hunters Organizations
Allen Parker	
Mike Tulang	
Paul Tanegawa	
Ron Bachman	
Ken Funai	
Wally Johnston	Ski Association of Hawaii
Dick Tillson	
Nicholas Terstenjak	Private Ski Tour Operator
Sunny Kaniho	Ski Hawaii

Conservation

George Winsley	Sierra Club
P. Quentin Tomich	Conservation Council

Scientific/Education

T.G. Phillips	California Institute of Technology
Joe Calmes	University of California
Teresa Yuen	
Jerry Nelson	
James Hall	U.K. Science and Engineering
Ray Tolcher	Research Council
R. Newport	
T.J. Lee	UKIRT
Rene Racine	CFHT

Technical

Ed Nakamoto	HELCO
Alva Nakamura	
Takeo Kawabata	Nakamura, Kawabata & Associates
Jitsuo Niwao	
George T.J. How	Harding Lawson Associates
Stanley Young	Fukunaga & Associates
Ernest Yuasa	Hawaiian Telephone
Tom Krieger	Mauna Kea Support Services

Other

David Ramos	Parker Ranch

B. PUBLIC INFORMATIONAL MEETINGS

A meeting to inform the public of the SRCDP planning process and to obtain their input into the Plan and EIS was held on September 22, 1982 at the campus center of the UH campus in Hilo.

The following people attended the meeting:

Pierre Bely, CFHT
Joe Calmes, University of California
Bill Carse, Scientific Coordinating Committee for the Pacific, Pahoa
Tom Fujii, County Councilman
Virginia Goldstein, County f Hawaii, Planning Department
Helene Hale, County of Hawaii Council
Ed Hara, guest of Mr. Joe Andrews, President, Kanoelehua Industrial Assoc.
Charlie Ice, Environmental Quality Commission
John Jefferies, UH Institute for Astronomy
James Juvik, Professor of Geography, UH Hilo
Stuart Kearns, County of Hawaii Department of Research & Economic Development
John Kofel, Vice-Chancellor, UH Hilo
Megumi Kon, Managing Director, County of Hawaii
T. Konashi, Representing Fire Chief, County of Hawaii
Tom Krieger, Mauna Kea Scupport Services
Terry Lee, UKIRT
Gerald Lelieve, CFHT
Mary Matayoshi, UH Hilo, CCECS
Richard Matsuura, State Representative
Robert Mitchell, Pohakuloa Training Station
Stephen Mitchell, Chancellor, UH Hilo
Ed Nakamoto, HELCO
Alva Nakamura, HELCO
Jacqueline Parnell, Director, Office of Environmental Quality Control
Ginger Plasch, UH Institute for Astronomy
Rene Racine, CFHT
Clark Richardson, (Ham radio operator, Kona)
Roy Sakamoto, Office of Environmental Quality Control
Nelson Santos, DLNR
Cy Savage, President, Hilo Contractor's Association
Tony Taniguchi, Japanese Chamber of Commerce
Charles Wakida, DLNR Forestry Division
Miles Nakahara, DLNR
Harold Masumoto, UH Vice President for Administration
Francis Oda, Group 70
Marilynn Metz, Group 70

The following individuals were invited but did not attend:

David Ames, Volcanoes National park
Ron Bachman, DLNR
Frank deLuz, County Council
Byron Fox, President, Kona Chamber of Commerce
Robert M. Fujimoto, Chairman, Board of Regents
Sidney Fuke, County Planning
Senator Richard Henderson
Edward Harada, County of Hawaii
Roland Higashi, Big Island Representative, BLNR

Stephen A. Holmes, Conservation Council of Hawaii
Al Inoue, Sportsman
Jay Jacobi, Environmentalist
Wally Johnston, Hawaii Ski Association
Bill Kawahara, County Council
Mae E. Mull, Hawaii Audubon Society
Donald Okahara
Henry H. Ross, private citizen
Representative Herbert Segawa
Blake Shigii, County Planning
Walt Southward, Hawaii Chamber of Commerce
Glen Taguchi, DLNR
Dick Tillson, Ski Shop Hawaii
Susan Wells, North Kohala
Donald Yamada, Hawaii Chamber of Commerce
Stephen Yamashiro, Chairman, County Council

The relationship of the SRDP to existing policies and plans was explained by Harold Masumoto. Francis Oda then described the planning process undertaken in preparation of the Plan and discussed the preliminary findings. The public was invited to comment on all aspects of the Plan.

Major concerns expressed by those attending the meeting were related to the following areas:

1. That planning should include all of the Science Reserve, not just the summit area where the telescopes are located;

2. That the impacts on feral animals on the environment and the effects on hunting be addressed in the Plan;

3. Protection of archaeological sites should be an important planning consideration;

4. That impacts of improved access on the resources of the summit area be addressed and any restrictions or limitations on public access to the mountain be specified;

5. That the positive and negative effects of skiing at the summit be considered in developing the Plan;

6. That the potential impact of millimeter-wave telescopes on radio-ham operators be specifically addressed in the EIS;

7. That the implications of road construction and paving on drainage, erosion, road maintenance, and flora be carefully considered during the planning process.

All of these concerns are addressed in the draft EIS.

C. PERSONS RECEIVING NOP'S

The following agencies, organizations and firms received copies of the Notice of Preparation for the Environmental Impact Statement. Starred (*) agencies, organizations, and individuals responded to the Notice and double starred (**) respondents made substantive comments which are included in this section of the EIS.

FEDERAL

Department of Agriculture

**Soil Conservation Service
Institute of Forest Service-Pacific Islands Forestry

Department of the Army

*U. S. Army Engineer District, Honolulu
**Headquarters U. S. Army Support Command, Hawaii

Department of the Air Force

Department of the Interior

**U.S. Geological Survey, Water Resources Division
Division of Ecological Services
*Fish & Wildlife Service
**National Park Service

National Science Foundation

Federal Communications Commission

STATE

Governor
*Department of Accounting and General Services
*Department of Defense
Department of Hawaiian Homes Lands
**Department of Health
**Department of Land and Natural Resources
**Division of Conservation & Resources Enforcement, Hawaii District
*Department of Planning and Economic Development
*Department of Transportation
**Office of Environmental Quality Control

University of Hawaii

Board of Regents, Hawaii Representative
Chancellors Office
Department of Oceanography
**Environmental Center
Institute for Astronomy
Lyon Arboretum
*Water Resources Research Center

State Legislature

Representatives for the Hawaii District (5)
Senators from the Hawaii District (3)
Chairperson, House Committee on Ecology
Chairperson, House Committee on Water and Land
Chairperson, Senate Committee on Environment, Recreation and Ecology

COUNTY OF HAWAII

**Mayor's Office
Hawaii County Council
**Fire Department
Department of Parks and Recreation
Planning Department
*Police Department
**Department of Public Works
Department of Research and Development
*Department of Water Supply

ORGANIZATIONS AND INDIVIDUALS

**Advisory Council on Historic Preservation
Mr. Bob Akamine
Animal Species Advisory Committee
Mr. Jeff Bigler
Bishop Museum
Brock & Associates
California Institute of Technology
**Canada-France-Hawaii Telescope Corporation
Chamber of Commerce, Hawaii Island
Conservation Council, Hawaii Island
Construction Industry Legislative Organization (CILO)
*Hamakua District Development Council, Francis McGough
Hawaii Audubon Society, Island of Hawaii Representative
Hawaii Audubon Society, State of Hawaii
Hawaii Botanical Society
Hawaii Society of Professional Engineers, Big Island Chapter
Hawaiian Electric Company
**Hawaii Electric Light Company
*Hawaiian Telephone Company
Hawaii Trails and Mountain Club
Mr. Roland Higashi, BLNR
Hilo Chamber of Commerce
Hilo Contractors Association
**Mr. Stephen Holmes
Hunters Association
Mr. James D. Jacobi
Mr. Lawrence Katahira, Hawaii National Park
Life of the Land
Ms. Mary Matayoshi, UHH
Mauna Kea Foundation
Mauna Kea Ski Patrol
Mr. Fred Metcalf

Mr. Stanley Mukai BOR Hawaii Representative
Mrs. Eric Mullmann
**Mr. Clark Richardson
Mr. Don Romero
**Mr. Henry A. Ross
Sierra Club, Hawaii Chapter
**Mr. Rick Scudder
**Ski Association of Hawaii
Mr. Power Sogo, UHH
Sportsmen of Hawaii
**Mr. Dick Tillson
United Kingdom Infrared Telescope Unit
Ms. Susan Wells
Mr. Rick Wershauer
Dr. Alfred Woodcock
Pohakuloa Commander

United States
Department of
Agriculture

Soil
Conservation
Service

P.O. Box 50004
Honolulu, Hawaii
96850

July 22, 1982

University of Hawaii
Vice President for Administration
ATTENTION: Louis Lopez
2444 Dole Street
Honolulu, HI 96822

RECEIVED
JUN 26 1982
GROUP 70

Dear Sir:

Subject: EIS Preparation Notice for Mauna Kea Science Reserve Master Plan, Mauna Kea, Hamakua, Hawaii

We have reviewed the subject notice and offer the following comments for your consideration:

Care should be taken to minimize grading activities. Cut slopes and side slopes should be at grades that will minimize erosion. Establishing vegetation at this site will be nearly impossible, so graded areas may have to withstand normal weather conditions without a protective vegetative cover. Each new development will create increased runoff. Provisions should be included for safe disposal of this water.

Page 13 discusses the leveling of the top of the cinder cone and using the material to make a road fill between the site and IRTF. Most low areas function as drainageways, hence this should be considered in the design and location of roads requiring fill.

Since several more observatories are proposed, blending the constructed areas into the surrounding terrain will be important. One possible way to accomplish this would be to use colors similar to the surrounding area. This would lessen the impact of having shiny objects that would be visible from miles away.

Thank you for the opportunity to review this notice.

Sincerely,

Francis C. H. Lum

FRANCIS C. H. LUM
State Conservationist

cc: Group 70

UNIVERSITY OF HAWAII

Vice-President for Administration
23 September 1982

Mr. Francis C.H. Lum
State Conservationist
US Department of Agriculture
Soil Conservation Service
P.O. Box 50004
Honolulu, HI 96850

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Lum:

Thank you for your comments on the subject NOP. In response to your specific concerns:

1. Grading will be limited to specific telescope sites and, if required, certain sections of the existing and proposed roads. Although precipitation on Mauna Kea is very slight, provisions will be included in all plans for safe disposal of any runoff. These items will be discussed in the draft EIS.

2. The alignment of the proposed road from IRTF to the UC site is conceptual at this time. Drainage will be considered in the actual design and location of this road and any others that might require fill.

3. I enclose an explanation from Dr. John Jefferies, Director of the UH Institute for Astronomy, regarding the technical reasons for painting telescope domes white. It should be noted, however, that the surrounding terrain is white from 4 to 7 months of the year.

Very truly yours,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

HSM:cf

Enclosure

2444 Dole Street • Room 202 • Honolulu, Hawaii 96822

PAINTING OBSERVATORY DOMES WHITE

The selection of a site for a telescope is made on the basis of a large number of factors, but of prime (and often overriding) importance is the stability of the images which are formed through the telescope—a characteristic astronomers refer to as "seeing," and which is especially fine on Mauna Kea. Seeing is imperfectly understood, but it is traceable to the presence of small, randomly fluctuating cells in the atmosphere above the telescopes. Locating an observatory building on the site cannot <u>improve</u> the <u>inherent</u> seeing quality of the site (which is set by the ambient atmosphere); the best that can be done is to try to insure that the adverse affect of the building is as small as possible.

One way of doing this is to pay special attention to insuring that there are no local sources of heat inside the dome which would result in convection plumes, which could (and do) destroy the seeing and so invalidate the very reason for selecting the site in the first place. Close attention must also be paid to insuring that the building (especially the dome) comes rapidly to equilibrium with the nighttime air temperature after the sun has set; otherwise the dome itself becomes a source of heat and convection plumes, and again interferes seriously with the observing quality.

To guard against <u>interior</u> sources of heat, most modern observatories not only pay attention to isolating these, but also provide a floor-chilling system inside the dome which is set to the anticipated nighttime air temperature and, in effect, refrigerates the interior of the dome to that temperature. Insulation on the dome limits the heat transferred from the hotter dome exterior to the inside, while highly reflective paint is used to make sure that the dome heats up as little as possible in the sunlight. This is one reason for using a white (i.e., highly reflective) paint. A second factor controlling the nature of the paint is the need to have the dome cool down very rapidly after sunset. This has been effected through the use of titanium oxide (TiO) paint which has a very high emissivity in the infrared region of the spectrum; i.e., it radiates heat into space very effectively.

The choice of TiO white paint is almost universal in modern telescope facilities, and (as explained above) is chosen in order to (1) minimize the heat buildup during the day, and (2) minimize the time to cool down after sunset. It is possible to achieve these objectives simultaneously with this paint because the heat source (the sun) is at a high temperature (6000° Celsius), while the source to be cooled (the dome) is at the relatively very much lower temperature of about 10° C.

The above explanation represents the conventional wisdom and corresponds well to experience. Additional studies would be valuable; however, critical funding shortages have prevented us from conducting them. There is absolutely no reason whatever to believe, however, that the results of such tests would change the conclusion that the TiO white paint, as currently used, represents the best means for minimizing the degradation of the natural site properties attendant on constructing a telescope building and dome on Mauna Kea.

August 3, 1982

John T. Jefferies, Director
UH Institute for Astronomy

RECEIVED
JUL 21 1982
GROUP 70

APZV-EHV

19 JUL 1982

University of Hawaii
Vice President for Administration
ATTN: Mr. Louis Lopez
2444 Dole Street
Honolulu, Hawaii 96822

Gentlemen:

The Environmental Impact Statement (EIS) Notice of Preparation for the University of Hawaii Mauna Kea Science Reserve Master Plan, Mauna Kea, Hamakua, Hawaii has been reviewed and the following comments are provided:

a. It appears that the corridor A route for the powerline from Saddle Road to Hale Pohaku will transverse portions of Pohakuloa Training Area (see attached map) and, therefore, if constructed may impact upon military training activities, including infantry and aircraft operations.

b. The choice of the communication method between the telescopes and sea level should be evaluated if it may result in interference with operations or functions of the Defense Communication Systems.

Request that the EIS address these potential impacts on military activities at Pohakuloa Training Area. If you require additional information or assistance, please contact the Environmental Management Office at 655-0691/0694.

Thank you for the opportunity to comment on the Notice of Preparation and we look forward to receiving a copy of the draft EIS.

Sincerely,

Original signed by

LEONARD HASSE, JR.
LTC, CE
Acting Director of Engineering and Housing

1 Incl
As stated

CF:
Group 70
ATTN: Ms. Merilynn Metz
924 Bethel Street
Honolulu, Hawaii 96813

UNIVERSITY OF HAWAII

Vice-President for Administration
23 September 1982

Ltc. Leonard Hasse, Jr., CE
Acting Director of Engineering & Housing
Department of the Army
Headquarters US Army Support Command, Hawaii
Fort Shafter, HI 96858

Attn: AP2V-EHV

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Ltc. Hasse:

Thank you for your comments on the subject NOP. I understand that our consultants, Group 70, a representative of the UH Facilities Planning Office, and the design consultant for the powerline met with members of your staff on 20 August 1982. The preliminary assessment of the project by your staff indicated that alternative powerline Corridor A would not present any problems to training activities at Pohakuloa. We will, however, keep you informed as our planning for the powerline progresses.

In response to your concerns about the communications systems between the telescopes and sea level, and potential interference with operations or functions with the Defence Communication Systems, be advised that all Federal regulations concerning the use of radio communications transmitters will be adhered to.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, HONOLULU
FT. SHAFTER, HAWAII 96858

RECEIVED
JUL 27 1982
Vice President For Administration

PODED-PV

23 July 1982

JUL 28 9 37 PM '82
FACILITIES PLANNING OFFICE

Mr. Harold Masumoto
Vice President for Administration
University of Hawaii
2444 Dole Street
Honolulu, HI 96822

Dear Mr. Masumoto:

Thank you for the opportunity to review the Notice of Preparation of an Environmental Impact Statement (EIS) for the Mauna Kea Science Reserve Master Plan. After reviewing all inclosed subject matter, we provide the following comments to assist you with your EIS preparation:

a. No Department of the Army (DA) permit is required.

b. The site of the proposed Mauna Kea Science Reserve, which is located in the Mauna Kea Forest Reserve, is classified as Zone C, or area of minimal flooding, according to the Flood Insurance Study for the Island of Hawaii prepared by the Federal Insurance Administration, Federal Emergency Management Agency. Zone C areas are not designated flood plains or special flood hazard areas.

We look forward to reviewing the EIS upon completion.

Sincerely,

KISUK CHEUNG
Chief, Engineering Division

CF:
Group 70
ATTN: Marilynn Metz
924 Bethel Street
Honolulu, HI 96813

UNIVERSITY OF HAWAII

Vice-President for Administration
15 October 1982

Mr. Kisuk Cheung
Chief, Engineering Division
Department of the Army
U.S. Army Engineer District, Honolulu
Ft. Shafter, HI 96858

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Cheung:

Thank you for reviewing the subject NOP. The information provided will be incorporated into the draft EIS.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

2444 Dole Street · Room 202 · Honolulu, Hawaii 96822

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
P.O. Box 50166
Honolulu, Hawaii 96850

RECEIVED
AUG 9 1982

RECEIVED
GROUP 70
AUG 2 1982

July 27, 1982

University of Hawaii
Vice President for Administration
2444 Dole Street
Honolulu, Hawaii 96822
Attn: Louis Lopez

Dear Mr. Lopez:

Subject: Mauna Kea Science Reserve Master Plan, Mauna Kea, Hamakua, Hawaii - EIS Preparation Notice

The following are comments by my staff on the subject EIS Preparation Notice.

Page	Item	Comments
30	4.2	Add "shallow developable" before "ground water resources".
30	4.3	Water from Lake Waiau was sampled and analyzed by the U.S. Geological Survey for standard mineral analysis in 1978. The analysis is available at the U.S. Geological Survey in Honolulu.

Thank you for giving us an opportunity to comment on this document.

Aloha,

BLJones

Benjamin L. Jones
District Chief

UNIVERSITY OF HAWAII

Vice-President for Administration
23 September 1982

Mr. Benjamin L. Jones
District Chief
US Department of the Interior
Geological Survey
Water Resources Division
P. O. Box 50166
Honolulu, HI 96850

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Jones:

Thank you for reviewing the subject NOP. Your staff comments and water quality analysis will be incorporated in the draft EIS.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

2444 Dole Street • Room 202 • Honolulu, Hawaii 96822

United States Department of the Interior
NATIONAL PARK SERVICE
HAWAII VOLCANOES NATIONAL PARK
HAWAII 96718

IN REPLY REFER TO:

August 12, 1982

L7621(HAVO)

University of Hawaii
Vice President for Administration
2444 Dole Street
Honolulu, HI 96822
Attention: Mr. Louis Lopez

Dear Sir:

We appreciate the opportunity to comment on the Mauna Kea Science Reserve Master Plan, Mauna Kea, Hamakua, Hawaii E.I.S. Preparation Notice. We apologize for missing the August 8 deadline, and hope that the following comments will be of value to you.

1. The Mauna Kea Science Reserve is only part of the summit area of Mauna Kea, yet you propose a master planning document which enumerates construction projects of sufficient magnitude to significantly impact areas well beyond the Science Reserve. We believe a proposal for master planning for such a small area only compounds an existing problem of blurred jurisdictions, overlapping and conflicting land use patterns, and piece-meal development of the larger summit area. We would prefer to see a proposal for a comprehensive, long-term plan for the Mauna Kea summit area which includes the lower margins of the *mamane-naio* forest. Such a plan would, in our opinion, more adequately address the very serious and interrelated issues of environmental protection, recreation, archaeological and historical preservation, geologic features protection, astronomical science progress, and military land use. We suggest you submit your master plan proposal to an agency, perhaps the Department of Land and Natural Resources, which can provide broader scope to land use planning for Mauna Kea.

2. We find no reference in your proposal which would provide a mechanism for evaluating telescope development to prevent overlapping functions, inefficient use of summit area space, to ensure application of best available design and technology, to retrofit or dismantle obsolete facilities, or to conduct environmental restoration following accidents.

3. We appreciate your reference on page 19 for visitor reception areas at Hale Pohaku, and especially your efforts to provide visitor education through exhibits, etc. We would suggest that you go further and provide facilities for lectures, seminars, demonstrations. Our agency will be very glad to collaborate with you in this endeavor.

4. Controlling public access, as noted on pages 19-20, is a good idea, and we would welcome more specific details regarding method. We believe that merely limited parking in summit destinations and restricted road conditions are generally not useful as control methods, contrary to implications of your proposal.

5. On pages 6, 19, and 20-21, you propose to afford protection to recreational and scenic features, but decline to be specific about means and degree of protection. For example, you claim that the integrity of Lake Waiau and the adze quarry will not be compromised as a result of development of telescopes and roadways. We would welcome a more specific declaration, such as, "will not be disturbed," or "will not be allowed to deteriorate," coupled with specific measures you would use to ensure this degree of protection. We would suggest that you obliterate roadways to these features and provide access by a foot trail only.

6. We have trouble reconciling your commitment to maintaining "scenic attributes" of Mauna Kea, Objective #2, page 5, with plans mentioned some pages later for 13 huge telescopes and an eight-foot diameter microwave transmitter on a line-of-sight horizon between Waimea and Hilo. We do not believe these installations are compatible with Objective #2, and we encourage you to raise this issue openly so it can be subjected to public scrutiny.

7. On page 44, paragraph #7, please identify Hawaii Volcanoes National Park correctly.

We look forward to receiving the first draft of your Environmental Impact Statement, and will be very pleased to comment on it.

Thank you for the opportunity to comment on this E.I.S. Preparation Notice.

Sincerely,

David B. Ames
Superintendent

cc: Group 70
924 Bethel Street
Honolulu, HI 96813
Attention: Marilynn Metz

UNIVERSITY OF HAWAII

Vice-President for Administration

23 September 1982

Mr. David B. Ames, Superintendent
United State Department of the Interior
National Park Service
Hawaii Volcanoes National Park
Hawaii, 96718

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Ames:

Thank you for your comments on the subject NOP. In answer to your specific concerns:

1. The Mauna Kea Plan, which was adopted by the Board of Land and Natural Resources in 1977, is the policy plan for the mountain. It was prepared in order to address the questions that you have raised concerning overlapping jurisdictions and conflicting uses. Your concerns should be directed to the BLNR for possible resolution through the plan amendment process.

   The Mauna Kea Science Reserve Master Plan is being prepared in response to public concern that a long-range physical plan of the Reserve is necessary to prevent piece-meal development and to assess cumulative impacts of additional telescopes on the mountain. This plan is being guided by the Mauna Kea Plan, the University of Hawaii Research Development Plan for the Science Reserve and Related Facilities, and by the Hale Pohaku Complex Development Plan.

2. The University's Research Development Plan contains a mechanism for evaluating all applications for telescopes on the mountain. This evaluation covers areas of overlapping functions, efficient use of summit area space, etc. In addition, the Mauna Kea Plan sets forth criteria for evaluating new telescopes. These criteria are addressed during the CDUA process. The dismantling of obsolete facilities and restoration of areas are specifically mentioned as terms of the lease between the University of Hawaii and the Board of Land and Natural Resources.

3. We appreciate your interest in the Information Station and we will contact you for programmatic advise at the appropriate time.

2444 D.S. Street • Room 202 • Honolulu, Hawaii 96822

Mr. David B. Ames, Superintendent
United State Department of the Interior
National Park Service
23 September 1982

4. &
5. A monitoring management plan specifically directed to controlling access to the summit will be incorporated into the Master Plan. This plan will also specify the means that will be undertaken to protect recreational and scenic features of the mountain. For your information, the Natural Area Reserves Commission has decided to close roadways to Lake Waiau and the Adze Quarry and is currently arranging for this. Henceforth, access will only be by foot.

6. Some people believe the sight of telescopes on the mountain is beautiful and some do not. A visual analysis will be presented in the EIS. For your information, the microwave transmitter will not be visible from other areas of the island.

We will see that you receive a draft EIS when it is filed. Thank your for your comments on the NOP.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

RECEIVED
JUL 22 1982
GROUP 70

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

CHARLES G. CLARK
DIRECTOR OF HEALTH

JOHN F. CHALMERS, M.D.
DEPUTY DIRECTOR OF HEALTH

HENRY N. THOMPSON, M.A.
DEPUTY DIRECTOR OF HEALTH

MELVIN K. KOIZUMI
DEPUTY DIRECTOR OF HEALTH

ABELINA MADRID SHAW, M.A., J.D.
DEPUTY DIRECTOR OF HEALTH

In reply, please refer to:
File: EPHSD/SAN

July 21, 1982

University of Hawaii
Vice President for Administration
2444 Dole Street
Honolulu, HI 96822

Attn: Louis Lopes

Dear Sir:

This letter is in response to the announcement of the Mauna Kea Science Reserve Master Plan in the July 8, 1982 edition of the EQC Bulletin. The magnitude of the proposal indicates that a public water system may be necessary to support activities at the Science Reserve either presently or at some point in the future.

The Department of Health is vested with the responsibility of regulating public water systems within the state of Hawaii. Chapter 20, Title 11, Administrative Rules defines a public water system as a water system which serves 25 or more individuals at least 60 days per year or one which has a minimum of 15 service connections. Enclosed for your information and use is a copy of Chapter 20, Title 11, Administrative Rules which governs public water systems. The Department would greatly appreciate your review of this document and assessment of its applicability to the existing and future water supply situation at the Science Reserve. Of special note are the requirements of Section 11-20-29 of Chapter 20 dealing with new sources of potable water serving public water systems. All public water systems as defined must be served by an approved potable water source. This approval must be obtained by the Director of Health and is dependent primarily on the submission of an engineering report which adequately addresses all concerns set down in Section 11-20-29. This report must be prepared by a professional engineer and bear his or her seal upon submittal.

We would greatly appreciate your advising us of the present status of the water supply facilities at the Reserve. Thank you for your time and attention to this letter.

Sincerely,

THOMAS E. ARIZUMI
Supervisor
Drinking Water Program
Sanitation Branch
Environmental Protection and
Health Services Division

MJH:dnn

Enclosure

cc: Marilynn Metz, Group 70

UNIVERSITY OF HAWAII

Vice-President for Administration

15 October 1982

Mr. Thomas Arizumi, Supervisor
Drinking Water Program, Sanitation Branch
Environmental Protection and Health Services Division
State of Hawaii
Department of Health
P.O. Box 3378
Honolulu, HI 96801

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Arizumi:

Thank you for your comments on the subject NOP. As suggested, our consulting engineer reviewed Chapter 20, Title II, Administrative Rules which governs public water systems. The engineer has come to the conclusion that the requirements of Section 11-20-29 of Chapter 20 are not applicable as there are no plans to develop a new water source at the Mauna Kea Science Reserve. With the exception of the Mid-Elevation Facility at Hale Pohaku, the telescope facilities will have less than 25 people present at each site. Each telescope facility will have its own water storage tank with a capacity to sustain approximately 10 to 20 days of water usage. Water will be trucked from Hilo to each telescope site and to Hale Pohaku. The truck carrier will comply with Section 11-20-31 of Chapter 20, Use of trucks to deliver drinking water.

Very truly yours,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

HSM:cf

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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

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

OCT 12 1982

REF. NO.: CPO-562

Honorable Fujio Matsuda
University of Hawaii
Bachman Hall
2444 Dole Street
Honolulu, Hawaii 96822

Dear Dr. Matsuda:

We have completed our review of the Environmental Notice of Preparation for the Mauna Kea Science Reserve Master Plan and have the following comments to offer:

1. Indicating the relevant location for the Mauna Kea Ice Age Natural Reserve would be of benefit. (The reserve is identified elsewhere only on small-scale map figures.) P. 17, Figure 6

2. Sewage disposal through leaching may develop to be a major concern. The underlying geological features of the immediate and general summit area, including any groundwater and permafrost conditions, should be discussed in terms of sewage impact at the summit area as well as potential effects downslope, where Lake Waiau and spring waters are present. P. 19, 3.3 and P. 39, 5.0

3. As the Natural Area Reserve is situated along most of the length of the summit road, perhaps consideration could be given to treating the reserve as a distinct entity, while interpreting its geological, archaeological and biological features. P. 19, 4.2

4. Chapter 209 is an Administrative Rule rather than a statute, as referred to in References (p. 51). P. 20, 4.2

5. Because of its size and proximity along most of the summit road, it should be helpful to show the reserve on a larger scale. P. 33, 9.2

6. It is stated on page 2 that the Research Development Plan (RDP) projects a total of 13 major telescopes by the year 2000. The third paragraph, page one lists four established major telescopes and mentions there are also two smaller telescopes. Scenario three, pages 23 and 24, envisions seven more telescopes (as listed) in addition to the existing six facilities which presumably includes the two smaller ones. What is the actual projected number of all major and smaller telescopes?

7. Neither the Master Plan nor Environmental Impact Statement is meaningful and adequate when it includes facilities that are "envisioned" but not planned or proposed. We cannot adequately assess the project.

8. Anticipated space requirement at the mid-level facility (Hale Pohaku) is based on assumptions and unsubstantiated expectations. It is admitted that a precise prediction of added space requirement is difficult to determine. If these are not known and sited we cannot assess the impact.

9. Indications are that construction camp housing will probably be proposed at or near Hale Pohaku (first paragraph, page 16). Can the facilities and designated space in Hale Pohaku Master Plan accommodate them?

10. Road plans should include the covering up of all abandoned segments (existing and future) of the Hale Pohaku to Summit Road to enhance aesthetics, minimize erosion problems and to help control off road driving. Better dispersion of road runoff to alleviate erosion problems, and control of current erosion need to be planned and implemented. Viewpoint parking and parking areas for snow play should be planned and constructed.

11. All powerlines within the boundaries of the Mauna Kea Forest Reserve should be underground. By generally following the old road, underground lines can be installed from the reserve boundary to Hale Pohaku with minimal ground and vegetation disturbance.

    Skiing and snow play are both significant and important uses of the Mauna Kea summit area. However, snow play participants greatly outnumber skiers and their needs should receive a higher priority. Skiing and snow play must be regulated for safety.

12. Encouraging the Ski Patrol to assist in visitor control is a plausible idea. However, their legal authority, responsibility, control (over them), liability, etc. must be clearly defined.

13. Is there a general consensus that the State (Mauna Kea) should become the "pre-eminent international center for observational astronomy"? Is this in the State or any functional plan? Who decides this?

14. The area being considered for millimeter-wave telescopes is also popular for skiing and snow play, especially when snowfall is light and confined to the higher elevations. These users should be considered in planning the location of telescopes in this area.

15. Permitted and non-permitted uses, and restrictions and conditions of uses within the science reserve, including the areas intended to serve as a "buffer zone" should be spelled out for clear understanding.

16. There should be a written assurance in the plan that public access for recreational purposes will not be restricted. Appropriate and necessary control of access need to be spelled out or at least addressed.

17. You have stated that the Research Development Plan "adopted by the University of Hawaii Board of Regents on January 22, 1982, was developed to reflect State policies such as those set out in the Mauna Kea Plan..." (p. 2).

    The University specifically participated in the development of the Mauna Kea Master Plan along with several special interest groups and the public and presented their proposals and arguments to the Land Board prior to its adoption in 1977.

    Is this Master Plan consistent with the Mauna Kea Plan, and, if not why not?

18. You state that other scientific activities may be allowed pending review and approval by the Board of Land and Natural Resources with the main policy guideline that "the activities should not interfere with the ongoing scientific work" (p. 21).

    What is the University's position if the public engaging in snow play, skiing, hunting or some other form of recreation should interfere with the ongoing scientific work.

19. You state that skiing is to be comparable with astronomical observation (p. 36). Which takes precedence?

20. You state that skiers will be consulted so that "their needs and preferences can be identified and considered (p. 44).

OCT 12 1982

21. What is meant by considered?

22. You state that, "At the present time there is no plan to restrict access to the summit area for anyone." (p.45)

    Do you have future plans to restrict access to the summit area for anyone?

23. You state the improved roads will be a benefit to visitors by making the area more accessible and improving the visitors safety (p. 45).

    You further state that, "An increase in the number of visitors, though might adversely affect the astronomers at the mid-level who sleep during the day. Mitigating measures will be incorporated in the design of the dormitory facility." (p. 45)

    What will happen to those dormitories whose design plans have already been approved by both the University and our department?

    If future design measures do not satisfy the sleeping astronomers, what do you intend to do about these visitors?

    Should a conflict arise in the future between visitors to the area and sleeping astronomers which will take priority?

24. There needs to be clarification and elaboration on the question of enforcement of all the various activities which occur on the mountain from Hale Pohaku to the summit including jurisdiction and funding.

Thank you for allowing us to comment on this Notice of Preparations. I would appreciate your continuing efforts in allowing your staff to continue to work closely with mine toward resolving these concerns.

Very truly yours,

SUSUMU ONO, Chairman
Board of Land and Natural Resources

UNIVERSITY OF HAWAII

Vice-President for Administration

28 October 1982

Mr. Susumu Ono, Chairman
Board of Land and Natural Reserves
State of Hawaii
P.O. Box 621
Honolulu, HI 96809

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN - NOTICE OF PREPARATION OF EIS - REFERENCE NO. CPO-562

Dear Mr. Ono:

Thank your for your letter of 12 October 1982. We have replied to your comments in the same order in which you addressed them.

1. As suggested, the boundaries of the Mauna Kea Ice Age Natural Area Reserve will be indicated on the figures showing the proposed paved summit road and the powerline corridor alternatives.

2. Our geological consultant, Dames & Moore, states that permafrost is known to have been identified in only two locations, both in sheltered portions of cinder cone craters, Puu Wekiu and Puü Goodrich. Dames & Moore further states that: "Woodcock and Friedman (1979) speculate that permafrost might exist 60 meters below the top of the Summit Cone, and Woodcock (1981) speculates that permafrost may underlie the groundwater body east of Lake Waiau, (but not under Lake Waiau). In general, the climate on Mauna Kea is considered to be slightly too warm for permafrost, and whether the few permafrost bodies are modern or relics of the last ice age is uncertain. Thus, it appears highly unlikely that a permafrost layer exists at any locations but few very local, special ones. . . No borings for existing facilities are known to have encountered permafrost."

   Septic tanks and leaching fields will probably continue to be the method of choice for sewage disposal for future telescope developments. Impacts are expected to be negligible because residual effluent flow from leaching fields are subject to rapid purification due to filtering within the underlying lava rock on the summit. The

2444 Dole Street · Room 202 · Honolulu, Hawaii 96822

radially dispersed flow rate would be insignificant within a distance of a few hundred feet from the source. Many of the future telescopes will be in the siting areas on the north side of the summit. Effluent from them will tend to flow northward away from Lake Waiau. Effluent from the installations on top of the cones likely will tend to disperse downward in all directions. Thus, at present only the Caltech 10-meter telescope and possibly the UK/NL millimeter-wave telescope are directly north of Lake Waiau. Amounts of effluent will be very small; 40 to 80 gallons per day are estimated for the Cal Tech installation. UK/NL MT personnel are expected to generate an equal amount.

Effluent in the subsurface will tend to percolate downward, and any lateral flow will tend to flow parallel to the surface drainage pattern. The surface drainage from the telescope siting area turns westward in a depression north of Lake Waiau and then gradually turns south well to the west of the lake. Thus, the logical path for any subsurface effluent flow does not approach Lake Waiau.

A letter from Dames & Moore to our consultants, Group 70, evaluating the possible impact on Pohakuloa Springs from sewage effluent generated in the Mauna Kea Science Reserve is attached for your information. This letter will be appended to the draft EIS.

The impact of sewage disposal on summit features will be discussed thoroughly in the draft EIS.

3. A management plan specifying the means that will be undertaken to protect recreational and scenic features of the mountain will be incorporated into the Master Plan.

4. We appreciate the information provided. The appropriate correction will be made in the EIS.

5. Please note our response to comment #1.

6. The Science Reserve CDP is for a <u>total</u> of 13 telescopes (large and small) by the year 2000. There are six existing telescopes, including four <u>larger</u> telescopes, and two <u>smaller</u> ones. The seven additional telescopes are projected to be large ones.

7. The word "envisioned" has been changed to "planned", the maximum number planned to the year 2000 is 13. The CDP designates areas where future telescope development is recommended; descriptions and environmental assessments of each designated area will be incorporated in the EIS. The cumulative impacts of astronomical development to the year 2000 will also be assessed.

8. The CDP projects that an additional 61 to 77 bedrooms will be required at Hale Pohaku by the year 2000. Space is available for three or four dormitory buildings in the vicinity of the UH temporary buildings, an already disturbed area. All of the area allocated for future dormitories may not be required, but the maximum projected impact is estimated at 77 bedrooms, actual needs will be determined by each proposing agency when it applies for authorization to locate its telescope on Mauna Kea. The estimates in the plan are believed to be conservative because of technical advancements in remote operations. The EIS assesses the impacts of expanding the Hale Pohaku facility and identifies the expansion area on a site plan.

9. One of the temporary UH buildings adjacent to the large stone cabin can be used for sleeping accommodations for construction workers. The building has ten bedrooms and two storage areas. It is currently being used by scientists and other astronomy personnel who are working at the summit. Dining and recreation facilities for construction workers can be accommodated in the other UH building. This building was formerly a messhall but is currently being used as a research preparation area. In addition the University of Hawaii and DLNR are currently discussing the possibility of the University being given responsibility for the two stone cabins, located at Hale Pohaku, which are currently under the jurisdiction of DLNR Division of State Parks, Outdoor Recreation and Historic Sites. If DLNR chooses to transfer this jurisdiction, the large stone cabin can also be used to house construction workers. The cabin can be arranged to sleep 12 people.

10. Road improvements are only in the planning phase; a design consultant has not as yet been retained. The CDP will recommend that all abandoned road segments be covered up. Drainage and erosion control measures will also be recommended. The CDP includes parking areas for visitors and recommends that the design consultant incorporate viewpoints in the road design.

11. Both underground and overhead powerlines from the Saddle Road to Hale Pohaku are being evaluated. Comparative costs, aesthetics, and environmental impacts of these alternatives are addressed in the draft EIS. Only underground lines are being considered for the Hale Pohaku to Summit portion of the powerline.

    Both the Physical Plan and Management Plan portions of the Science Reserve Complex Development Plan (SRCDP) address the needs of skiers and snowplay participants. The Management Plan addresses the issue of control.

12. The responsibilities of the Ski Patrol and the limits of their liability will be clearly defined in the Management Plan.

13. The development of "the Mauna Kea Observatory into a pre-eminent international center for observational astronomy" is specifically identified in the Higher Education Plan as a high priority implementing action which will "maintain and strengthen the position of the University of Hawaii at Manoa as a leading national and international research center." The development of the observatory as an international center for astronomy is cited in the State Conservation Lands Plan as a complementary interest.

14. In his review of the NOP for the subject project, Dick Tillson, of Ski Shop Hawaii, stated: "The telescopes which use the tops of the cones or the flats at their base compliment the skiing by improving the access to the ski slopes. Even while opening the road to the proposed Cal Tech 10-meter scope will cut the connecting trail from the Poi Bowl to the lower slopes, it will improve access for the snow players, beginners and spectators and only make a minor change in the ski patterns."

15. Proposed permitted uses and restrictions within the Mauna Kea Science Reserve will be described in the draft EIS.

16. Access controls will be addressed in the draft EIS.

17. The Mauna Kea Plan is the <u>policy guide</u> for all of the Conservation District land on Mauna Kea from the summit down to the Saddle Road. On the other hand, the Mauna Kea Science Reserve Complex Development Plan (SRCDP), (formerly called the Mauna Kea Science Reserve <u>Master Plan</u>), is a <u>physical plan</u> which reflects future development of the

summit of Mauna Kea and related facilities to the year 2000, as set forth in the UH Research Development Plan. The objective of the SRCDP is to guide and control development in order to preserve the scientific, physical and environmental integrity of the mountain. The SRCDP will form the basis of requests to amend the Mauna Kea Plan.

18&
19. According to the terms of General Lease S-4191 between the UH and BLNR. . . "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."

    The lease also states that ". . . all hunting and recreation rights on the demised lands, to be implemented pursuant to rules and regulations issued by said Board (BLNR). . .; 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." (General lease S-4191). Because recreation is restricted to day-light hours and astronomical operations are generally at night, there should be minimal conflict.

20&
21. Many groups and individuals were contacted during the planning process; skiers were among those consulted. The Ski Association provided us with invaluable information concerning skiing and snow play activities. They assisted us in determining facility needs and made suggestions concerning management of winter recreation activities in the summit area. The views of the skiers, as well as the views of all other interested groups, were evaluated in relation to both the proposed Physical Plan and proposed Management Plan portions of the SRCDP. Some of the skiers suggestions are incorporated into the plan.

22. A Management Plan is being proposed which will control (but not necessarily restrict) access to the summit area. It is possible that visitor access may be restricted to "day-light" hours only.

23. The problem of day visitors vs. day sleepers at Hale Pohaku was addressed in the Hale Pohaku Complex Development Plan (DLNR 1980). The dormitories currently under construction are sound proofed future dormitories will also incorporate noise abatement features in their design.

Mr. Susumu Ono, Chairman
Board of Land and Natural Reserves
State of Hawaii
28 October 1982

Page Six

24. The Complex Development Plan and EIS will summarize the roles of the University, the Board of Land and Natural Resources, the County of Hawaii and the public in managing and using the Science Reserve. The CDP may also recommend some changes in jurisdictional responsibilities.

Very truly yours,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

HSM:cf

Enclosure

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

DIVISIONS:
CONSERVATION AND RESOURCES ENFORCEMENT
CONVEYANCES
FISH AND GAME
FORESTRY
LAND MANAGEMENT
STATE PARKS
WATER AND LAND DEVELOPMENT

STATE OF HAWAII
DEPARTMENT OF LAND AND NATURAL RESOURCES
DIVISION OF CONSERVATION AND RESOURCES ENFORCEMENT
P. O. BOX 936
HILO, HAWAII 96720

July 28, 1982

University of Hawaii
Vice President for Administration
2444 Dole Street
Honolulu, Hawaii 96822

ATTENTION: Mr. Louis Lopez

Dear Sir:

This is in response to your letter dated July 8, 1982, regarding comments to the Mauna Kea Science Reserve Master Plan.

The Research Development Plan (RDP) is projecting a total of thirteen major telescopes on Mauna Kea by the year 2000. Four (4) major telescopes are presently operating on the mountain with three (3) proposed telescopes to be built in the 1980's.

In the proposal relating to the UK/NL milimeter wave telescope, the argument is the gap between radio astronomy and optical astronomy has been steadily decreasing. It then goes on to say that the gap is finally closed. If these more advanced telescopes are being built, it should follow that the more advanced models may be replacing and surpassing work that would or could be done with the present models.

Some of the Mauna Kea Master Plan's planning considerations were:

1. Minimize disturbance to the mountain ecosystem;
2. Minimize the visual impact of development of the mountain;
3. Locate facilities within the science reserve ina compact configuration as is consistent with the technical requirements of the telescopes;
4. Minimizing disturbances to undeveloped areas.

In view of four of the planning considerations of the Mauna Kea Master Plan, it seems that the building of thirteen (13) telescopes on the mountain will not coincide with the planning considerations. While the scientific community is voicing strong support in building more and more telescopes, they have been silent relative to the usefulness of the older telescopes which would play a minor role if any due to functional obsolescence. It would seem more feasible if we are guided by the Mauna Kea Planing consideration by removing the out moded telescopes, redesigning the existing structure, and placing the new telescope on it. This action will:

1. Reduce the projected number of telescopes needed;

2. Not add appreciably to the visual impact;
3. Insure that all the equipment on Mauna Kea is the best the scientific community has to offer;
4. Eliminate redundant structures; and
5. Attempt to keep within the guidelines of the Mauna Kea Master Plan.

In Part I of Section C, RDP is envisioning a single EIS and overall physical plan for all summit and related development to the year 2000. This would seem to be contrary to Chapter 343 HRS.

In Part III, serious dust problems because of the unpaved road is addressed, yet there is nothing stated as to what specific site or specific problem it is talking about. It only states a serious dust problem.

As to the road being paved for safety reasons, paving of the road in itself will not appreciably reduce or eliminate any safety problems. It would invite drivers to drive faster and ice or frost would collect on the hard surface and create a more dangerous condition. The safety problems that are now encountered and should be rectified are:

1. Placing guard rails on curves and high shoulders and
2. Increase the slope of curves and have it beveled inward instead of outwardly.

Vehicular problems presently encountered are vehicles stuck in the snow or having car trouble. There is no major vehicular accident that can be related to the present summit road.

I hope that some of these comments have some significance in preparing your report. Thank you for allowing me to comment on this matter.

Yours truly,

Charles K. Supe
Hawaii Branch Chief

CKS/mjy

CC: Marilynn Metz, Group 70
Maurice M. Matsuzaki-DOCARE

UNIVERSITY OF HAWAII

Vice-President for Administration
23 September 1982

Mr. Charles K. Supe
Hawaii Branch Chief
Department of Land & Natural Resources
Division of Conservation and Resources Enforcement
P. O. Box 936
Hilo, HI 96720

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Supe:

Thank you for responding to our Notice of Preparation for the subject project. We appreciate input from concerned individuals and organizations at this early stage of the planning process.

In response to your concerns over functional obsolence of ground-based telescopes, we offer the following explanation:

Telescopes are essentially light-gathering devices whose basic design has not changed significantly over the past 75 or 100 years. Telescopes, per se, do not suffer from "functional obsolescence." What does change is the instrumentation which is attached to the telescope. More sensitive light detectors, more sophisticated ways of depicting and recording characteristics of the light from astronomical objects, have been the driving force in astronomical observations, and it is these that grow obsolete - not the telescopes themselves.

The large "older" telescopes on Mauna Kea (the oldest is only 12 years old and all the others are only 3 years old) will continue to play as important a role in the future as they have in the past in contributing to our knowledge about astronomy - just as the Mt. Palomar 200-inch telescope (about 35 years old) and the Mt. Wilson telescope (nearly 80 years old) continue to do with updated instrumentation and detectors. The new telescopes proposed for Mauna Kea are intended to provide new capabilities in new wavelength ranges (infrared and submillimeter) to provide resources to groups who presently have none - they are not intended as replacements in any sense. The four large telescopes are every bit as important as are the potential new ones.

Mr. Charles K. Supe
Hawaii Branch Chief
Department of Land & Natural Resources
23 September 1982

Page Two

As far as staying within the guidelines of the Mauna Kea Plan, the University has developed a procedure within their Research Development Plan to evaluate each request for new telescopes on the mountain based on the criteria specified in the Plan. In addition, the CDUA process insures that each application conforms to the Mauna Kea Plan before a permit is granted.

The EIS and physical plan are in conformance to EIS regulations implementing Chapter 343 HRS in that:

"A group of proposed actions shall be treated as a single action when: (1) the component actions are phases or increments of a larger total undertaking; (2) an individual project is a necessary precedent for a larger project; (3) an individual project represents a commitment to a larger project; or (4) the actions in question are esentially identical and a single Statement will adequately address the impacts of each individual action and those of the group of actions as a whole." (1:22b.)

The problems associated with dust caused by the unpaved road will be addressed in detail in the draft EIS.

The road improvements envisioned in the plan are meant to alleviate rather than exacerbate hazardous driving conditions. Recent major vehicle accidents related to the road include:

1973: A construction truck turned over resulting in serious injuries to the crew.

1978: A vehicle going down the mountain "fish-taile" and rolled over. Two persons were injured.

1979: A car driven by a Honolulu driver rolled over. Both occupants of the car were hospitalized for at least 2 days.

Thank you for your comments. We hope you will review the draft EIS.

Very truly yours,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

HSM:cf

GEORGE R. ARIYOSHI
GOVERNOR

RECEIVED
JUL 28 1982
Vice President For Administration

Jacqueline Parnell
DIRECTOR

TELEPHONE NO.
548-6915

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
550 HALEKAUWILA ST.
ROOM 301
HONOLULU, HAWAII 96813

FACILITIES PLANNING OFFICE
AUG 2 4 46 AM '82

July 27, 1982

MEMORANDUM

TO: Mr. Harold Masumoto
Vice-President for Administration
University of Hawaii

FROM: Jacqueline Parnell, Director
Office of Environmental Quality Control

SUBJECT: Environmental Impact Statement Preparation Notice for Mauna Kea Science Reserve Master Plan, Mauna Kea, Hamakua, Hawaii

We have reviewed the subject preparation notice and offer the following comments for your consideration:

PAGE vii

The reference to Chapter 343, Hawaii Revised Statutes is inaccurate. The sections 1:22 and 1:23 refer to the EIS Regulations promulgated under Chapter 343, Hawaii Revised Statutes. Moreover, the master plan requires an EIS because the agency is proposing the use of state lands and the use of state funds not for the reasons as stated in the text. The proper citation is section 1:12 of the Environmental Impact Statement Regulations.

ABBREVIATIONS

We recommend that the initials MKMP not be used as an abbreviation for Mauna Kea Science Reserve Master Plan because it is easily confused with the Department of Land and Natural Resources Mauna Kea Master Plan which also has the same initials.

KINDS OF TELESCOPES AND THEIR EFFECTS

The EIS should discuss the different kinds of telescopes that could be used atop Mauna Kea and their impacts. For example, the possibility of locating a radio telescope has been proposed and may be developed. The effects from such telescopes can be significant because of their extreme sensitivity. Normal activities such as civil defense system, FM station or other communication devices could hamper the telescopes' reception and eventually create conflicting uses.

CAMP HOUSING FOR CONSTRUCTION

The EIS should discuss the camp housing and its effect on the environment. The location and size of area needed should also be included in the statement.

STATE ENVIRONMENTAL POLICY ACT, CHAPTER 344, H.R.S.

The EIS should also discuss the project in relationship to Chapter 344, H.R.S.

We trust that these comments will be helpful to you in preparing the EIS. We look forward to reviewing the document.

cc: Group 70

UNIVERSITY OF HAWAII

Vice-President for Administration

23 September 1982

Ms. Jacqueline Parnell, Director
Office of ENvironmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Ms. Parnell:

Thank you for reviewing the subject NOP. In answer to your specific comments:

1. Page vii: The draft EIS will contain corrected citations and purpose.

2. Abbrevations: Thank you for calling this to our attention. The subject plan will be abbreviated as SRMP in all future publications.

3. Kinds of Telescopes: The draft EIS will address impacts of different kinds of telescopes on the mountain. Potential radio interference problems will also be discussed.

4. Construction Housing: This subject will be addressed in the draft EIS. At the present time, the University is investigating the feasibility of using the existing large stone cabin for this purpose. Discussions are being held with DLNR concerning this possibility.

5. State Environmental Policy Act: The project will be discussed in relation to this Act in the fraft EIS.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

2444 Dole Street • Room 202 • Honolulu, Hawaii 96822

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

September 7, 1982

PN:0020

Mr. Louis Lopez
University of Hawaii
Vice President for Administration
2444 Dole Street
Honolulu, Hawaii 96822

Dear Mr. Lopez:

EIS Preparation Notice
Mauna Kea Science Reserve Master Plan
Mauna Kea, Hamakua, Hawaii

In accordance with our usual review procedures for EIS's at the preparation stage the Environmental Center has conducted a brief in-house review of the above cited document and would like to offer the following comments for your consideration in the preparation of the Draft EIS.

The preparation notice for an EIS for the Mauna Kea Science reserve is a most welcomed announcement and we are certainly pleased to assist in whatever way we can to aide in the development of a comprehensive document.

Several areas of particular concern that have been brought to our attention over the past years during the course of our reviews of previous environmental documents prepared for specific proposed actions on Mauna Kea and the Mauna Kea Master Plan. General areas of concern with regard to the development of observatories on this mountain include the following:

Permafrost:

A discussion of the possible effects of the proposed developments on the permafrost layer should be included. For example, would the excavations for the proposed additional structures and the required energy demands and waste disposal systems have any effect on the depth or distribution of the permafrost? If the permafrost is affected, what if any are the environmental/biological implications?

Surface Water:

The potential for pollutant nutrients to find their way to Lake Waiau is of critical concern. It is our present understanding that the topography and distance of the proposed sewage drainage fields is such that contamination is highly unlikely. The basis for such a conclusion however should be objectively described and emphasized in the EIS, so as to assure reviewers of the EIS that adequate care has been given to eliminate this concern. At the present time visitors are not permitted to use toilet facility at the observatories. Certainly some provision for restroom facilities for visitors must be made at the earliest possible time. Responsibility for these facilities, while legally most probably is the kuleana of DLNR, the University must share responsibility inasmuch as it is responsible for opening the area to greater usage.

Air quality:

In earlier reviews of activities on the mountain a concern was expressed as to the effects of the proposed observatory developments on air quality and in particular the air quality monitoring being conducted on Mauna Loa. To assure adequate awareness of plans we suggest that the development of this EIS be coordinated with NOAA staff of the Mauna Loa Observatory. It is our undertanding that Dr. Kinsell Coulson at the Hilo office of the National Weather Service would be the appropriate contact person.

Certainly a major concern of the facility is the generation of dust from the road and exhaust emissions from automobiles as well as the power generators. It might be appropriate to consider a shuttle bus service from the Pohakuloa mid-level facility to the top. Perhaps a regularly scheduled electrically powered tram would not only reduce traffic-dust emissions but also automotive exhaust pollutants. Many of the national parks are currently operating electrical tram services for visitors to eliminate traffic congestion and exhaust emissions. Information on the economics and feasibility of their operation should be readily available from the existing parks programs. If adequate measures could be taken to assure that visitors to the top were kept within specified areas so that the extremely fragile environment would not be damaged, the transport of visitors to the top and skiers to the ski areas along the way might well offset the cost of operating the tram for the scientists. Road surfacing requirements could perhaps be minimized and maintenance costs lessened if only the light weight tram was permitted in the upper area. Furthermore, summit parking requirements would be greatly reduced thus reducing the amount of land to be disturbed for relatively unproductive benefits.

Access and Use:

The most critical concern expressed by our earlier reviewers is basically one of access and use. Because of the truly hostile environmental conditions on the mountain at the higher elevations, years will be required to recover from any physical disturbance to recover to the "natural" appearance or ecosystem, if such recovery is even possible. It seems to us absolutely essential that some form of controlled access and use be instituted at the earliest possible time. We have noted in the present assessment that "at the present time, there is no plan to restrict daytime access to the summit area for anyone". We suggest that a review of this policy is critical. We do not suggest that visitors be denied access. On the contrary, we would not be surprised if in the future the facility were to become a definite visitor attraction point. In fact, the promotion of the scientific accomplishments of the facility, through visitor access, might well encourage public support for continued state and federal funding of the observatories. We suggest that a definite plan for visitor use at the top be examined at the earliest possible phase so that indiscrimate wandering -hiking - skiing - etc. can be absolutely controlled. At present, 4-wheel drive vehicles are permitted to travel with apparently no restrictions and the endangered ecosystem is ignored.

Diligently enforced limitations on pedestrian traffic at the top and near Lake Waiau and the adze quarry are essential and the plan and methods for controlled access, use, and enforcement should be spelled out in detail in the EIS.

Site Preparation:

We note that considerable grading will be required for site preparation. A thorough discussion of what will be necessary in terms of grading, drainage and erosion controls with appropriate contour maps to show the proposed modifications should be included in the EIS.

Powerline:

The proposed alignment of the powerline, whether it is above or below ground, and the potential impacts of its construction on the physical-biological environment must be addressed in the EIS.

Social impacts:

Mention is made in the Environmental Assessment that "the final alignment and decisions as to whether the line will be above or underground will be determined by both cost and environmental considerations." The installation of an underground powerline is certainly esthetically preferable and we would not be surprised if vehement opposition would ensue from the Hawaii island community should above ground utilities be proposed. While the Center does not generally comment on subjective areas such as aesthetics, the social impact of an above-ground wiring decision and ramifications may have a major impact on the financial analyses of the project. In evaluating the relative costs and benefits of underground vs. above-ground wiring, consideration should probably also be given to the potential costs of delays generated by citizen actions in opposition to above ground power lines at the summit area.

Vegetation:

The assessment indicates that a botanical study will be conducted in the summit area as part of the Master Plan. While this is laudable we must strongly urge that such a survey be made a part of the EIS. Because of the fragile and endangered ecosystem at the summit, it is essential that a comprehensive baseline be established for the flora (and fauna) so as to evaluate the impacts and evaluate appropriate mitigative measures, and their effectiveness.

Fauna:

We suggest that you contact Dr. Sheila Connant of the UH General Science Department for information on the avifauna. She is likely the most knowledgeable person in the University (if not the State) with regard to the Mauna Kea avifauna. Similar competancy and expertise for the environmental analysis of the Mauna Kea invertebrates and flora can be found in Drs. Francis A. Howarth and Wayne Gagne of the Bishop Museum and Dr. Clifford

Smith of the UH Botany department respectively.

The preparation of an EIS which will address the environmental impacts associated with the overall future development of the Mauna Kea Science Reserve is a welcomed and long-sought exercise. External to our comments on what we perceive to be the major environmental concerns to be addressed in the EIS we have certain proceedural concerns which if followed we foresee as having considerable potential for community concern and the potential of litigative delays. Hawaii Revised Statutes (Chapter 343) and the Environmental Quality Commission Regulations set forth the legal requirements for an acceptable Environmental Impact Statement. In particular they state that if a statement is accepted for an action no further statement will be required. However, because of the time period over which these various construction projects will be initiated (to the year 2000) and thus the strong likelihood that the environmental conditions and concerns expressed today may have significantly changed relevance to conditions existing 10 years or more in the future, we would be greatly concerned if no other environmental review is contemplated for future observatory developments. Recognition of this concern and acknowledgement of the need to prepare supplemental statement to address the potential impacts of specific projects at the time of their construction would help to mitigate public concern with future Mauna Kea developments.

We appreciate the opportunity to assist in identifying areas of concern to be addressed in the EIS for the development of the Mauna Kea Science Reserve. If you have any questions regarding our comments please contact Jacquelin Miller of our office at 948-7361.

Yours truly,

Doak C. Cox
Director

cc: Group 70
Ginger Plasch, Astronomy Dept.
Office of Environmental Quality Control
Jacquelin Miller
Pamela Bahnsen
Richard Erwin

UNIVERSITY OF HAWAII

Vice-President for Administration

15 October 1982

Dr. Doak C. Cox, Director
Environmental Center
University of Hawaii at Manoa
Crawford 317, 2550 Campus Road
Honolulu, HI 96822

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN - NOTICE OF PREPARATION OF EIS

Dear Dr. Cox:

Thank you for responding to our Notice of Preparation for the subject project. We appreciate input from concerned individuals and organizations in the early stages of the planning process. In response to some of your specific comments:

Permafrost and Surface Water: Our geological consultant, Dames & Moore, states that permafrost is known to have been identified in only two locations, both in sheltered portions of cinder cone craters, Puu Wekiu and Puu Goodrich. Dames & Moore further states that: "Woodcock and Friedman (1979) speculate [emphasis added] that permafrost might exist 60 meters below the top of the Summit Cone, and Woodcock (1981) speculates [emphasis added] that permafrost may underlie the groundwater body east of Lake Waiau, (but not under Lake Waiau). In general, the climate on Mauna Kea is considered to be slightly too warm for permafrost, and whether the few permafrost bodies are modern or relics of the last ice age is uncertain. Thus, it appears highly unlikely that a permafrost layer exists at any locations but few very local, special ones. . . No borings for existing facilities are known to have encountered permafrost."

Preliminary analyses indicate that septic tanks and leaching fields will probably continue to be the method of choice for sewage disposal for future telescope developments. Impacts are expected to be negligible because residual effluent flow from leaching fields are subject to rapid purification due to filtering within the underlying lava rock on the summit. Many of the future telescopes will be located in the siting areas on the north side of the summit. Effluent from these telescope facilities will tend to flow northward away from Lake Waiau. Effluent from leaching fields located on top of the cones will tend to disperse downward in all directions. Thus, the telescope facilities of concern are limited to those located on the plateau directly north of Lake Waiau. At present only the Caltech 10-meter telescope and the UK/NL millimeter-wave telescope are planned to be located in this area. The UK/NL is investigating the possibility of locating their septic tank and leaching field on the northern portion of their site where effluent would flow northward away from Lake Waiau. The total amount of effluent from both telescopes will be very small; 35 to 50 gallons per day are estimated for the Cal Tech installation, and approximately the same amount for the UK/NL MT.

A letter from Dames & Moore to our consultant, Group 70, evaluating the possible impact of sewage effluent on Lake Waiau is attached for your information. This letter will be incorporated into the draft EIS.

The possibility of installing restroom facilities at the summit for visitors is currently being considered for inclusion in the Physical Plan. Placement of these facilities will avoid areas where drainage patterns affect Lake Waiau.

Air Quality: As suggested, Dr. Kinsell Coulsen was contacted on 17 September 1982. In summary, Dr. Coulsen stated that activities on the summit of Mauna Kea do not effect the air quality or air quality monitoring on Mauna Loa; he, therefore, did not see any reason to coordinate the preparation of the Science Reserve Complex Development Plan EIS with NOAA staff at the Mauna Loa Observatory.

The possibilty of establishing a shuttle bus service is being considered. This service would be instituted when monitoring of visitors to the summit area indicates a need for it.

It should be noted that the alternative of an electrically-powered tram was considered in the EIS for the Mauna Kea Observatory Access Road, prepared by the Department of Transportation, Highways Division on 31 July 1973. A tram or cog railway would require the construction of roadbed and tracks, creating new scars on the surface of the mountain. The installation of a tram system would not eliminate the need for a conventional road as the transport of water and construction materials will continue into the forseeable future. The establishment of a tram system will not minimize the need to improve and resurface the existing road. The conditions of the road are such that improvements are necessary even for a reduced level of traffic. The only advantage of this alternative would be the reduction of parking requirements at the summit.

Access and Use: A plan for monitoring and managing access to the summit will be incorporated into the Complex Development Plan. This plan will specify the means that will be undertaken to protect recreational and scenic features of the mountain. For your information, the Natural Area Reserves Commission has decided to close roadways to Lake Waiau and the Adze Quarry and is currently arranging for this. Henceforth, access will only be by foot.

Management plan options including methods for controlling access and for enforcement will be included in the EIS.

Site Preparation: A description of the grading, drainage and erosion controls during site preparation and contour maps showing proposed modifications for the UK/NL MT project will be included in the EIS. The UC TMT design has not progressed to the point where detailed maps are available. Proposed grading, drainage and erosion controls will be discussed in the draft EIS; specific plans will be submitted to the DLNR during the CDUA process.

Powerline: Although the final alignment of the powerline may not be known at the time that the EIS is printed, the potential impacts of the construction of the powerline in all alternative corridors will be included in the EIS.

Social Impacts: For your information, the powerline will not be placed overhead in the section between Hale Pohaku and the summit. While it is not yet known whether the powerline would be placed overhead or underground between the Saddle Road and Hale Pohaku, it should be noted that in at least one of the corridors being considered, overhead lines would not be visible from the Saddle Road or from the County road to Hale Pohaku. In another alternative, overhead lines would not be visible until it approaches the County road. As of this writing vehement opposition from the Hawaii island community to above ground utilities has not yet materialized.

Vegetation: The botanical study conducted by the Bishop Museum will be appended to the EIS. Dr. Clifford Smith was involved in this study.

We appreciate your suggestion of Sheila Connant as a source of information on the avifauna of Mauna Kea, however, in the course of our investigations we have contacted Mike Scott and Derral Herbst of the U.S. Fish and Wildlife Service. Drs. Francis Howarth and Wayne Gagne of the Bishop Museum were contracted by us to conduct the survey for arthropod fauna at specific sites on the summit.

Other: In answer to your procedural concerns related to environmental impacts of future development at the summit, an environmental assessment will be prepared for each project that is not specifically identified in the CDP, even though it is not required under Chapter 343 HRS and EQC regulations. At that time a determination will be made as to whether or not an amendment to the SRCDP EIS is required.

Thank you for your comments. We hope you will review the draft EIS.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

Dames & Moore

1144 10th Avenue, Suite 200
Honolulu, Hawaii 96816
(808) 735-3585
Telex: 634100 Cable address: DAMEMORE

September 20, 1982

Group 70, Inc.
924 Bethel Street
Honolulu, Hawaii 96813

Attention: Mrs. Marilyn Metz

Gentlemen:

Evaluation of Possible Impact on Lake Waiau
From Sewage Effluent
Mauna Kea Science Reserve Area
Mauna Kea, Hawaii, Hawaii

As you have requested, this letter presents our opinion regarding the possibility of sewage effluent from the proposed Science Reserve Area reaching Lake Waiau. Briefly, our opinion is that this is not possible. This conclusion is discussed in the following paragraphs.

The proposed Science Reserve Area envisions a total of 13 telescopes at selected areas on the top of Mauna Kea. Present sewage disposal practices reportedly consist of collecting untreated sewage in septic tanks and discharging effluent in leaching fields. Future systems presumably will be similar, and concern has been expressed that effluent might reach Lake Waiau.

The general setting of the telescopes relative to Lake Waiau is shown on the attached Map of Area. The closest telescopes will be about 4,000 feet away and will be more than 300 feet higher in elevation. The subsurface generally consists of volcanic cinders at the cinder cones, and andesitic lava flows elsewhere. Both materials are quite permeable. Although the lavas contain dense rock, fractures and clinker zones will conduct water readily. The only groundwater known to exist consists of perched water in the center of some of the cones, including the area immediately east of Lake Waiau (Woodcock, 1974, 1980). Borings for existing telescopes did not encounter groundwater.

We discussed the performance of the sewage disposal system at the University of Hawaii 88-inch telescope recently with Dr. Hans Boesgaard of the Institute for Astromony. He believes that the septic tank never discharges into the leaching field; instead, the effluent frequently is below the inlet level so that unpleasant odors coming back up the system have been a problem. At first, we assumed that this lack of discharge could be explained by evaporation, but a few calculations indicate that this is highly unlikely. Although the very low humidity at the summit encourages evaporation; the low temperatures tend to inhibit it significantly. (We are not aware of any specific evaporation data for the summit area.) We believe that evaporation can play only a minor role in short-term disposal of sewage effluent, although its effects should be considered whenever possible in design of future disposal systems. Nevertheless, Woodcock (1979) has observed relatively high outflow of moist air from within one of the cinder cones. Apparently this phenomenon helps dissipate subsurface moisture in the summit area, and thus, will tend to reduce the amount of sewage effluent.

The question remains concerning the fate of the remaining effluent. Many of the future telescopes will be in the siting areas on the north side of the summit. Effluent from them will tend to flow northward away from Lake Waiau. Effluent from the installations on top of cones likely will tend to disperse downward in all directions. Thus, the telescopes of concern are limited to those in Siting Area II directly north of Lake Waiau. At present only the Cal Tech 10-m telescope and the UK/NL millimeter-wave telescope are planned for this area. Amounts of effluent will be very small; 35 to 50 gallons per day are estimated for the Cal Tech installation.

To illustrate how small the discharge will be, assume that 200 gallons per day ultimately will be discharged into Area II. This is equivalent to an annual precipitation of about 0.1 inch over the roughly 1 million square feet of Area II. Actual precipitation is more than 100 times this amount, but the only known groundwater tables are in some craters, probably perched on soil or cemented volcanic ash deposits. Thus, effluent cannot be expected to contribute significantly to existing subsurface moisture. Further, Woodcock (1980) has concluded that under present conditions "there is little or no surface and subsurface flow into Waiau Lake and groundwaters from the surrounding catchment area of the crater."

Effluent in the subsurface will tend to percolate downward, and any lateral flow will tend to flow parallel to the surface drainage pattern. As shown on the attached map, the surface drainage from Area II turns westward in a depression north of Lake Waiau and then gradually turns south well to the west of the lake. Thus, the logical path for any subsurface effluent flow does not approach Lake Waiau. If we again assume a total effluent discharge of 200 gallons per day from Area II and an overall 20 percent voids in the subsurface, then about 135 cubic feet of subsurface would be adequate to accept one day's discharge. This volume could be pictured as a flow front 11.5 feet wide and high advancing 1 foot per day. Thus, it can be seen that all discharge could be easily accommodated by a very narrow area directly underlying the surface drainage if it did not percolate directly downwards.

Impermeable layers outside cinder cones could exist that would deflect percolation laterally. These are likely to consist of dense lava flows and cemented ash or tuff zones. Their existence will be known in the telescope area to depths explored by borings, but their possible influence in the region between the telescopes and Lake Waiau cannot be known, given the complex of eruptive centers and flows at the top of Mauna Kea. As demonstrated above, however, the very low flows and large distances involved indicate that effluent from the telescope could never reach Lake Waiau.

If you have any questions concerning this letter, please contact us.

Yours very truly,

DAMES & MOORE

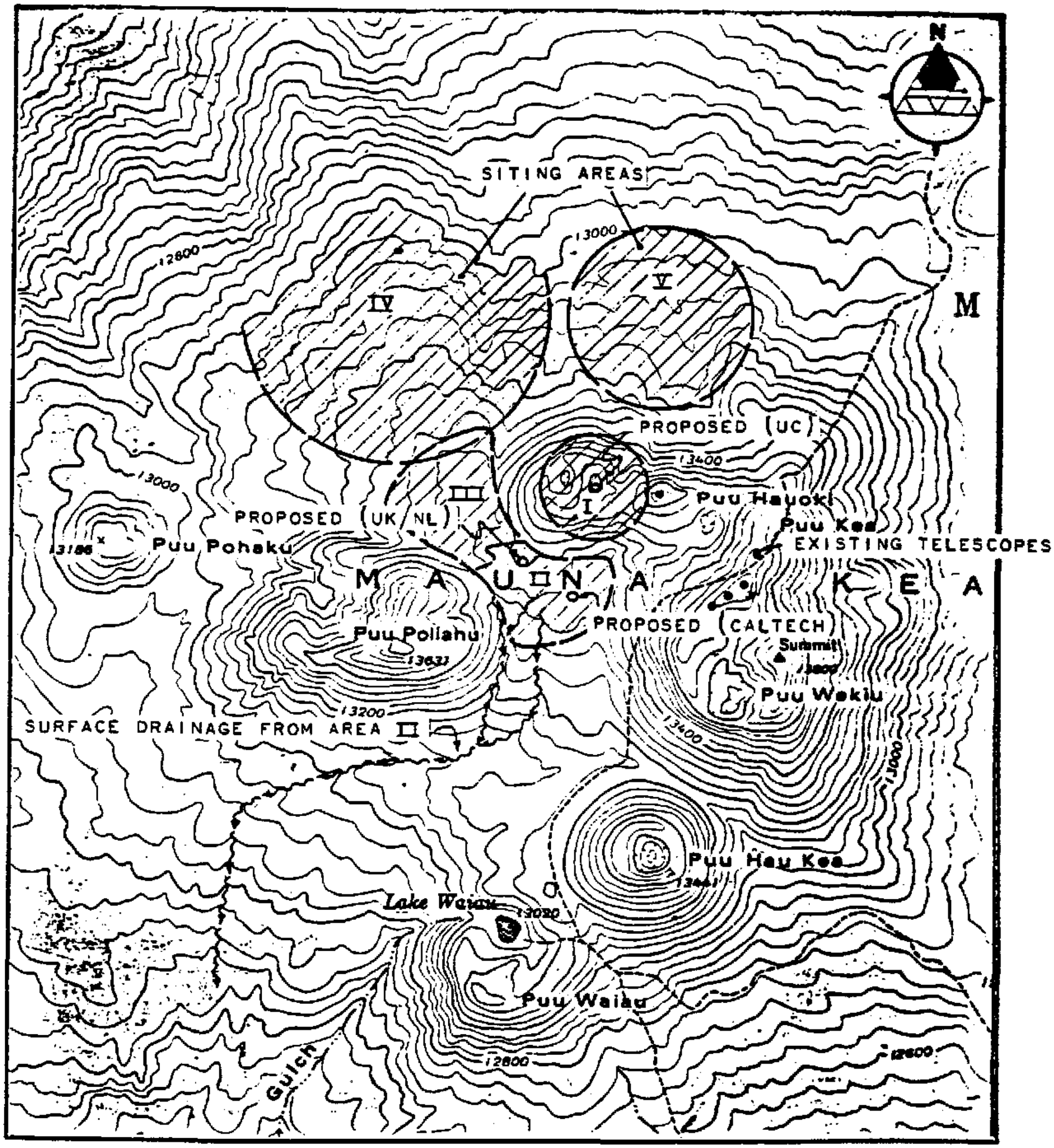
Damon R. Runyan

Damon R. Runyan
Associate

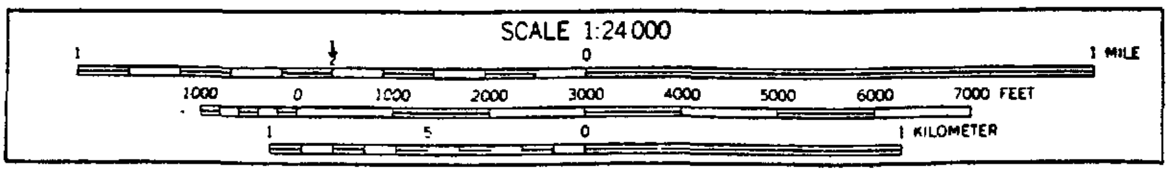
DRR:jlh9520-003(3148A)
(Two copies submitted)

Attachment: Map of Area

CHECKED BY 9/20/82 FILE BY DATE



MAP OF AREA



REFERENCE:
U.S.G.S. TOPOGRAPHIC MAP
MAUNA KEA, HAWAII, HAWAII
DATED 1956

DAMES & MOORE
ATTACHMENT

COPY

OFFICE OF THE MAYOR — county of hawaii, hilo, hawaii 96720

August 10, 1982

University of Hawaii
Vice President for Administration
2444 Dole Street
Honolulu, HI 96822

Attention: Mr. Louis Lopez

Thank you for giving us this opportunity to comment on the preparation notice.

There are two major areas we believe the EIS should address. For these areas to be meaningfully addressed, certain basic commitments and/or resolutions may have to be made. These areas are:

1. Visual appearance from the rest of the island. This concern has been underscored not only within the General Plan but also within the Northeast Hawaii Community Development Plan.

2. Mid-level facilities. With the advent of three (3) new telescopes "proposed for construction during the 1980's," and the possibility of four (4) more thereafter, the development of mid-level facilities must be evaluated in relation to the ultimate development scheme for the summit. The mid-level facilities are supportive of the primary use(s) at the summit, and their development must be closely coordinated.

Since the California Institute of Technology's 10-meter telescope application will probably precede the completion of the Mauna Kea Master Plan, we refer you to a copy of our February 10, 1982, letter to Walter Muraoka of the University of Hawaii.

We look forward to reviewing the full document. In the meantime, if you have questions regarding our comments please call Donald Tong of the Planning Department at 961-8288.

HERBERT T. MATAYOSHI
MAYOR

cc: Group 70
DLNR
OEQC

HERBERT T. MATAYOSHI
MAYOR

Office of the Mayor

RECEIVED
FEB 8 1982
Vice President For Administration

February 3, 1982

Mr. Harold Masumoto
Vice President for Administration
University of Hawaii at Manoa
2444 Dole Street
Honolulu, HI 96822

RE: California Institute of Technology
Proposed 10-Meter Telescope for Millimeter
and Sub-millimeter Astronomy at Mauna Kea,
Hamakua, Hawaii - E.I.S. Preparation Notice

Thank you for the copy of the Environmental Impact Statement, Notice of Preparation for the proposed sub-millimeter telescope at Mauna Kea.

We have forwarded a copy to the Planning Department for its review. They will be providing substantive comments for your consideration.

We would like, however, to note that while the proposed telescope is included within the University's Research Development Plan, if it is to ultimately serve as the State's Master Plan for the science reserve, an approval of this plan by the Board of Land and Natural Resources would also seem appropriate.

We would appreciate if a copy of the draft Environmental Impact Statement could be forwarded to the Planning Department when it is completed.

Sincerely,

HERBERT T. MATAYOSHI
MAYOR

FACILITIES PLANNING OFFICE
FEB 10 9 05 AM '82

VG:lrp

cc: Planning Department

UNIVERSITY OF HAWAII

Vice-President for Administration

1 October 1982

The Honorable Herbert T. Matayoshi
Mayor
County of Hawaii
Hilo, HI 96720

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Mayor Matayoshi:

Thank you for commenting on the subject NOP. In response to your specific comments:

1. Visual appearance of proposed telescopes from the rest of the island will be specifically addressed in the Master Plan and EIS.

2. Coordination of expansion of the mid-level facilities with construction of the proposed telescopes is a primary consideration within the Master Plan.

Procedures are currently being worked out to obtain the Board of Land and Natural Resources input on the Master Plan prior to its adoption since amendments to the 1977 BLNR Mauna Kea Plan may be necessary to implement certain actions proposed in the Plan.

Very truly yours,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

HSM:cf

2444 Dole Street · Room 202 · Honolulu, Hawaii 96822

RECEIVED
AUG 6 1982
GROUP 70

August 4, 1982

University of Hawaii
Vice President for Administration
2444 Dole Street
Honolulu, Hawaii 96822

Attention: Louis Lopez

Dear Sir:

The following are our comments on the EIS Preparation Notice for the Mauna Kea Science Reserve Master Plan.

Because of the remoteness and the travel time of our suppression units to the Mauna Kea Reserve facilities, we would like to stress the importance of preventive measures. These include:

(1) Combustible materials, like paper cartons and boxes, be kept at a minimum.

(2) Daily removal of rubbish be enforced.

(3) Storage of combustible and flammable liquids be according to NFPA #30 requirements.

(4) Annual training of fire extinguishers be programmed with our department.

(5) A communication system be devised between buildings to provide some kind of fire brigade or rescue brigade.

(6) Fire plan be prepared for all buildings.

Initial response should be geared to incipient fires within the scope of portable fire extinguishers. Should fire get out of hand, evacuation procedures shall be implemented. Life safety shall be of prime importance.

Because Observatory personnel are to render emergency medical service to the public as well as staff personnel, while in the Observatory area, the concern should be:

(1) The level of emergency training for these personnel.

Recommendation: Minimum level should be advanced first aid.

(2) Cardio-pulmonary resuscitation training.

(3) Maintain adequate first aid supplies.

Yours very truly,

SHOZO NAGAO
FIRE CHIEF

SN/mo

cc: Group 70
Attn: Marilynn Metz

UNIVERSITY OF HAWAII

Vice-President for Administration
19 October 1982

Mr. Shozo Nagao, Chief
Hawaii County Fire Department
466 Kinoole Street
Hilo, HI 96720

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Nagao:

Thank you for responding to our Notice of Preparation for the subject project. We appreciate your suggestions on preventive measures and the minimum levels of training and supplies required to provide emergency medical service. It is our understanding that you or members of your staff have been in contact with Tom Kreiger of the Mauna Kea Support Services in developing plans for fire protection of facilities within the Mauna Kea Science Reserve.

Thank you for your comments. We hope you will review the draft EIS.

Very truly yours,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

HSM:cf

2444 Dole Street · Room 202 · Honolulu, Hawaii 96822

C O P Y

COUNTY OF HAWAII
DEPARTMENT OF PUBLIC WORKS
HILO, HAWAII 96720

RECEIVED
JUL 30 1982
GROUP 70

July 29, 1982

Mr. Harold Masumoto
Vice-President for Administration
2444 Dole Street
Honolulu, HI 96822

Attention: Mr. Louis Lopez

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN
MAUNA KEA, HAMAKUA, HAWAII
EIS PREPARATION NOTICE

Thank you for allowing us to review the EIS Preparation Notice for the subject project.

In addressing our review to the assessment on access road, sewage disposal and solid waste disposal, we find that these areas are adequately covered. With the necessity to truck water to the summit, the safety aspect of the road will be enhanced with the road improved and paved. Other beneficiaries will be users and visitors to the area.

It is noted, however, that such improvement proposal will require an amendment to the Mauna Kea Plan.

Edward Harada
EDWARD HARADA
Chief Engineer

cc: Mayor
Planning Department
Group 70, Attn: Marilynn Metz

UNIVERSITY OF HAWAII

Vice-President for Administration

1 October 1982

Mr. Edward Harada, Chief Engineer
County of Hawaii
Department of Public Works
Hilo, HI 96720

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Harada:

Thank you for your comments of the subject NOP. We appreciate your support on the issue of road improvements. If necessary a Mauna Kea Plan amendment will be sought to allow the road to be paved.

Very truly yours,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

HSM:cf

2444 Dole Street · Room 202 · Honolulu, Hawaii 96822

Advisory Council On Historic Preservation

1522 K Street, NW
Washington, DC 20005

Reply to: Lake Plaza South, Suite 616
44 Union Boulevard
Lakewood, CO 80228.

FACILITIES PLANNING OFFICE
AUG 23 3 49 PM '82

"PLEASE NOTE OUR CHANGE IN ADDRESS"

730 Simms Street, Room 450
Golden, Colorado 80401

August 19, 1982

RECEIVED
AUG 23 1982
Vice President For Administration

Mr. Harold S. Matsumoto
Vice President for Administration
University of Hawaii
2444 Dole Street
Honolulu, Hawaii 96822
ATTN: Louis Lopez

Dear Mr. Matsumoto:

On July 16, 1982, the Advisory Council received your letter and accompanying Environmental Impact Statement Preparation Notice regarding the Mauna Kea Science Reserve Master Plan, Hawaii. As you requested, we have reviewed the EIS Preparation Notice, including its outline for the EIS issue content. It is apparent that the need to discuss the proposed undertaking's possible direct and indirect impacts on the adze quarry and, perhaps, other, as yet unidentified, cultural features has been adequately anticipated by the writers of the notice.

We would only add the reminder that, if the master plan or the development subsequently guided by the master plan is federally assisted or funded, the appropriate Federal agency has a responsibility in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended, to take into account the effect of the undertaking on any property listed or determined eligible for listing in the National Register of Historic Places. Section 106 of the Act further requires the head of the Federal agency to afford the Advisory Council a reasonable opportunity to comment with regard to the undertaking, if there will be an effect.

If compliance with Section 106 is applicable to this undertaking, the Advisory Council's regulations (36 CFR Part 800) provide the procedural process for obtaining the Council's comment. We call to your attention that, properly constructed, the draft EIS may also provide the documentation necessary to permit the Advisory Council's review and comment, and the document must be accompanied by a cover letter requesting comment in accordance with Section 106. Integration of NEPA and NHPA documentation is explained at Section 800.9 of the Council's regulations. Copies of the Council's regulations and the amended 1966 Act are enclosed for your reference.

Thank you for contacting the Advisory Council.

Sincerely,

Robert Fink

for Louis S. Wall
Chief, Western Division
of Project Review

Enclosures

cc: Group 70
924 Bethel Street
Honolulu, HI 96813
w/enclosures

UNIVERSITY OF HAWAII

Vice-President for Administration
23 September 1982

Mr. Louis S. Wall, Chief
Western Division of Project Review
Advisory Council on Historic Preservation
730 Simms Street, Room 450
Golden, CO 80401

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Wall:

Thank you for your comments on the subject NOP. At the present time the preparation of the plan is being funded entirely from State and private sources. Should Federal funds be used in the implementation phases of the plan, appropriate Federal documentation will be prepared.

We understand that our archaeological consultant, Bishop Museum, is keeping you informed as to our actions being taken in regard to existing and newly discovered historic sites. The significance of these sites will be discussed in the forthcoming EIS.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

cc: Dr. Pat McCoy, Bishop Museum

2444 Dole Street • Room 202 • Honolulu, Hawaii 96822

Canada · France · Hawaii Telescope Corporation
P. O. Box 1597 Kamuela, Hawaii 96743 USA
Société du Télescope Canada · France · Hawaii
Telephone (808) 885-7944 Telex 633147 CFHT

13 July 1982

University of Hawaii
Vice-President for Administration
2444 Dole Street
Honolulu, Hawaii 96822

Dear Vice-President Masumoto:

Thank you for sending us a copy of the EIS Preparation Notice for the Mauna Kea Science Reserve Master Plan.

As current users of the Mauna Kea facilities we are particularly pleased to note that the Plan envisages "paving of the access road above Hale Pohaku [and] the construction of a powerline to service the mid level facilities and the summit facilities". (p.4)

Experience has shown that the present road, unpaved and very rough, constitutes a serious danger to people, equipment and environment.

The socio-economic factors (p. 40) of the development of scientific facilities on Mauna Kea and on Big Island cannot be understated. The fostering of frontier researches and technologies on the Island of Hawaii will have increasingly positive economic and cultural impacts. In this respect, the 2nd last paragraph of p. 40 could be made to read:

> "The presence of the existing telescopes on Mauna Kea benefited the University of Hawaii at Hilo (UHH) and highschools on the Big Island. The CFHT and UKIRT observatories are providing research opportunities each summer to selected participants in the NSF - Student Science Training Program at UHH. The UHH, the Hawaii Preparatory Academy (Waimea) and other teaching institutions have also called upon astronomers for lectures, seminars and informal

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> workshops and interaction with their students. Public lecture programs on science and astronomy are being presented island-wide by CFHT, UKIRT and UH staff astronomers. The proximity of the research facilities has enabled students and citizens on the Big Island to receive first-hand exposure to advanced research."

Finally, two precisions concerning our own organization:

p. 36; "The CFHT Base Support Facility is located in Waimea".

p. 46; Mr. Pierre Bely, Canada-France-Hawaii Telescope Corporation (CFHT)

Sincerely yours,

René Racine
Executive Director

RR/lf/4491

cc: Group 70

UNIVERSITY OF HAWAII

Vice-President for Administration
15 October 1982

Dr. René Racine
Executive Director
Canada - France - Hawaii Telescope Corporation
P. O. Box 1597
Kamuela, HI 96743

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN - NOTICE OF PREPARATION OF EIS

Dear Dr. Racine:

Thank you for reviewing the subject NOP. The information provided will be incorporated into the draft EIS.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

2444 Dole Street · Room 202 · Honolulu, Hawaii 96822
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ENV 2
H-W/G

HAWAII ELECTRIC LIGHT COMPANY, INC.

P. O. BOX 1027 HILO, HAWAII - 96720

RECEIVED

August 6, 1982

University of Hawaii
Vice President of Administration
2444 Dole Street
Honolulu, Hawaii 96822

Attention: Mr. Louis Lopez

Gentlemen:

SUBJECT: Mauna Kea Science Reserve Master Plan
Mauna Kea, Hamakua, Hawaii - EIS
Preparation Notice
RE: Item 3.2, "Power"

We have reviewed the EIS and the following are our comments:

1. As an introduction to Paragraph 3.2, "Power", we suggest a statement similar to the following:

   "To fulfill the requirements of delivering power to the Mauna Kea Science Community, the following will be required: a switching station near the existing 69KV transmission line by Saddle Road; a 69KV distribution substation at Hale Pohaku; a 69KV transmission line connecting the switching and distribution stations; and a 12.47KV underground distribution system from the distribution substation to the summit."

2. The statement, "standard 50 foot poles", is not accurate. Poles to be used in corridors "A, B or C" would consist of 60, 65, or 70 foot poles, depending on the terrain.

   The installation of an underground 69KV transmission line in Corridor "B" would require 6 - 5" ducts (1 cond. per duct) in concrete encasement. Large manholes are necessary to accommodate cable splicing and/or sharp deviation angles. The technology is presently available; however, the cost for an underground 69KV installation would be prohibitive--approximately $1,000,000 plus per mile. Please note that HELCO does not have a 69KV underground installation on its system.

Mr. Edward Nakamoto of my staff, and Messrs. T. Kawabata and J. Niwao of Nakamura, Kawabata & Associates, recently conducted an initial field check of the three proposed corridors on August 3, 1982. Additional field checks will be scheduled the week of August 9, 1982.

HAWAII ELECTRIC LIGHT COMPANY, INC.

In summary, HELCO would very much like to provide power to the Mauna Kea facilities; however, the difficulty of doing the installation and maintaining the electric facilities for the various routes must be addressed. Please consider our comments in finalizing your EIS.

Very truly yours,

Alva K. Nakamura, Manager
Engineering Department

AKN:MMV:mg

xc: Group 70 ✓
M. Valera

UNIVERSITY OF HAWAII

Vice-President for Administration
23 September 1982

Mr. Alva K. Nakamura, Manager
Engineering Department
Hawaii Electric Light Company, Inc.
P.O. Box 1027
Hilo, HI 96720

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Nakamura:

Thank you for your comments on the powerline discussion in the subject NOP. Your concerns will be addressed in the draft EIS. Our consultant, Group 70, is working closely with the UH Facilities Planning Office, the Department of Accounting and General Services (DAGS) and their consultant, T. Kawabata, and Ed Nakamoto of your staff in preparing the pwoerline aspects of the draft EIS and Master Plan.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

RECEIVED
AUG 11 1982

P.O. Box 1217
Pahoa, Hi. 96778

RECEIVED
AUG 13 1982
GROUP 70

University of Hawaii
V.P. for Administration
2444 Dole St.
Honolulu, Hi. 96822

Dear Mr. Lopez,

After reading through the Mauna Kea Science Reserve Master Plan notice of E.I.S. preparation, I would like to respond on several matters.

I would like to see plans drawn up in the final E.I.S. to downgrade the road to Lake Waiau to a trail. This could be accomplished by scattering larger stones over the present road. Several conservation-oriented groups could be contacted to do this at no cost. As a part of a Natural Area Reserve, this lake deserves special protection from indiscriminate use by off-the-road vehicles.

I would like to see details on the impact of an expanded parking area at HalePohaku for scientists and visitors to the proposed information center included in the final E.I.S.

I would like to suggest that meetings be held to inform construction workers and contractors of the need to preserve the fragile summit environment while carrying out their projects.

Many people that I have talked to have expressed great concern about an above groud powerline. I would hope that environmental and aesthetic considerations not take a back seat to cost considerations in this matter.

I would, further, like to see a system of limited access past Hale Pohaku be implemented as soon as possible. Proper baseline studies of the environment can hardly be prepared under the current situation. I feel provisions for restricted use of the summit already exist in the current master plan. In recent years, it has gotten all too popular to test drive new 4-wheel drive vehicles on Mauna Kea. Surely, no one is served by such use.

Finally, I would like to volunteer the Conservation Council of Hawaii in helping to set up materials and/or displays in the proposed information center at Hale Pohaku.

Sincerely,

Stephen A. Holmes

UNIVERSITY OF HAWAII
23 September 1982
Vice-President for Administration

Mr. Stephen Holmes
P.O. Box 1217
Pahoa, HI 96778

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Holmes:

Thank you for commenting on the subject NOP. We appreciate receiving comments at an early stage of the planning process. In answer to you specific comments:

1. You will be pleased to know that the Natural Area Reserve Commission has taken steps to downgrade the road to Lake Waiau to a trail.

2. Impacts of parking at Hale Pohaku were addressed in the EIS for the Hale Pohaku Master Plan. If it is necessary, as a result of this plan, to expand these planned parking areas, impacts of this action will be addressed in the draft EIS.

3. Your suggestion that meetings be held to inform construction workers and contractors of the need to protect the fragile summit environment is an excellent one. The Master Plan will incorporate this as a management recommendation.

4. We are still evaluating above and underground powerlines from the Saddle Road to Hale Pohaku. Aesthetic consideration are of great concern to us; however, there are actions associated with burying a 69 KV line which may be of greater harm to the environment. The forthcoming EIS will examine all aspects of this issue. The 12 KV line from Hale Pohaku to the summit will be buried.

5. A Management Plan addressing controlled access to the summit from Hale Pohaku will be incorporated in the Master Plan for the Science Reserve.

Thank you for your offer to assist in setting up materials and displays in the proposed Information Station. We shall call on you in the future.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

2444 Dole Street • Room 202 • Honolulu, Hawaii 96822

LETTERS FOR CLARK RICHARDSON

CAN BE FOUND IN

APPENDIX L - RADIO INTERFERENCE

HE'IRY A. ROSS

to: University of Hawaii, V.P. for Administration
2444 Dole Street, Honolulu, HI, 96822

RECEIVED
AUG 4 1982
GROUP 70

attn: Louis Lopez

29 July 1982

I have received a copy of the EIS Preparation Notice on the Mauna Kea Science Reserve Master Plan.

I appreciate to be a consulted party in this matter and would like to offer some views as a resident of the Big Island and of the State of Hawaii. From where I live in North Kohala I can see the top of Mauna Kea over the range of the Kohala Mountains and I can also see a little speck of white which I know to be a telescope dome. I know of course that there are a few more such domes on the mountain which I cannot see, but I would not mind seeing them all, because these are our eyes into the universe, the intracacies of which we still have to fathom.
The Babylonians had to build ziggurats to study the heavens 4000 years ago because they lived on flat land but were nonetheless so interested in their universe that they went to great effort to build small mountains to better observe the night skies.
We have this beautiful 14,000 feet mountain here which brings us so much closer to a clear observation of the skies, that we may not let this opportunity pass to pry further and examine this universe of which we are but an infinitesimally small particle.

I extend this little bit of philosophy here, not because I am a dreamer (County and State agencies certainly know me as an active antagonist of environmentally unsound developments) but because too few people realize that education in any form is the basis of better understanding and better living, a happier environment. And on top of MaunaKea mankind is educating itself about its humble place in the vastness of space.
We may be one of many life forms in other places of this space, but we might also be the only life form in the universe which has gained conciousness of its surroundings and the interaction of macro-and micro- cosmos, and one that asks questions about its origin, its present and its future, which Albert Einstein has taught us may lie in the same plane of factual existence.

In order to find that out we need more scientific research and of course more and different telescopes next to the microscopic endeavors that go on in laboratories on the earth or in space via satellites.

People all over this globe are very much interested in the results of such scientific examinations into our being on three distinct planes. One, of our microscopic and biological composition, the next, of our interaction as individuals on the earth, and then of course one step further: into our place and existence in an awsome cosmos of a magnitude that very few people can envisage.

Thus, making our mountain available to more and deeper scientific (astronomical) research, is, or at least may be a conditio sine qua non for better understanding on one of the other planes afore mentioned, that of our present living together on this speck of dust that we call Earth, in peace, instead of in war and discontent.

I see any scientific endeavcr into our real being, and Mauna Kea

box 99 kapaau - hi - 96755

can become an important facet of that, as a <u>peace-conducive effort.</u> If we learn our place in the universe better, that will lead to also knowing ourselves better. And knowing ourselves better will no doubt lead to the awareness that petty differences between nations, as are artificially magnified by politicians and some governments for their own sake, do not really exist to any extent that wars must be waged.

MAUNA KEA AND ITS SCIENTIFIC ENTERPRISES . ARE A WORTHWHILE CONTRIBUTION TO WORLD PEACE AND IF WE STIMULATE THIS SCIENTIFIC ENDEAVOR WE DO EFFECTIVELY CONTRIBUTE TO THE FURTHERANCE OF PEACE BETWEEN NATIONS, WHICH WILL LEAD TO MORE HAPPINESS OF ALL PEOPLE.

This is not a pipe dream. This is reality. And we on the Big Island of Hawaii as well as the State should rejoice in having the natural environment for such a worthwhile industry as astronomy is.

Now for the more pragmatic side of developing Mauna Kea into a world center of astronomical observations.

Some people have uttered objections to telescope domes being visible from outside or around the mountain.
To pacify them let's put the domes in less obtrusive places on the mountain wherever possible, and fortunately there are many places which enable this. I am only saying this because we have to overcome this kind of dumb resistance of people who do not really know what they are talking about but who might have political influence.
In sum-total if 20 domes were visible from all around it would not make a dent in the overall appearance of the mountain. It would be less that a millionth of the overall view and if not specifically pointed out to tourists for example they do not even notice the domes. And we have many ugly features on this island that hold back tourists from repeated visits, like unnecessary powerlines on both sides of our roads, which obliterate the otherwise fantastic landscape. One powerpole that is not necessary along the Hamakua coastal road or the Saddle Road is about a thousand times worse than a dome on top of the mountain for those who object, and we have hundreds of such poles.

And talking of power poles, a thorough study should be made of putting all powerlines underground. It does not cost that much more. In fact it would be cheaper to have put all powerlines on the island underground to begin with, but utility companies were as short-sighted as most industries and out for a first gain that they lost track of the long range implications of power outings and repairs of overhead lines. With the weather as it prevails in the Mauna Kea area you do not want to be without power at any time, and this will happen when you put any of these lines overhead. More importantly for environmental purposes all lines must be put underground. They deface the natural look and beauty of the mountain and certainly do not enhance tourism, which is an important source of income to this island.

While on the subject of utilities, I abhor to find that water is being trucked in from Hilo. It may be the cheapest way now, but it causes heavy traffic of (usually diesel) trucks to the top of the mountain. I would like to offer a possible alternative. As I have noticed, the mountain is capped by snow about six months out of every year. Why not use the natural precipitation, filter it and collect it in reservoirs to be built, that would serve the facilities on a year around basis? If taken over a twenty year period this may be the cheaper way and it would enhance the project as a self-sustaining facility.
Engineeringwise I do not see any problems with this.

And your projection of 13 telescopes by the year 2000 seems too low to me. Better make it twenty and base your utility capital outlays on that or at least provide for a one time digging for powerlines with sufficient empty conduits to pull additional cables later.
Of course solar voltaic panelling may be in the future also, especially so because there is practically uninterrupted sunshine on top of the mountain, but this will have to be studied as an alternative with a projection of possible lower prices in the future. However it might be possible to get Arco Solar or the federal government interested in trying this out. For the PV industry this would offer an enormous technical and public relations possibility to show the potential of their product, if they would put some R&D money into this.

I am saying that more than likely 20 telescopes would be up there by 2000 because on the mainland the present telescope sites are being crowded in by urban development and their observational capacity is going down relevantly. This would not very likely happen around Mauna Kea, and so in this over-populated world Mauna Kea will have much potential to become the science center of the world in astronomical respect.
It must of course be stressed in the draft EIS that this is a positive impact on the prestige of this state, its university and also on the island where Mauna Kea is situated. It will definitely attract tourists, as it will become ever more a feature to behold.

Contemplating an enhancement in tourism as an indirect positive impact it must at the same time be treated as an aspect that might kill the chicken with the golden eggs, (or was it a goose?) There will be plenty of touristic interest, but uncontrolled traffic would cause air, noise, and all kind of other pollutions. Because of that it might be wise to project the access in such a way (and certainly paved properly) that tourists can be taken up in a shuttle service, instead of everybody just driving up there whenever it pleases them; at nighttime such traffic should of course be minimized to some demonstration trips at set times for people who really want to look at the "stars", as is done now on a limited scale.

One very important aspect of this environmentally clean industry must be emphasized in the draft EIS, especially so where unclean industries are trying to make headway on this island with all kind of shenanigans and arguments of multipliers as to their employment potential for local people.
You should not only mention the potential amount of jobs that would become available to local people with an adjacent amount of foreign workers, but apply to that total a multiplier, as other EIS planners do, of indirect jobs that would be created by this industry and project that to the year 2000, as others do. You will come up with an impressive number of jobs, thus created on this island by an acceptable industry and that makes it economically more attractive to people and decision makers who are not really interested in the scientific angle of this development.

As for pilali birds. I recognize the problem, but I do not think that if traffic is regulated and limited as per above there would be any imminent danger to the survival of that species and other animals that find a habitat on the mountain. That mountain is really so big that it would be hard to endanger pilali birds with telescopes more than hunting and skiing do.

Hale Pohaku as a midway station might also be designated to receive visitors with some kind of a pavillion as I believe was projected in its plans. That of course might be the right site for a shuttle bus to take off to the top for tourists. The shuttle could serve at the same time to also take scientists to the top, with the idea of better one bus than 4 cars.

I have to agree withJohn Jefferies of the Institute for Astronomy in Manoa, that the state should take a more active interest in this project.
The Governor has mentioned as one possibility to attract the electronics industry to Hawaii, which is also a clean industry. But the electronics people are not coming.
Instead the Department of Planning & Economic Development is pushing very hard to get some dirty industries to this very island, like a geothermal industry which would produce in excess of five-fold the necessity of this island's power at any place even to the detriment of people living in its vicinity which would only produce about one hundred jobs by the year 2000, if successful.
Also a manganese nodule industry is being attracted by the state, and millions have already been spent to do so.
The people on this island do not want such industries. They want jobs, yes, but not that badly as to have to put up with polluting and poisonous residues that eventually find their way into the food chain.

Yes I think that our state government ought to wake up and made to see the terrific potential of this totally clean industry that you are projecting.

If I can be of any help with engineering problems or otherwise, please let me know. I think this is a great opportunity.

Henry A Ross

cc. Group 70, Honolulu
Mr Susumu Ono DLNR, Honolulu
Mr Hideto Kono DPED, Honolulu
Mr John Jefferies UH Manoa, Honolulu
Mrs Mary Matayoshi, CCECS- UH Hilo
Mr Frank DeLuz, County Council, Hilo
Mr Sidney Fuke, Planning Dept, Hilo
Mr Yoshito Takamine, State Representative
Dr Malama Solomon, Senate candidate
Mr Richard Santiago, member EQC, Hawi
Kohala Community Association, Kapaau
Environmental Quality Commission, Honolulu
Hawaii Tribune Herald, Hilo
Mr Walt Southward, Chamber of Commerce, Hilo

P.S. for xerox copy recipients:
This is regarding Mauna Kea as a planned site for multi-national, national and local observation facilities for astronomical purposes like the accomodation of a dozen or more telescopes.

UNIVERSITY OF HAWAII

Vice-President for Administration
23 September 1982

Mr. Henry A. Ross
P. O. Box 99
Kapaau, HI 96755

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Ross:

Thank you for commenting on the subject NOP. We appreciate contributions such as yours to the planning process. In response to some of your specific comments:

1. May we quote some of your excellent prose in the preface of our Master Plan?

2. Telescope locations are constrained by certain technical requirements such as wind, visual obscuration and heat sources. It is, therefore, not always possible to "hide" them from view. These constraints and other reasons for selecting certain locations rather than others for future telescope locations will be addressed in detail in the draft EIS. Incidentally, we wish everyone felt as you did about the visibility of telescopes on the mountain.

3. Both underground and overhead powerlines are being evaluated for the corridor from Saddle Road to Hale Pohaku. There are several problems, however, in placing 69-KV lines underground which are not only extremely costly to overcome but could result in environmental damage to the area. The 12-KV powerline from Hale Pohaku to the summit will of course, be buried.

4. Your observations on water supply will be addressed in the draft EIS.

5. Based on analysis of national and international demand for telescopes until the year 2000 and assumptions concerning future funding for ground-based astronomy, the University determined that 13 major telescopes would be the best guess estimate of the total that could be expected for Mauna Kea by the end of the century.

6. Alternative sources of energy will be addressed in the draft EIS.

2444 Dole Street • Bachman 202 • Honolulu, Hawaii 96822

Mr. Henry A. Ross
23 September 1982

Page Two

7. A Management Plan which will address controlling access to the summit will be incorporated in the Master Plan. Shuttle service as one means of controlling visitor access, is under serious consideration. An Information Station for visitors is presently under construction at Hale Pohaku.

8. An economic analysis of the impact of astronomy development on the Big Island economy will be incorporated into the draft EIS. Estimates of direct and indirect jobs generated by future astronomy developments will be a part of this assessment.

9. Impacts of development on wildlife will be addressed in the draft EIS.

Thank you again for your thoughtful comments on the proposed plan. We look forward to your comments on the draft EIS.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

FACILITIES PLANNING
OFFICE

AUG 12 8 33 AM '82
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P.O. Box 751
Honolulu, HI,96808
August 10, 1982

Mr. Harold Matsumoto
Vice President for Administration
University of Hawaii
2444 Dole Street
Honolulu, HI 96822

Dear Mr. Matsumoto:

I would like to offer the following comments on the Mauna Kea Science Reserve Master Plan - EIS Preparation Notice:

There is little or no discussion of the uses of the mountain by hunters. Mouflon sheep are still present as well as game birds at lower elevations. Hunting should be discussed in the EIS.

Other users of the summit include state agencies who maintain communications facilities, especially for use in emergencies. The master lease states that there can be limitations placed on electronic installations in the science reserve. This potential limitation should be discussed with regards to the State's emergency communications setup.

There are economic benefits to be derived from the further development of scopes on Mauna Kea. These would occur on the Big Island, elsewhere in the State on the mainland and foreign countries. Income to Hawaii would derive from both technical and non-technical support services. To maximize potential benefits from the technical support services, the private sector should be involved rather than the Institute for Astronomy. The Institute may be capable of providing such services but should not be in a position where they compete with private firms. The growth of high-technology firms in Hawaii is a stated goal of the State Administration. Growth of these firms broadens the tax base by creating tax-paying entities rather than tax-supported entities. This should be discussed included in the Mauna Kea Science Reserve Master Plan and EIS.

In the past, there has been confusion over the roles of the University, the Institute for Astronomy, the Board of Land and Natural Resources, the County of Hawaii and the citizens of the State regarding the management and use of Mauna Kea. The lease for the Mauna Kea Science Reserve is with the University of Hawaii. Yet, one gets the feeling that the Institute of Astronomy owns the summit and controls all its uses. The Master Plan and the EIS should clearly spell out the roles of the various entities involved with managing and using the reserve. How are State funds used by each of these entities, if any, in their respective roles? What agreements are made, ie. sub-lease, use/support between the University, the IFA and the other telescope organizations? I note that in the past this has been somewhat of an ad-hoc arrangement. Will that continue? These questions need to be addressed in the Master Plan and the EIS. The economic benefits and environmental impacts are directly influenced by the roles each entity will have.

A minor point - on p. 27 the map incorrectly shows the location of Kauai and Niihau.

Thank you for the opportunity to provide comments on this EIS Preparation Notice. I would like to receive a copy of the draft EIS when it becomes available.

Yours truly,

Rick Scudder

Rick Scudder

cc: Group 70

UNIVERSITY OF HAWAII

Vice-President for Administration
19 October 1982

Mr. Rick Scudder
P.O. Box 751
Honolulu, HI 96808

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN - NOTICE OF PREPARATION OF EIS

Dear Dr. Scudder:

Thank you for responding to our Notice of Preparation for the subject project. We appreciate input from concerned individuals and organizations at this early stage of the planning process. In response to some of your specific comments:

1. Hunting activities on Mauna Kea will be discussed in the EIS. For your information, Mr. Mike Tulang, past president and Mr. Ken Funai, current president of the Sportsmen of Hawaii, an organization of hunters, have been contacted regarding hunting activity in this area.

2. There are four existing transmitters within the Mauna Kea Science Reserve, two belong to the National Weather Service (NWS), one to the the State Department of Land and Natural Resources, Division of Forestry, and one to the Volcano Observatory. As you are familiar with the terms of the master lease, you are aware that these transmitters are allowed until one or another of the transmitters interferes with observatory operations. When interference occurs the offending transmitter must be removed.

   The NWS transmitters are used primarily to send weather information to NWS station in Ewa Beach, Oahu. The NWS transmitters also play a role in the Tsunami Warning System. The transmitter/receiver translator used by the Volcano Observatory was initially installed for use in monitoring two active volcanoes, Kilauea and Mauna Loa. The Division of Forestry transmitter is to be used in case of forest fires. The DLNR has a contract with a private firm to design a microwave system. Upon construction, the Forestry transmitter would be removed. This information will be included in the EIS.

3. The impacts of further development of telescopes on Mauna Kea on the economy of the island of Hawaii will be discussed in the EIS.

2444 Dole Street · Room 202 · Honolulu, Hawaii 96822
An Equal Opportunity Employer

4. The Complex Development Plan and EIS will summarize the roles of the University, the Board of Land and Natural Resources, the County of Hawaii and the public in managing and using the Science Reserve. For purposes of clarification, please note as stated in the master lease, that the Mauna Kea Science Reserve is owned by the State of Hawaii and is under the jurisdiction of the Board of Land and Natural Resources (BLNR). Since January 1, 1968, the Board of Land and Natural Resources has leased all lands above the 12,000-foot elevation to the University of Hawaii for 65 years. The University of Hawaii formulated a Research Development Plan (RDP) which was adopted by the UH Board of Regents on 22 January 1982. The RDP reflects the University's policy on the development of the Mauna Kea Science Reserve. The RDP sets forth criteria for agreements between the UH and telescope sponsors. Each existing telescope has entered into a sublease and operating agreement with the University of Hawaii. The BLNR must approve each sublease. All future telescopes must follow this procedure.

   The Institute for Astronomy does not own the land; the Institute for Astronomy is a department within the University of Hawaii (UH).

5. We appreciate the information provided about the State map.

Thank you for your comments.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

SKI ASSOCIATION OF HAWAII

P.O. Box 8327 / Honolulu, Hawaii 96815 Recorder Phone 949-7807

RECEIVED
AUG 4 1982
GROUP 70

July 30, 1982

University of Hawaii
Vice President for Administration
2444 Dole Street
Honolulu, Hawaii 96822

Attention: Mr. Louis Lopez

Gentlemen:

SUBJECT: Mauna Kea Science Reserve Master Plan EIS

The Ski Association of Hawaii appreciates the opportunity to comment on the EIS submitted with your July 8, 1982 letter. We offer the following comments:

1. Pg. 19, para. 4.2 - Management Plan
   This paragraph indicates that a plan is presently being developed by the University of Hawaii and DLNR to establish the method or degree of control of access to the summit area. Since winter sports activities represent at least one of the major reasons for people to go to the summit, we ask that the Ski Association be advised of the present status of this planning effort. Also that we be permitted to contribute to to the decision process as it is being developed.

   We suggest that the philosophy and degree of control to be exercised at Hale Pohaku would be that appropriate to any state or national park area in a similar environment utilized by the public for recreational purposes.

2. Paragraph B 2.0 - Access Roads - Fig. 2
   We suggest that the switchback access road from the generator to the summit of Puu Wekiu be abandoned and the cones natural slope be restored. A new access road should then be built from the generator to the Cal Tech site over the existing branch road. From there it would curve up along the south face of the cone sited for the new U.C. proposed telescope

and tie into the existing access road to the IRTF and U.H. telescopes. This alignment would eliminate a major part of the existing road alignment that encounters heavy snowdrifts that blocks access to the summit area. It would also eliminate the scar on the face of Puu Wekiu that is visible from lower elevations.

The proposed new road alignment does not suffer from snowdrifts and melts off faster since it is either sheltered or is on a south facing slope. It is also only visible within close proximity of the summit bowl between the cones.

2. Paragraph B 2.0 Access Roads - Fig. 2 and Fig. 11
To increase the recreational use of the summit for winter sports, we wish to propose including in the master plan at this time the early installation of a new access road that would open up the bottom of Alii, Warrior and Pele's Parlor ski runs. This road would improve and extend the existing road from the proposed Cal Tech telescope, past the NRAO site and around the north and northeast base of the summit cones containing the proposed U.C. and IRTE telescopes. This road would provide access to the most dependable ski runs on Mauna Kea from the standpoint of adequate and long lasting snow. The proposed alignment is shown on the attached marked up copy of Fig. 11. This road will eventually also serve telescopes to be built on the summit shoulder to the northeast as shown on Fig. 3 of the EIS.

We appreciate the opportunity to offer our input to the EIS process.

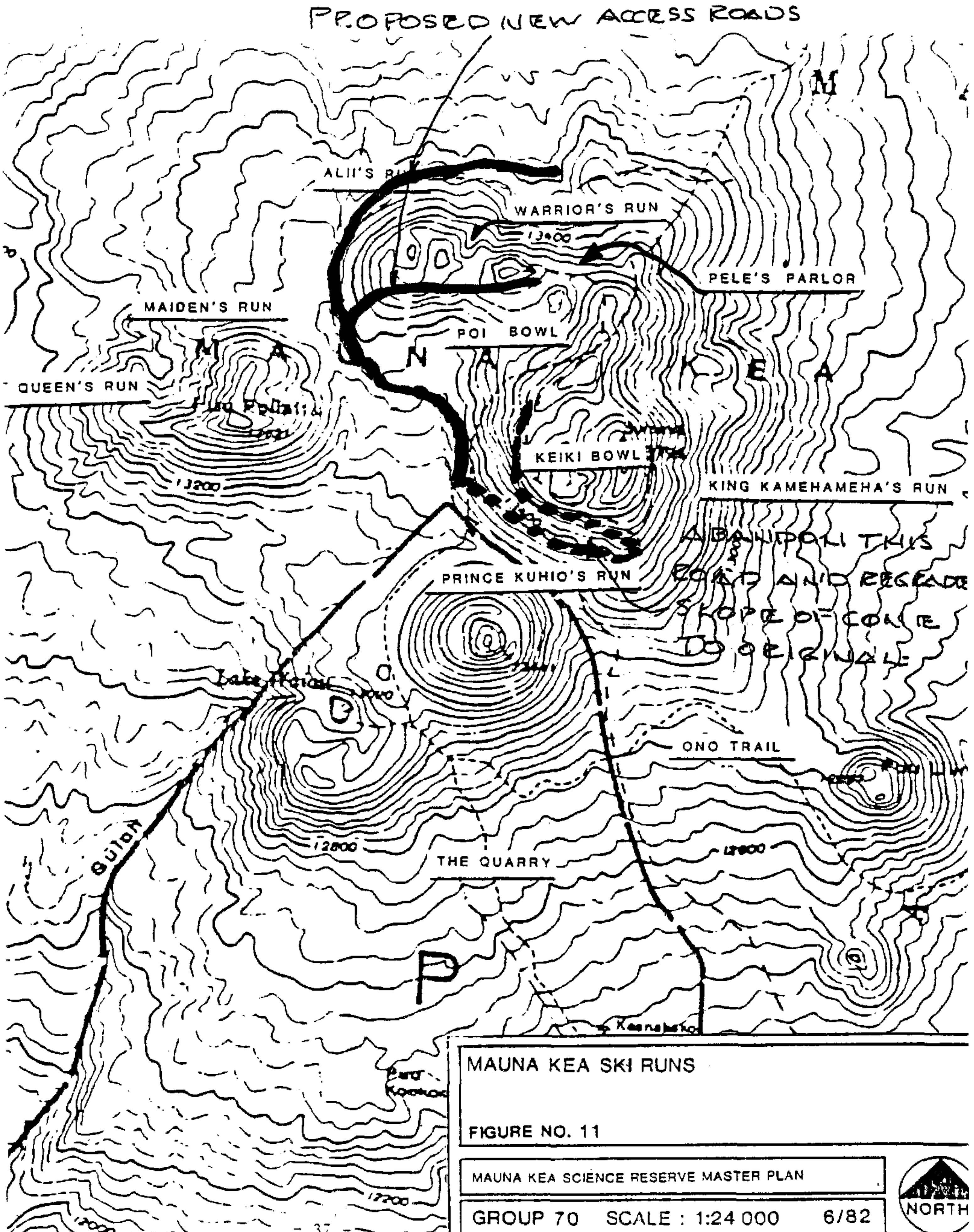
Sincerely,

Dick Tillson

Dick Tillson
President

WDJ:mac

cc: Group 70, Marilynn Metz



MAUNA KEA SKI RUNS

FIGURE NO. 11

MAUNA KEA SCIENCE RESERVE MASTER PLAN

GROUP 70 SCALE : 1:24 000 6/82

UNIVERSITY OF HAWAII

Vice-President for Administration

15 October 1982

Mr. Dick Tillson
Ski Association of Hawaii
P. O. Box 8327
Honolulu, HI 96815

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Tillson:

Thank you for responding to our Notice of Preparation for the subject project. We appreciate input from concerned individuals and organizations at this early stage of the planning process. In response to some of your specific comments:

1. A monitoring management plan specifically directed to controlling access to the summit will be incorporated into the Master Plan. This plan will also specify the means that will be undertaken to protect recreational and scenic features of the mountain including skiing resources.

   In addition, please be assured that the proposed role that the visitor information station will play in the recreational use of the Science Reserve area will be comparable to a similar facility in a state or national park. To this end, close consultation with the Department of Land and Natural Resources, Division of Parks and Recreation will continue to be maintained during the preparation of the management plan.

2&
3. Closing the portion of the summit road from the generator to the summit of Puu Wekiu, construction of an additional section of road connecting the generator to the Caltech, UC TMT and IRTF sites, and the construction of a road providing access to the Alii, Warrior and Pele's Parlor ski runs was considered, however, it was determined that it would not be feasible at this time.

Thank you for your comments. We hope you will review the draft EIS.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

2444 Dole Street · Room 202 · Honolulu, Hawaii 96822
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HSM:cf

c: Nishimoto Group 70

SKI SHOP HAWAII
& Hawaii Ski Schoo

University of Hawaii
Vice-Pres. of Admin.
2444 Dole St.
Hono.Haw.96822

July 26, 1982

RECEIVED
AUG 9 1982
GROUP 70

Mauna Kea Science Reserve Master Plan
Notice of Preparation
Environmental Impact Statement

I welcome this opportunity to contribute information, comments and recommendations to the Mauna Kea Science Reserve Master Plan. My unique and special knowledge of Mauna Kea may be very helpful in this endeavor.

The skiers have always been in close contact and strong support of the scientific community on Mauna Kea. We provided the first help in snow removal when we gained the help of the U.S.Army in plowing the snow in earlier years. And again when we obtained the Legislature appropreation that provided the funds the snowblower in current use. Our joint use of Mauna Kea Allows us to share and benifit from each others activity. I encourage and support the developement of the Mauna Kea Science Reserve Master Plan for the maximum and best scientific use of Mauna Kea.

It is ironic that we enter the space age and undertake space age developements while we are still trying to over come a Stone Age mentality. The problems of public support, and understanding and awareness must be considered to over come the selfish objections of a few who insist that their activity and interests come first and are paramont.

Since it is the goal of this master plan to consider the the goals and objectives of the other user groups, and to maintain and protect the harmonious and compatible uses of Mauna Kea, I am sure that it will be successful.

Skiing and Snow Play

Snow play on Mauna Kea was an ancient Hawaiian sport and may well predate the adze operation at the Keanakakoi Quarry, making it the oldest use of Mauna Kea. Certainly people that traveled thousands of miles across unknown waters would not hesitate to climb a few more to find out what white stuff was up there. The ancient Hawaiians spent considerable time on Mauna Kea, they knew it well. A check with Dr. McCoy of the Bishop Museum indicates that the only written record is in the Legend that Madam Pele and her sister Poliahu raced their sleds. It was a sport worthy of the gods, and still is.

830 Ala Moana Blvd.#222
Honolulu,Haw.96813

OAHU
PO Box 8232 Honolulu, Hawaii 96815 PH (808) 537-4065

BIG ISLAND
Parker Ranch Road Waimea (Kamuela) Hawaii 96743 PH (808) 885-4188

The excellant quality and large quanity of snow on nearly perfict slopes has gained the attention and interest of skiers around the world. The Socio-Economic effect on the big island and the state is already growing rapidly and will be substancial.

Perma-Frost

The skiers have been aware of the perma-frost on Mauna Kea for some time. There is also a phenomenon of thermal movement of the cinders by solar expansion. During our early efforts to build a rope tow in the center of the Poi Bowl and in Pele's Parlor below the NASA infrared telescope, we found the perma-frost layer to be 6 to 8 inches thick laying 6 to 12 inches below the surface. The new snow at the begining of the season creates a new layer at the surface which sinks and joins the lower layer, perpetuating it as the surface snow melts.

Thermal movement

The thermal movement of the cinders is a large factor in the difficulty in maintaining road cuts that create steep slopes. Dry cinders will sluff to a set angle with the thermal movement continuing to reduce this angle substancilly in time.

Geoligy

Since the melting snow perpetuates the perma-frost layer I tend to discredit the theory that glacial ice is still under the cinders. There are no signs of any settling or sluffing that certainly would show somewhere at some time. The waters of Lake Waiau are more likely the result of the snow melt which sinks into the cinders. There is no surface run-off from the snow melt. The slopeing underlaying layer of lava and possably even a hardpan coldera reservoir the water for Lake Waiau.

The puu of Lake Waiau and Puu Puliahu are considerably older then all the others having extensive erosion and oxidation. The east face of Puu Puliahu has had a latter eruption. All of the other cones in the top area are of a much newer and more recent activity and show no signs of natural erosion.

Telescopes

The telescopes which use the tops of the cones or the flats at their base compliment the skiing by improving the axcess to the ski slopes. Even while openning the road to the proposed Cal Tech 10 meter scope will cut the connecting trail from the Poi Bowl to the lower slopes, it will improve access for the snow players, beginners and spectators and only make a minor change in the ski patterns.

Snow removal

Snow removal even with the snow-blower is still a major problem due to the road location. The pass between Puu Haukea and Puu Wekiu is a wind funnel drifting snow up to 10 feet in the pass. The ventory effect intensifys the wind and causes massive drifting all the way up Puu Wakiu. This section could be eliminated.

I recommend that with the openning of the road to the Cal Tech 10 meter telescope, that a short additional section of road be added connecting from the NASA IFRsight staight down to the flats just above the Cal Tech sight. The snow removal problem could be reduced substancially. This short section of road, not visible from below, is a south exposure that receives very little snow and the wind exposure is much less. The drifting on this short streight section would be minimul. It would also open up the possiblity of removing the road up Puu Wakiu that has caused some objections.

Power Line

The under ground powerline from Hale Pohaku to the 12,800 foot level manhole need not follow the road from 9,000 to the 11,000 foot level. The soft cinders in that area would allow a near streight shot and cut the length and cost of that section in half. Between 11,000 and the 12,800 foot manhole it may be neccessary to design the electric line into the shoulder of the new road. The lack of soft ground cover most of the way would mean blasting or jackhannering a trench in hard rock. Water seepage collecting in the trench could wash out whole sections.

From the Saddle Road to Hale Pohaku I would like to note. Everyone seems to accept power poles and overhead powerlines in town for power and phone in their home and business, but consider them an eyesoar everywhere else. Therefore I recommend considering a fourth option. That is to go underground following corridor A. This would be shorter then following the road and the ground would yeald to using a good ditch-digger and would be quite cost effective.

New Road Paving

It is imparitive that proper concern be included in the design and paving of the road above 9,000 feet, to reduce the the cost of snow removal, to prevent erosion problems from the excess runoff and to include provissions for the public and other users of the mountain.

The present road because of the simple bulldozer and grader method of construction has created a Frankenstien of a trench with boulder walls. A six inch snow fall and a little wind puts 4 to 5 feet of snow on the road. And pushing the snow out of the trench builds a higher wall so that the next snow fall fills it back even deeper.

Since paving will require a base fill material, it gives an opportunity to reverse the situation. Sufficient base and subbase material should be used to bring the road back up elevating 6 to 12 inches above the general terrain. This will also provide cover for the underground electric line to be included in the shouldr of the road. The slightly elevated road would only have light snow cover except for major storms and would reduce the time and cost of snow removal bya big factor.

Road run-off is an added problem of major concern. During initial design of the lower road I recommended that the run-off be collected and reservoired. While the idea was considered it was not included. I note that the Parker Ranch has recently constructed a reservoir above Humuulu and is taking advantage of some of the run-off but is only getting a fraction of what could be collected In the mean time the high concentration of run-off has already started extensive and irreversible erosion in a number of locations, and is very objectionable. In the soft cinders of the steeper upper slopes the erosion problem will be much greater. Additional swales and run-off control on the lower road should be included in the design and paving of the upper road.

Recommendation

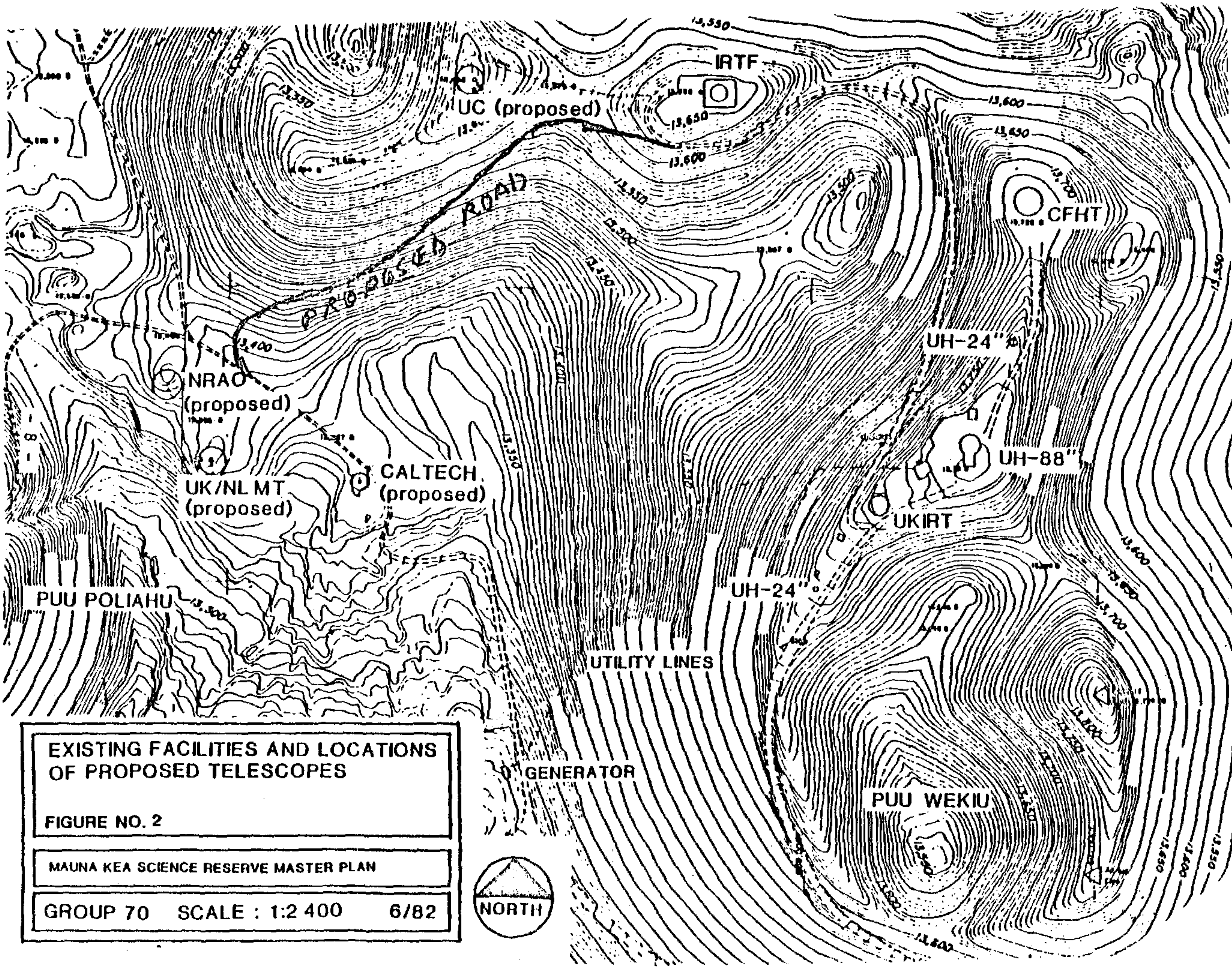
I highly recommend that the Wildlife, Forestry and State Parks Outdoor Recreation departments be asked to join in the design, implimentation and the funding of the related road improvements. A joint effort could make the road improvements highly desirable and beneficial to everyone, and easily justify the funding needed Mauna Kea is a multiple user area, it should not be a one user responiblity.

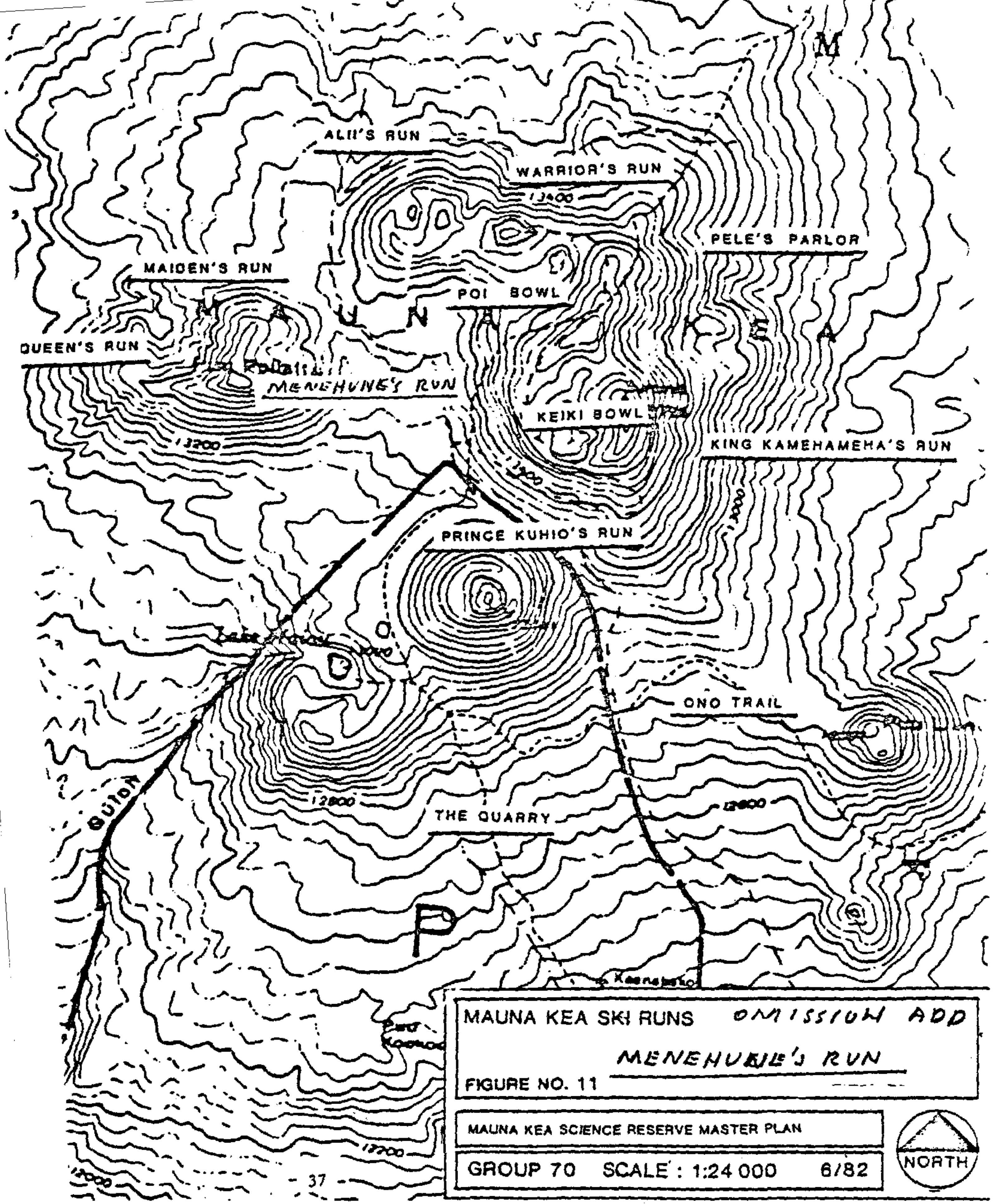
I make services available and I will prepare a plan of what I see as the skiers future road needs, and present this to the Dept. of Land and Natual Resources Div. of Outdoor Recreation. Problems can be solved now that can not be outlawed later.

Respectfully

Dick Tillson

Dick Tillson


IRTF
UC (proposed)
PROPOSED ROAD
CFHT
UH-24"
NRAO (proposed)
UH-88"
CALTECH (proposed)
UK/NL MT (proposed)
UKIRT
UH-24"
PUU POLIAHU
UTILITY LINES
GENERATOR
PUU WEKIU
EXISTING FACILITIES AND LOCATIONS OF PROPOSED TELESCOPES
FIGURE NO. 2
MAUNA KEA SCIENCE RESERVE MASTER PLAN
GROUP 70 SCALE : 1:2 400 6/82
NORTH



MAUNA KEA SKI RUNS *OMISSION ADD*

MENEHUNE'S RUN

FIGURE NO. 11

MAUNA KEA SCIENCE RESERVE MASTER PLAN

GROUP 70 SCALE : 1:24 000 6/82

Mr. Sonny Kamiko	Ski Hawaii
Mr. Francis McGough	Hamakua District Development Council
Mr. Alva Nakamura Mr. Dennis Tanigawa	Hawaii Electric Light Company

Correction,

Mr. Sunny Kaniho

UNIVERSITY OF HAWAII

Vice-President for Administration
15 October 1982

Mr. Dick Tillson
Ski Shop Hawaii & Hawaii Ski School
P. O. Box 8232
Honolulu, HI 96815

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Tillson:

Thank you for responding to our Notice of Preparation for the subject project. We appreciate the input received in your comment letter and in our subsequent meeting and telephone conversations at this early stage of the planning process. In response to some of your specific comments:

Permafrost and Geology - Our geological consultant, Dames & Moore, states that permafrost is known to have been identified in only two locations, both in sheltered portions of cinder cone craters, Puu Wekiu and Puu Goodrich. Dames & Moore further states that: "Woodcock and Friedman (1979) speculate that permafrost might exist 60 meters below the top of the Summit Cone, and Woodcock (1981) speculates that permafrost may underlie the groundwater body east of Lake Waiau, (but not under Lake Waiau). In general, the climate on Mauna Kea is considered to be slightly too warm for permafrost, and whether the few permafrost bodies are modern or relics of the last ice age is uncertain. Thus, it appears highly unlikely that a permafrost layer exists at any locations but few very local, special ones. . . No borings for existing facilities are known to have encountered permafrost." This information will be included in the EIS.

Thermal Movement - The access road will be located so that it follows as nearly as possible the existing slope and grade in order to minimize grading. Cuts and fills will be minimized where possible, and where they exist, cut and fill slopes will be constructed so that they will minimize erosion by benching and using a relatively flat slope. Presently, natural erosion of the mountain (on parts of the road with embankments), 100 to 300 feet away from the road, sluffs down on the road and requires periodic maintenance. Proposed widening of the roadway in these areas which requires cutting into the mountain, will include the construction of retaining walls. Where cut and fill slopes are necessary, protection measures may take one or more of the following forms:

a. riprap over the slope;

2444 Dole Street · Room 202 · Honolulu, Hawaii 96822

Mr. Dick Tillson
Ski Shop Hawaii
15 October 1982

Page Two

b. gabions or rock breast walls at the bottom of a cut slope;

c. locating a diversionary or interceptor ditch at the top of the slope;

d. slope benching;

e. slope drains;

f. filter fabrics or netting stapled or otherwise fixed to the ground surface; and,

g. a sprayed layer of asphalt, chemical binder or organic mulch.

Some of these measures will be effective only in the short term (during construction), while others may serve as long-term erosion control measures. This information will be included in the EIS.

Snow Removal and New Road Paving - The proposed improved summit road could be designed to minimize the cost of snow removal and reduce the problem of snow accumulation on the roadway. This could be accomplished by eliminating through cuts wherever possible. Since the road will be generally on a side-cut, the elevation of the road can be established or the road "day-lighted" so that there is no cut on the downhill side. Snow can then be more readily removed by disposal down the slope of the mountain.

Construction of an additional section of road connecting the IRTF site to the flats above the Caltech site was considered, however, it was determined that it would not be feasible at this time.

The installation of paved gutters, where necessary and the frequent use of culverts to carry runoff across the road should minimize erosion problems, particularly if flared-end sections or aprons are provided at the culvert outlets.

Powerline - We are presently considering underground powerline alignments that do not strictly follow the road from Hale Pohaku to the summit. While ease of construction is an important consideration, other factors such as environmental impacts and the proximity to the Mauna Kea Ice Age Natural Reserve will also determine the final alignment.

Overhead powerlines in corridor alternative "A" will not be readily visible either from the Saddle Road or the County road to Hale Pohaku. We are also evaluating the placement of the powerline underground in corridor "A". Preliminary investigation of this corridor indicates that underground lines will cost $6,500,000, and overhead lines, $950,000.

Recommendation - The Department of Land and Natural Resource, Divisions of Forestry and Wildlife, Parks and Outdoor Recreation Water and Land Development, Land Management, Conservation and Resources Enforcement, Aquatic Resources and the offices of Planning Natural Area Reserves System have been consulted during the preparation of the Complex Development Plan.

Thank you for your comments. We hope you will review the draft EIS.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

HAMAKUA DISTRICT DEVELOPMENT COUNCIL

HONOKAA, HAWAII 96727

P. O. Box 637

RECEIVED
AUG 1 1 1982
GROUP 70

August 6, 1982

University of Hawaii
Vice-president for Administration
2444 Dole St.
Honolulu, HI 96822
Attn: Louis Lopez

RE: Mauna Kea Science Reserve Master Plan, EIS Preparation Notice, July 1982

The Hamakua District Development Council maintains a continuing positive interest in the astronomy programs on Mauna Kea for their contributions to the increase of knowledge about our universe, for the effects of such development on the mountain ecosystem, and for the concerns of the local economy and people. A number of points arise from our study of the document.

1. ACCESS ROAD - HALE POHAKU TO THE SUMMIT

a. This segment of the road should be paved, to include spurs servicing the various observatories.

b. The implications of "realignment" are not clear. If such changes are for the purpose of reducing the grade so that any passenger car has access to the summit area, a grievous error will have been committed. There has been enough realignment of the original 1964 track in the way of residual scars on the face of the mountain.

c. The road should be paved on its present route to eliminate dust, reduce maintenance costs and facilitate the passage of carefully driven 4WD vehicles. Because of increased danger inherent in paving to 2WD vehicles on the downward passage (requiring excessive braking) such vehicles should be absolutely barred from the road despite such safety devices as guard rails.

2. POWER SUPPLY - An old issue that may now be approaching a solution.

a. Buried cable from Hale Pohaku to the summit is certainly in order, to follow the access road, not only from the esthetic perspecitve but also to eliminate heat, odor, rumbling and particulate matter emanating from the present generators, and the trucking of some 1000 gallons per day of fuel from Hilo.

b. Transmitting power from the HELCO 69KV line in the saddle to Hale Pohaku requires some careful consideration of alternatives. Whereas, an underground cable would be desirable it may not be mandatory because of the lesser intrusion by overhead lines on a forested slope compared to bare lavas at higher elevations. Corridor C would generate the lesser esthetic distraction to the mountain from the perspective of persons driving the adjacent access road or the Saddle Road. If construction in Corridor C could be done by helicopter lift and thus avoid surface disturbance of yet another area of the mountain by vehicles, it would be the choice route. Should air lift not be feasible in the rarefied air of the 6000-10000 foot altitude range, we then would favor an overhead line to follow Corridor B where disturbance has already occurred along the access road.

d. Vehicles should be checked in and out at Hale Pohaku, the intention of the party declared, and all vehicles restricted to the paved roadways, their shoulders or designated parking sites. DAMAGE BY OFFROAD VEHICLES MUST CEASE.

e. Present roadways in the Ice Age Age Natural Area Reserve should be reduced to trail width and access to vehicles blocked. Regulation forbids motorized conveyances of any kind in the Reserve.

3. ARTHROPODS OF THE AEOLIAN ECOSYSTEM

a. Meaningful long term research on the entire life system of the summit region, and its response to the intrusion of observatory facilities, are recommended highly. Surveys and brief studies are not enough.

Thank you for the opportunity to respond to this Preparation Notice.

Sincerely yours,

P. Quentin Tomich

P. Quentin Tomich, Secretary

CC: Group 70
924 Bethel St.
Honolulu, HI 96813
Attn: Marilyn Metz

UNIVERSITY OF HAWAII

Vice-President for Administration

23 September 1982

Mr. P. Quentin Tomich, Secretary
Hamakua District Development Council
P. O. Box 637
Honokaa, HI 96727

SUBJECT: MAUNA KEA SCIENCE RESERVE MASTER PLAN - NOTICE OF PREPARATION OF EIS

Dear Mr. Tomich:

Thank you for your comments on the subject NOP. Your continuing positive contributions are appreciated. In answer to your specific comments:

1. Various improvements to the summit access road are being evaluated. Paving to eliminate dust and reduce maintenance costs is one major action which is being proposed. This will require an amendment to the Mauna kea Plan. The preferred action at the present time is to preserve the present alignment wherever this is feasible based on civil engineering considerations. The road would have a 15-foot paved travel service with a 5-foot paved gutter. It would be designed to permit an average speed of 30 miles per hour. Methods of controlling of access to this road from Hale Pohaku are being evaluated as part of a Management Plan which will be incorporated in the Master Plan.

2. Buried cable from Hale Pohaku to the summit is the major alternative being considered to provide power along that corridor. We are still evaluating the pros and cons of buried vs. overhead for the 69-KV line from the Saddle Raod to Hale Pohaku. There are actions inherent in burying a high-voltage line which could be damaging to the environment. Aesthetic and environmental considerations are major concerns in choosing the powerline corridor.

3. The management plan, which will be a part of the Master Plan, will address the problem of off-road vehicles.

4. You will be pleased to hear that the Natural Area Reserve Commission has decided that the road to Lake Waiau should be closed off and is arranging for this.

2444 Dole Street • Room 202 • Honolulu, Hawaii 96822

Mr. P. Quentin Tomich, Secretary
Hamakua District Development Council
23 September 1982

Page Two

5. Arthropod fauna was studied as part of the planning process.

We appreciate your interest in Mauna Kea

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:cf

REFERENCES & FOOTNOTES

1. "Research Development Plan for the Mauna Kea Science Reserve and Related Facilities", Institute for Astronomy, University of Hawaii, September 1981, p.15.

2. "State Higher Education Plan", University of Hawaii, 1 May 1982, p.18.

3. Dames & Moore, "Geotechnical Evaluation of Telescope Siting Areas, Mauna Kea Science Reserve Area", July 1982.

4. Harding Lawson, "Soils Report of the UK/NL MT Site", 1982.

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6. Donald R. Mullineaux and Donald W. Peterson, "Volcanic Hazards on the Island of Hawaii", open-file report 74-239, 1974.

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9. Department of the Army, Environmental Assessment for the 25th Infrantry Division Field Training Exercise (FTX) on Island of Hawaii, June 1982.

10. A. Woodcock, U.H. Dept. of Oceanography, personal conversation, October 8, 1981.

11. Ibid.

12. Ibid.

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18. Robert Lee, DLNR Natural Area Reserve System, personal conversation, 29 May 1982.

19. Patrick C. McCoy, The Mauna Kea Adze Quarry Complex Hawaii: A First Analysis, August 1979.

20. Ibid.

21. Ibid.

22. Tom Krieger, Mauna Kea Support Services, personal conversation, September 23, 1982.

23. Ibid.

24. Lucian Kramer, U.S. Fish and Wildlife Service, informal consultation, September 1982.

25. University of California, "10-M Telescope Project, Report of the Site Survey Committee", 1 March 1979.

26. Lucian Kramer, September 1982.

27. T.G. Phillips, Caltech Submillimeter Observatory, personal conversation, 6 July 1982.

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29. Fish and Wildlife Service, Endangered Species Act of 1973, P.L. 93-205 (87 Stat. 884).

30. Raymond J. Kramer, Hawaiian Land Mammals, 1971.

31. State of Hawaii, Division of Fish and Game, "Ecology of the Feral Pig on the Island of Hawaii", 1968-1972.

32. Ibid.

33. State of Hawaii, Division of Fish and Game, "Ecology of the Mouflon Sheep on the Island of Hawaii, 1975-1979.

34. Ibid.

35. Hawaii Audubon Society, 'Elepaio, Volume 43, Number 4, October 1982.

36. Patrick C. McCoy, August 1979.

37. Ibid.

PART XVII: COMMENTS AND RESPONSES ON THE DRAFT ENVIRONMENTAL IMPACT STATEMENT

The following agencies, organizations and individuals reviewed and commented on the draft Environmental Impact Statement during the review period. Those who made substantive comments concerning the porposed action received written responses to their concerns. They are indicated by an asterick (*) in the following list. All of the letters received and responses sent are reproduced on the following pages of this Appendix.

State Agencies

Office of Environmental Quality Control
Department of Accounting and General Services
Department of Defense
Department of Planning & Economic Development
Department of Transportation
University of Hawaii
*Environmental Center
Hawaii Natural Energy Institute

Federal Agencies

*U.S. Department of the Army - Headquarters Support Command
U.S. Department of the Army - Corps of Engineers
U.S. Fish and Wildlife Service
U.S. Department of Interior - Geological Survey
*U.S. Department of Agriculture - Soil Conservation Service

County of Hawaii

*Office of the Mayor
*Planning Department
Fire Department
County Council

Individuals and Organizations

*Conservation Council for Hawaii
*Hawaiian Electric
*Hamakua District Development Council
*Hawaii Island Chamber of Commerce
Hawaii Island Contracors Association
*Ski Shop Hawaii
Ski Association of Hawaii
*Sportsmen of Hawaii

United States Department of the Interior

FISH AND WILDLIFE SERVICE
300 ALA MOANA BOULEVARD
P. O. BOX 50167
HONOLULU, HAWAII 96850

IN REPLY REFER TO:
ES

RECEIVED
DEC - 1 1982
NOV 30 1982

GROUP 70

Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

Re: EIS, Mauna Kea Science Reserve
Complex Development Plan
Mauna Kea, Hawaii

Dear Ms. Parnell:

We have reviewed the Mauna Kea Science Reserve Complex Development Plan (SRCDP) Environmental Impact Statement forwarded by the State Environmental Quality Commission on November 8, 1982. The Service believes that fish and wildlife resources, probable impacts, and appropriate mitigation associated with development on Mauna Kea have been adequately addressed in this document.

Thank you for providing this opportunity to comment.

Sincerely yours,

Ernest Kosaka
Project Leader
Office of Environmental Services

cc: NMFS - WPPO
HDF&W
EPA, San Francisco
Group 70
UH-VP for Administration

DEPARTMENT OF THE ARMY
PACIFIC OCEAN DIVISION, CORPS OF ENGINEERS
FT. SHAFTER, HAWAII 96858

RECEIVED
DEC - 2 1982
GROUP 70

PODED-PV

1 December 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Thank you for the opportunity to review and comment on the EIS for Mauna Kea Science Reserve Complex Development Plan, Mauna Kea, Hawaii. Our previous comment dated 23 July 1982 is still valid. We commented:

a. No Department of the Army (DA) permit is required.

b. The site of the proposed Mauna Kea Science Reserve, which is located in the Mauna Kea Forest Reserve, is classified as Zone C, or area of minimal flooding, according to the Flood Insurance Study for the Island of Hawaii prepared by the Federal Insurance Administration, Federal Emergency Management Agency. Zone C areas are not designated flood plains or special flood hazard areas.

Sincerely,

"signed"

KISUK CHEUNG
Chief, Engineering Division

Copy Furnished:
University of Hawaii
Vice President for Administration
ATTN: Ginger Plasch
2444 Dole Street, Room 201
Honolulu, Hawaii 96822

Group 70
ATTN: Marilyn Metz
924 Bethel Street
Honolulu, Hawaii 96813

United States Department of Agriculture

Soil Conservation Service

P. O. Box 50004
Honolulu, Hawaii
96850

December 1, 1982

Mrs. Jacqueline Parnell
Director, Office of Environmental
Quality Control
550 Halekauwila St., Room 301
Honolulu, HI 96813

RECEIVED
DEC - 3 1982
GROUP 70

Dear Mrs. Parnell:

Subject: Draft EIS for the Mauna Kea Science Reserve Complex Development Plan, Mauna Kea, Hamakua, Hawaii

We have reviewed the above-mentioned document as you requested and offer the following comment for consideration:

> Section 2.2 on page 102 of Volume 1 discusses potential erosion problems if cut slopes exceed 1.5 to 1. Because the soils on the site are highly erodible, as is acknowledged in the draft, we feel that without some type of erosion control measure such as surfacing, there will be erosion on the cut slopes. If these slopes are located above a facility such as a road or parking lot, there may be a potential sediment removal problem, also.

Thank you for the opportunity to review this document.

Sincerely,

Herbert J. Syford
ACTING

FRANCIS C. H. LUM
State Conservationist

cc:
Group 70
924 Bethel Street
Honolulu, HI 96813
Attention: Ms. Marilynn Metz

Vice President for Administration
University of Hawaii
2444 Dole Street, Room 201
Honolulu, HI 96822
Attention: Ms. Ginger Plasch

UNIVERSITY OF HAWAII

Vice-President for Administration

December 20, 1982

Mr. Francis C. Y. Lum
State Conservationist
U.S. Department of Agriculture
Soil Conservation Service
P. O. Box 50004
Honolulu, HI 96850

Re: Draft EIS for the Mauna Kea Science Reserve Complex Development Plan

Dear Mr. Lum:

Thank you for your comments on the subject EIS. We agree that erosion control measures should be taken in the construction of new facilities; such measures will be incorporated into the design of each project. Sediment removal is anticipated to be a part of regular maintenance.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:pz

cc: J. Jefferies/G. Plasch
Group 70

DEPARTMENT OF THE ARMY
HEADQUARTERS UNITED STATES ARMY SUPPORT COMMAND, HAWAII
FORT SHAFTER, HAWAII 96858

REPLY TO
ATTENTION OF:

APZV-EHV

1 DEC 1982

Ms. Jacqueline Parnell
Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

The draft Environmental Impact Statement (EIS) for the Mauna Kea Science Reserve Complex Development Plan has been reviewed. Comments on the proposed action were provided to the University of Hawaii and the consultants, Group 70, by US Army Support Command, Hawaii (USASCH) letter, dated 19 July 1982, and at a meeting on 20 August 1982. Additional comments are furnished below:

a. Because the switching station and a portion of the corridor for the A or B powerline route from Saddle Road to Hale Pohaku are within Pohakuloa Training Area (PTA), recommend that, if either route is selected, a formal request for use of the area be submitted to USASCH for timely consideration and approval.

b. The draft EIS proposes that access to the powerline corridor route service road be restricted. Access restrictions within PTA will also require prior USASCH coordination and approval.

If you require additional information or clarification, please contact the Environmental Management Office at 655-0691/0694. Thank you for the opportunity to comment on the draft EIS.

Sincerely,

RONALD A. BORRELLO
COL, EN
Director of Engineering and Housing

UNIVERSITY OF HAWAII

Vice-President for Administration

RECEIVED
DEC 14 1982
GROUP 70

December 9, 1982

Col. Ronald A. Borrello, EN
Director of Engineering and Housing
Department of the Army
Headquarters US Army Support Command, Hawaii
Ft. Shafter, Hawaii 96858

Attn: APZV-EHV

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN DRAFT EIS

Dear Mr. Borrello:

Thank you for your comments on the subject draft EIS. In response to your two specific concerns, please be assured that if either alternative powerline corridor "A" or "B" is selected, a formal request for use of the area will be submitted to USACH. At that time, consultation and approval from USACH for the proposed restriction of access to the service roads, will also be sought.

We appreciate your comments on this project.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:pz

Enclosure

cc: Group 70
J. Jefferies/G. Plasch

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
P.O. Box 50166
Honolulu, Hawaii 96850

December 7, 1982

Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

Dear ~~Ms. Parnell~~: Jackie

The Hawaii District Office of the U.S. Geological Survey, Water Resources Division, have reviewed the Mauna Kea Science Reserve Complex Development Plan (SRCD) and have no comments at this time.

Thank you for allowing us to review the environmental impact statement.

Aloha,

Benjamin L. Jones
District

Enclosure

University of Hawaii at Manoa

Hawaii Natural Energy Institute
Holmes Hall 246 • 2540 Dole Street • Honolulu, Hawaii 96822

RECEIVED
DEC - 1 1982
GROUP 70

November 26, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

Dear Ms. Parnell:

I have given the Environmental Impact Statement for the Mauna Kea Science Reserve Complex Development Plan a cursory review, and have no substantive comments to make. It appears to provide adequate coverage of the essential components of a satisfactory EIS, many aspects of which I am not qualified to evaluate.

The one area of frustration to me regarding this plan reflects my biases toward renewable energy resources, and this relates to the use of conventional energy system and a power line (underground or overhead) to the summit. Although the information regarding alternative energy sources is quite brief, I cannot fault the conclusion. On the basis of economics and reliability, I regret that there are no renewable energy supply sources available at this time which would be competitive with an electric power line from the utility grid.

Sincerely yours,

John Shupe

John W. Shupe
Director

JWS:sy

cc: ✓Ms. M. Metz
Ms. G. Plasch

United States Department of the Interior

GEOLOGICAL SURVEY
Water Resources Division
P.O. Box 50166
Honolulu, Hawaii 96850

December 7, 1982

Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

Dear ~~Ms Parnell~~: Jackie

The Hawaii District Office of the U.S. Geological Survey, Water Resources Division, have reviewed the Mauna Kea Science Reserve Complex Development Plan (SRCD) and have no comments at this time.

Thank you for allowing us to review the environmental impact statement.

Aloha,

Benjamin L. Jones
District

Enclosure

University of Hawaii at Manoa

Hawaii Natural Energy Institute
Holmes Hall 246 • 2540 Dole Street • Honolulu, Hawaii 96822

RECEIVED
DEC - 1 1982
GROUP 70

November 26, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

Dear Ms. Parnell:

I have given the Environmental Impact Statement for the Mauna Kea Science Reserve Complex Development Plan a cursory review, and have no substantive comments to make. It appears to provide adequate coverage of the essential components of a satisfactory EIS, many aspects of which I am not qualified to evaluate.

The one area of frustration to me regarding this plan reflects my biases toward renewable energy resources, and this relates to the use of conventional energy system and a power line (underground or overhead) to the summit. Although the information regarding alternative energy sources is quite brief, I cannot fault the conclusion. On the basis of economics and reliability, I regret that there are no renewable energy supply sources available at this time which would be competitive with an electric power line from the utility grid.

Sincerely yours,

John Shupe

John W. Shupe
Director

JWS:sy

cc: Ms. M. Metz
Ms. G. Plasch

GEORGE R. ARIYOSHI
GOVERNOR

HIDEO MURAKAMI
COMPTROLLER

MIKE N. TOKUNAGA
DEPUTY COMPTROLLER

STATE OF HAWAII
DEPARTMENT OF ACCOUNTING AND GENERAL SERVICES
P. O. BOX 119, HONOLULU, HAWAII 96810

LETTER NO. (P) 2061.2

NOV 30 1982

Ms. Jacqueline Parnell
Director
Office of Environmental
Quality Control
550 Halekauwila Street
Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Subject: Mauna Kea Science Reserve
Complex Development Plan
Draft EIS

Thank you for forwarding us a copy of the subject document. We have reviewed it and find that our concerns are adequately addressed.

Very truly yours,

HIDEO MURAKAMI
State Comptroller

RECEIVED
DEC - 2 1982

GROUP 70

STP 8.8761

November 29, 1982

MEMORANDUM

TO: Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control

FROM: Director of Transportation

SUBJECT: ENVIRONMENTAL IMPACT STATEMENT
MAUNA KEA SCIENCE RESERVE
COMPLEX DEVELOPMENT

Thank you for the opportunity to review the subject document.

We have no comments to offer which could improve the document.

Ryokichi Higashionna

Ryokichi Higashionna

ALX:ko

cc: HWY-P
Group 70
University of Hawaii

GEORGE R. ARIYOSHI
GOVERNOR

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DEC - 6 1982
GROUP 70

Jacqueline Parnell
DIRECTOR

TELEPHONE NO.
548-6915

STATE OF HAWAII
OFFICE OF ENVIRONMENTAL QUALITY CONTROL
550 HALEKAUWILA ST.
ROOM 301
HONOLULU, HAWAII 96813

December 2, 1982

University of Hawaii
Vice-President for Administration
2444 Dole Street, Room 201
Honolulu, Hawaii 96822

Dear Mr. Masumoto:

Subject: Mauna Kea Science Reserve Complex Development Plan EIS

We have reviewed your Mauna Kea Science Reserve Complex Development EIS and have no comments at the present time. Most of our concerns were answered at the Mauna Kea Science Reserve informational meeting that we attended in Hilo.

Generally, we believe that the siting of telescopes on Mauna Kea is an environmentally acceptable use and beneficial in that it establishes Hawaii as a center for astronomical research.

Sincerely,

Jacqueline Parnell

Jacqueline Parnell
Director

cc: Group 70

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DEC - 8 1982
GROUP 70

State of Hawaii
DEPARTMENT OF DEFENSE
OFFICE OF THE ADJUTANT GENERAL
3949 Diamond Head Road
Honolulu, Hawaii 96816

6 DEC 1982

HIENG

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Mauna Kea Science Reserve Complex Development

Thank you for providing us the opportunity to review the proposed project, "Mauna Kea Science Reserve Complex Development" Environmental Impact Statement.

We have completed our review and have no comments to offer at this time.

Yours truly,

signed

JERRY M. MATSUDA
Captain, HANG
Contr & Engr Officer

cc: Group 70/Ms. Marilyn Metz
UH/VP for Administration//Ms. Ginger Plasch
Env. Quality Commission w/EIS

GEORGE R. ARIYOSHI
GOVERNOR OF HAWAII

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

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GROUP 70

CHARLES G. CLARK
~~GEORGE A. L. YUEN~~
DIRECTOR OF HEALTH

JOHN F. CHALMERS, M.D.
DEPUTY DIRECTOR OF HEALTH

HENRY N. THOMPSON, M.A.
DEPUTY DIRECTOR OF HEALTH

MELVIN K. KOIZUMI
DEPUTY DIRECTOR OF HEALTH

ABELINA MADRID SHAW, M.A., J.D.
DEPUTY DIRECTOR OF HEALTH

December 9, 1982

In reply, please refer to:
File: EPHS-SS

MEMORANDUM

To: Mrs. Jacqueline Parnell
Office of Environmental Quality Control

From: Director of Health

Subject: Environmental Impact Statement (EIS) for Mauna Kea Science Reserve Complex Development Plan, Mauna Kea, Hawaii

Thank you for allowing us to review and comment on the subject EIS. On the basis that the project will comply with all applicable Public Health Regulations, please be informed that we do not have any objections to this project.

We realize that the statements are general in nature due to preliminary plans being the sole source of discussion. We, therefore, reserve the right to impose future environmental restrictions on the project at the time final plans are submitted to this office for review.

Melvin Koizumi
For CHARLES G. CLARK

cc: Group 70
VP for Administration, U.H.

GEORGE R. ARIYOSHI
Governor

HIDETO KONO
Director

FRANK SKRIVANEK
Deputy Director

DEPARTMENT OF PLANNING AND ECONOMIC DEVELOPMENT

Kamamalu Building, 250 South King St., Honolulu, Hawaii • Mailing Address: P.O. Box 2359, Honolulu, Hawaii 96804

December 6, 1982

C O P Y

Ref. No. 6851

RECEIVED
DEC 14 1982
GROUP 70

Ms. Jacqueline Parnell
Director
Office of Environmental Quality
Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Subject: Mauna Kea Science Reserve Complex Development Plan's EIS, Mauna Kea, Hawaii

We have reviewed the subject draft EIS and find that it has adequately identified the major impacts which can be anticipated to result from the proposed plan.

Thank you for the opportunity to comment on this matter.

Sincerely,

Frank Skrivanek

for Hideto Kono

cc: Group 70
Vice-President for Administration
University of Hawaii

University of Hawaii at Manoa

Environmental Center
Crawford 317 • 2550 Campus Road
Honolulu, Hawaii 96822
Telephone (808) 948-7361

December 8, 1982

RE:0363

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell:

Draft Environmental Impact Statement
Mauna Kea Science Reserve Complex Development Plan (SRCD)
Mauna Kea, Hamakua, Hawaii

Thank you for the opportunity to review the above cited document. Our environmental review has been prepared with the assistance of Sheila Conant, General Science; Ruth Gay and Charles Lamoureux, Botany; Mathew Spriggs, Anthropology; Tyrone Reinhardt, Hawaiian Studies, and Jacquelin Miller and Pamela Bahnsen, Environmental Center. The following points have been raised by our reviewers:

Page 29

The University of California Telescope preliminary plan includes an exhaust tunnel. "A approximately 60 to 70 inches in diameter tunnel will be constructed to convey unwanted warm air to a point approximately 130 feet north of the telescope building". Will similar tunnels be required for each of the telescopes? Has the location of this tunnel been taken into account with respect to archaeological sites? Is the tunnel above or below ground? What is the temperature of the exhaust? Will it cause significant elevation in temperature beyond the immediate vicinity of the outlet? Will the tunnel be screened?

Page 32

Recent public awareness of the needs of handicapped individuals, particularly with regard to educational-scientific facilities, prompts us to suggest that their requirements be taken into consideration whenever possible in the design of the facilities and Visitor Information Station.

Page 65

We are pleased to see that consideration is being given to the development of a Shuttle Bus Service. The reduction in parking requirements at the summit is an important advantage and one to be carefully considered.

Page 65, 66, 69

We are pleased to note that the University of Hawaii will be resposible for monitoring the security system for Mauna Kea along with the method of control and access. We would like to reiterate the extreme importance of keeping vehicles on the road. Any, and all, off the road vehicles are most destructive to the fragile ecosystem of Mauna Kea. A communication link should be provided between the people working at the summit and security personnel at the gate thus expediting immediate report and apprehension of any off-road vehicles.

Page 76

The last sentence, "Permafrost layers may exist within the cinder cones, but if present, are expected to be encountered by any construction" is somewhat confusing. Is the sentence correctly stated and if so what is the significance?

Page 88, 103, 104, 113, 144

Mr. Masumoto's letter of October 15, 1982, in response to our in-house review at the preparation stage, mentions that Mike Scott and Derral Herbst of the U.S. Fish and Wildlife Service were contacted as a source of information on the avifauna of Mauna Kea. Their specific findings with regard to the endangered Hawaiian Dark-Rumped Petrel ('Ua'a) should be included in the final EIS. The DEIS states that no Petrels were discovered during a "terrestial bird survey and during a one-day survey specifically for the species." Since the breeding season for the 'Ua'a is from March to October and they are nocturnal birds, it is important to know when this study was conducted. During what part of the year was this study conducted and was it during the day or the evening?

Page 106

The last sentence is incomplete, "All telescope personnel will abide by the terms of the general..."?

Page 114, 124

We note that the UK/NL MT expects to consume "60 - 120 gallons per day of water for heating, cooling, and domestic consumption" along with the "disposal of 40 - 80 gallons per day of liquid sewage". Presumably a large percentage of the "consumed" water for heating and cooling will be discharged. Will the 40 - 80 gallon per day liquid sewage to be discharged include the grey water waste from the "consumed" uses? How are these figures calculated? Future (year 2000) water consumption and sewage disposal (page 124) are expected to average 1,300 - 2,600 gallons and 910 - 1,820 gallons per day, respectively. Are the enviromental impacts assessed in the present DEIS based on the present or far greater future discharge volumes?

Page 125

We note on page 125, paragraph a., that "An intensive archaeological survey may (emphasis added) be under taken if it appears that one of the sites might be affected by telescope construction." In view of the conclusions reached by Dr. McCoy this statement should be amended to read "will be under taken."

Page 115, 209, 226

We note that there is a discrepancy in the amount of effluent from the Cal Tech and UR/NL MT installations. In the letter to Susumu Ono, dated 28 October 1982 (page 209) the amount of effluent to be discharged is stated to be "40 to 80 gallons per day" while the response to the Environmental Center's comments indicates a discharge of "35 to 50 gallons per day" (p. 226). The correct amount should be given in the revised EIS.

Page 180-187

In reviewing the lists of individuals and groups consulted during the preparation of this EIS, Hawaiian organizations with expertise in Hawaiian culture seem not to have participated either during the public meetings or at the consultaion phase. Given the numbers and apparent significance of the Archaeological sites and shrines, and the information presented in the Cultural Resources Reconnaissance Report (Appendix A) it would seem appropriate to contact the State Historic Sites Commission, chaired by Richard Paglinawan, the State Association of Hawaiian Civic Clubs, and the Office of Hawaiian Affairs for their possible input on cultural concerns. It is possible that the recommended future archaeological reconnaisance of the construction sites could be expedited through contacts with these organizations and their knowledge of both oral and written Hawaiian history.

Appendix A
Page A-28-A-65

We strongly concur with the suggested "miminal requirements" as specified in Volume 2, Technical Appendicies, A-61, specifically the stated need for intensive archaeological surveys of the telescope sites prior to any construction. In addition we suggest that Dr. McCoy or other similarly qualified Archaeological representative of the Bishop Museum, be present during the various construction phases.

Appendix D
D-5, 6

We are pleased to note and concur with the recommendations of the Fish and Wildlife Service with regard to conservation measures as outlined in paragraphs 1-3.

Appendix G
Page G-2-G-18

We concur with the recommendations listed in paragraphs 1 thru 5 in this Botanical survey. Of particular merit is the statement acknowledging that, "the information in this report should not be interpreted as plant survey data pertaining to specific telescope sites" (G-4). Will specific survey's be conducted as sites are determined?

Appendix H
Page H-1 - H-18

The recommendations numbered 1 thru 11, (H-8 - H-10) emphasizing protection measures for the fragile enviroment should be strictly observed and enforced.

We appreciate the opportunity to comment on this DEIS and hope you will find our comments useful in the preparation of the final revised document.

Yours truly,

[illegible]

[illegible]
Director

cc: Sheila Conant
Ruth Gay
Charles Lamoureux
Mathew Spriggs
Jacquelin Miller
Pamela Bahnsen
Tyrone Reinhardt

UNIVERSITY OF HAWAII

Vice-President for Administration

December 29, 1982

Dr. Doak Cox, Director
Environmental Center
2550 Campus Road
Honolulu, HI 96822

SUBJECT: DRAFT EIS - MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN

Dear Dr. Cox:

Thank you for commenting on the subject EIS. In answer to your specific comments:

Page 29 - UCTMT Exhaust Tunnel

A tunnel is not required for the UK/NL MT. It is not known at the present time if future telescopes (currently unknown) will require tunnels. The tunnel was taken into consideration in respect to archaeological sites and is, by definition, below ground. The temperature of the exhaust is estimated at approximately 55°-65°F, and will not cause significant elevation in temperature beyond the immediate vicinity of the outlet. The tunnel will be screened to keep dust and other foreign objects from entering the telescope building; there will be no particulates in the exhaust itself.

Page 32 - Handicapped Individuals

All of the buildings at the mid-level facilities at Hale Pohaku, including the Information Station, were designed to accommodate the handicapped. Each new telescope building will be designed to conform to all regulations regarding handicapped access.

Pages 65, 66 & 69 - Management Plan

The prevention of off-road vehicle travel is a major concern of the Management Plan. It is anticipated that security personnel will be equipped with two-way radios so that they can communicate with one another and, if required, with other enforcement officers.

Page 76

The sentence was in error. The correct quote is "permafrost layers may exist within the cinder cones, but if present are not expected to be encountered by construction." This statement has been corrected in the Final EIS.

2444 Dole Street · Room 202 · Honolulu, Hawaii 96822

Pages 88, 103, 104, 113 & 144 - 'Ua'u

The survey referred to was an informal survey conducted on two (rather than one) evenings in 1978 by Cameron Keppler and seven others to satisfy an academic interest in Woodside's previous studies. It was conducted August 2 and 3, 1975, late in the breeding season. The survey was limited to the summit access road and the "Circle Road" to Puu Kole. In addition, Dr. Pat McCoy, who is familiar with the bird, reported no evidence of the 'Ua'u during his extensive archaeological reconnaisance survey of the summit area July 12-17, 1982. Neither the botanists nor the entomologists reported evidence of the bird's presence, although it should be noted that their surveys were conducted during daylight hours.

Page 106

Pages 107 and 108 were inadvertently transposed. The complete sentence and remaining paragraph are found on page 108. This has been corrected in the Final EIS.

Pages 114 & 124 - Sewage Disposal

As stated on page 47 of the draft EIS, current water usage at the summit averages approximately 10 to 20 gallons per person/per day. Assuming the UK/NL MT is fully operational and based on this ratio, water usage for an average of three people for each of two shifts is estimated to be 60 (6 x 10) to 120 (6 x 20) gallons per day. Sewage is estimated at 70% of water usage; therefore, UK/NL should discharge 42 (.70 x 60) to 84 (.70 x 120) gallons of effluent per day. Because these are estimates, all numbers have been rounded to the nearest 10 gallons resulting in the published estimate of 40-80 gallons per day. This estimate includes all discharge. It should be noted that the low estimates are more in keeping with current experience; a range was given to account for unknown requirements of future telescopes.

The environmental impacts assessed in the draft EIS are related to a total of 13 telescopes at the summit by the year 2000. Because of the topography and geology of the summit area, the impacts are more appropriately related to individual areas where the telescopes are located (as stated on page 124 and also on pages 120, 121, 122 and 123 of the draft EIS). Because of the wide separation between points of discharge relative to the total area being considered, these point discharges are never expected to coalesce and, therefore, there will be no overall cumulative impact of sewage effluent discharge in the Mauna Kea Science Reserve.

Page 125 - Archaeological Survey

The paragraph quoted lists three types of mitigating measures. The term may was used in relation to an intensive archaeological survey to leave open other measures that may be suggested by the State Historic Preservation Office (point C).

Pages 115, 209 & 226 - UK/NL Sewage Discharge

The correct amount is 40 to 80 gallons per day.

Pages 180 - 187 - Consulted Parties

The NOP and the draft EIS were transmitted to the State Historic Preservation officer. In addition, he was made aware of the progress of the Plan and EIS throughout the planning process. The availability of the NOP and the draft EIS was published in the EQC Bulletin. In addition, 110 copies of the draft EIS were transmitted to agencies, organizations and individuals; DHHL was one agency which received both the NOP and the draft EIS.

Dr. Pat McCoy was retained to carry out the archaeological survey of the summit area because he is a well-regarded expert on Mauna Kea. He feels that the survey, as published, fulfills all requirements for such a study and is adequate for the EIS. He prepared the ethnographic background portion of his report after extensive review of historical documents and interviews with knowledgeable people. It is the consultant's prerogative, in scientific work, to contact whomever he feels will be most valuable in assisting him in his research. We have, however, passed along your suggestions for his consideration in any future research projects he may conduct in the area.

Pages A-28 - A-65 - Intensive Archaeological Surveys of Telescope Sites

We have discussed your comment with Dr. McCoy. His intent in this recommendation was that such a survey should be conducted for new telescopes in areas not yet surveyed and/or prior to construction near or on known sites. He does not believe that monitoring construction activities is necessary or appropriate for development at the summit.

Appendix D D-5 & 6 - Fish & Wildlife Service Conservation Recommendations

The recommendations will be followed in all future construction at Hale Pohaku.

Appendix G - Botanical Survey

The map on page G-18 of the botanical report indicates that all areas recommended for development to the year 2000, as shown on page 22, were included in the areas studied intensively during the botanical survey period. It is not anticipated that additional surveys will be conducted when specific sites are determined within these Areas. If telescopes are constructed in Area IV (page 22), care will be taken to minimize disturbance to the lichen Pseudephebe pubescens which is found there.

Appendix H - Page H-1 - H-18 - Entomological Study

As you have suggested, many of the recommendations are being incorporated into the Complex Development Plan. In addition, Dr. Frank Howarth has been consulted several times, informally, for his suggestions on various aspects of the Plan. The Management Plan, and eventually the regulations developed to implement the Plan, will emphasize enforcement and protection of the environment.

Sincerely yours,

Harold S. Masumoto
Vice-President for Administration

HSM:pz

cc: Group 70
J. Jefferies/G. Plasch

HERBERT T. MATAYOSHI
MAYOR

HAWAII COUNTY FIRE DEPARTMENT
466 KINOOLE STREET, HILO, HAWAII 96720
PHONE 935-2978

SHOZO NAGAO
FIRE CHIEF

FRANCIS E. SMITH
DEPUTY FIRE CHIEF

RECEIVED
NOV 29 1982
GROUP 70

November 24, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

Dear Ms. Parnell:

This is to acknowledge receipt of the EIS for the Mauna Kea Science Reserve Complex Development Plan. We have no comments on same.

Thank you for the opportunity to review the plan.

Sincerely,

Shozo Nagao

SHOZO NAGAO
FIRE CHIEF

SN/mo

Enclosure

cc: Group 70
Attn: Ms. Marilynn Metz

U of H Vice-President for Administration
Attn: Ms. Ginger Plasch

HERBERT T. MATAYOSHI, MAYOR
H. STUART KEARNS, JR.
Director

DEPARTMENT OF RESEARCH AND DEVELOPMENT

COUNTY OF HAWAII • 25 AUPUNI STREET • HILO, HAWAII 96720 • TELEPHONE (808) 961-8366

December 8, 1982

RECEIVED
DEC - 9 1982
GROUP 70

Ms. Jacqueline Parnell
Office of Environmental Quality Control
550 Halekauwila Street
Room 301
Honolulu, Hawaii 96813

SUBJECT: Mauna Kea Science Reserve Complex Development Plan, Draft Environmental Impact Statement, Volumes 1 & 2

The Department of Research and Development of the County of Hawaii requests the State Board of Land and Natural Resources to accept the Mauna Kea Science Reserve Complex Development Plan, Draft Environmental Impact Statement, Volumes 1 & 2 for the reasons which follow.

1. The Draft Environmental Impact Statement adequately addresses the issues and concerns which have been identified relative to the proposed Mauna Kea Reserve Complex Development Plan.

2. The proposed Mauna Kea Reserve Complex Development Plan will provide significant economic benefits to Hawaii County.

Thank you for your consideration of these comments.

H. STUART KEARNS, JR.
DIRECTOR

cc: Group 70
Attention: Ms. Metz
924 Bethel Street
Honolulu, Hawaii 96813

University of Hawaii at Manoa
Vice President for Academic Affairs
Attention: Ms. Plasch
2444 Dole Street, Room 201
Honolulu, Hawaii 96822

HERBERT T. MATAYOSHI
MAYOR

Office of the Mayor

December 8, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Reference: Mauna Kea Science Reserve Complex Development Plan (SRCD)

From the beginning I have maintained the position that the acceptance of a comprehensive development plan for Mauna Kea should be given the highest priority in the development process for astronomy. A comprehensive plan will definitely enhance the development of a major scientific, research and technology component, i.e. knowledge industry, of our local economy. It will also encourage the expansion of scientific and engineering programs at the University of Hawaii at Hilo.

I was pleased, therefore, to receive the Draft Environmental Impact Statement for the Mauna Kea Science Reserve Complex Development Plan prepared by the Research Corporation of the University of Hawaii. This document reflects the kind of planning process needed to develop a comprehensive plan. This is the approach I have advocated all these years. The EIS addresses the issues and concerns which have been raised by individuals and groups in Hawaii County.

I believe the EIS will lead to the development and finalization of a master plan that will provide a sound, acceptable basis for continuing the development of astronomy activities on Mauna Kea.

HERBERT T. MATAYOSHI
MAYOR

HTM:sar

cc: University of Hawaii
Planning Department
Research and Development

RECEIVED
DEC 27 1982
GROUP 70

UNIVERSITY OF HAWAII

Vice-President for Administration

December 20, 1982

The Honorable Herbert T. Matayoshi
Mayor, County of Hawaii
Hilo, Hawaii 96720

Dear Mayor Matayoshi:

Subject: Mauna Kea Science Reserve
Complex Development Plan
(Draft EIS)

Thank you for your comments in support of our comprehensive planning process for future telescope development on Mauna Kea. A Complex Development Plan (CDP) report based on the information presented in the EIS, is presently being prepared. This report will specify design and environmental criteria which should be followed when various elements of the CDP are implemented. These criteria will reflect concerns expressed in the EIS.

It has been proposed that the UH Board of Regents and the Board of Land and Natural Resources hold a public hearing on the CDP, in Hilo, some time in February or March 1983. This hearing will allow additional community input into the planning process.

Thanks for your support.

Sincerely,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

cc: J. Jefferies/G. Plasch
Group 70

PLANNING DEPARTMENT

25 AUPUNI STREET • HILO, HAWAII 96720

COUNTY OF
HAWAII

HERBERT T. MATAYOSHI
Mayor

SIDNEY M. FUKE
Director

DUANE KANUHA
Deputy Director

December 14, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

Dear Ms. Parnell:

Mauna Kea Science Reserve Complex Development (SRCD) Plan
Draft Environmental Impact Statement (EIS)

Thank you for the opportunity to comment on the draft EIS regarding the above referred master plan for scientific development of the summit area. We apologize for missing the December 8 commenting deadline, and hope that the following comments will be useful in your analysis.

1. In general we find that the document succeeds as a comprehensive effort to address the long-term physical development of the Mauna Kea Science Reserve. We are also pleased to see that a draft Management Plan for the management and monitoring of all activities affecting the reserve has been incorporated for joint review in this EIS. Since this Management Plan also includes Hale Pohaku and the summit access road/corridor, we anticipate that its development will be a significant step to properly implement the SRCD objectives. We look forward to participating in the development of the Management Plan in the near future.

2. It appears that the Mauna Kea Plan of 1977 will require two significant amendments if the SRCD Plan is considered. These amendments are that a) the summit access road be improved and paved; and b) overhead power lines be allowed.

With respect to the summit access improvements, we note that the Northeast Hawaii CDP (Ordinance 445) recommends that this road be relocated so as to provide a more direct route to Puu Hau Oki and mitigate the visual "scar" of the existing roadway along the side of the summit. Several responses to the preparation notice also favored this alignment. In light of the proposed SRCD Plan, this alternative should be more fully addressed in the final EIS.

Further, the draft EIS does not clearly indicate how the environmental concerns of the Mauna Kea Plan have been addressed or mitigated to the extent that both amendments to the Mauna Kea Plan are justifiable. Perhaps some background discussion on how the original policy positions on summit access and utility improvements were developed would be helpful to the reviewers.

3. Will amendments to the Hale Pohaku CDP be necessary in order to be consistent with the proposed Information Station and visitor parking expansion suggested through the SRCD Plan?

4. According to the Research Development Plan (RDP) adopted by the UH Board of Regents in January 1982, a total of 13 major telescopes are envisioned to be situated on the summit by the year 2000. In Part III (R) (2.2. Scenario Two-Maximum Capacity of Mauna Kea Science Reserve), a total of 19 to 22 major telescopes may be accommodated within the Mauna Kea Science Reserve. Does this represent the maximum "carrying capacity" of the Science Reserve and if so, how were these figures determined?

5. Full implementation of the SRCD Plan should be in accordance with all applicable County subdivision and building codes.

In summary, the draft document is well-conceived and should prove to be a very useful decision-making tool for the future use of the Mauna Kea Science Reserve. Should there be any further questions, please feel free to contact this office.

Sincerely,

SIDNEY FUKE
Planning Director

DK:db

cc: Mayor's Office
Group 70
UH Administration

UNIVERSITY OF HAWAII

Vice-President for Administration

December 28, 1982

Mr. Sidney Fuke
Planning Director
County of Hawaii
Hilo, HI 96720

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN DRAFT EIS

Dear Sidney:

Thank you for reviewing the subject draft EIS. We appreciate your input on a project that could significantly affect the County of Hawaii. In response to your specific comments:

1. Management suggestions from you and your staff which were reported to our social impact consultant (David Rae) were incorporated into the draft document. We will, however, be contacting you and other County Department Heads again for additional input before the Management Plan is finalized.

2a. <u>Summit Access Road Improvements</u>

As stated in the draft EIS (page 134), road improvements are only in the preliminary planning phase. The road relocation which you suggest was evaluated during the planning process; it was not recommended due, primarily, to the additional construction costs involved. The CDP report will recommend that the design consultant for the road do a more detailed analysis of this alternative alignment and come to his own conclusions based on engineering, environmental and cost criteria. The cost and feasibility of obliterating the existing road along the side of the summit will also have to be taken into consideration in his recommendation.

2b. <u>Amendments to Mauna Kea Plan</u>

I, personally, did not take part in the Mauna Kea Plan planning process. It is, therefore, difficult for me to discuss in any detail the background of how these policy positions were developed. Perusal of minutes of Citizens Advisory Committee meetings and draft documents leads me to the conclusion that the decision not to pave the road was made in order to restrict access. I feel that the draft Management Plan addresses impacts of increased access and that its implementation will control adverse effects.

Decisions to allow generation of power on-site and/or underground lines appear to have two bases: control of the number of telescopes and aesthetics. As you are aware, the cost of diesel fuel for generators has increased dramatically since the plan was adopted. In addition, a generator is subject to oil spills which is undesirable environmentally. Burying 69-kV powerlines is also damaging environmentally, as was described in the EIS. The proposed recommended alignment for overhead lines (Corridor A) was selected, in part, because the lines would not be visible from the Saddle Road or the County Road to Hale Pohaku.

The Mauna Kea Plan does allow for annual amendment and even makes the case that amendments will probably be necessary. We are currently discussing the procedure for amendment with DLNR.

3. Will Amendments to Hale Pohaku CDP Be Required:

   It is our understanding that the SRCD Plan will, when adopted, be the primary long-range plan for all University of Hawaii development on Mauna Kea. Environmental and design criteria specified in the Hale Pohaku CDP will be incorporated in the SRCD Plan.

4. Part III (P) 2.2 Scenario Two-Maximum Capacity of Reserve

   As stated in the draft EIS (p. 57), the scenario envisions development to the maximum physical capacity of the summit cinder cones, the 13,000-foot plateau, the shield areas to the north of the summit cinder cone, and the eastern plateau. It was derived by using "rule of thumb" technical requirements for locating telescopes in relation to the wind, obscuration considerations and the telescopes' relationships to one another. It is an estimate which would have to be verified by extensive testing. We are not sure what you mean by "carrying capacity;" the numbers given can be considered to be the theoretical technical capacity of the areas mentioned.

5. All applicable County subdivision and building codes will be adhered to in implementing the plan.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:pz

cc: Group 70
J. Jefferies/G. Plasch

OFFICE OF THE COUNTY CLERK
HAWAII COUNTY BUILDING
COUNTY OF HAWAII
HILO, HAWAII 96720

December 8, 1982

Refer: C-1013/EDC-50

To: State Environmental Quality Commission

Re: Mauna Kea Science Reserve Complex Development Plan

The following is the action of the Hawaii County Council adopted at its meeting held today:

Approve and adopt Committee on Economic Development Report No. 50.

R. B. Legaspi
COUNTY CLERK

Att.

cc: Mayor
Planning Dept.
Research & Development

REPORT OF THE
COMMITTEE ON ECONOMIC DEVELOPMENT

November 23, 1982

Chairman and Members
Hawaii County Council
Hilo, Hawaii

Your Committee on Economic Development to which was referred:

Comm. 1013: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN
From the State Environmental Quality Commission dated November 8, 1982, transmitting for comments or acknowledgement of no comments, an Environmental Impact Statement (EIS) that was prepared pursuant to Chapter 343, Hawaii Revised Statutes, and the Rules and Regulations of the Environmental Quality Commission. Comments must be received or postmarked by December 8, 1982;

has reviewed the Environmental Impact Statement for the Mauna Kea Reserve Complex Development Plan and feels the problems have been adequately addressed; and that the State Environmental Quality Commission be so notified.

Further recommends that the Council work together with the administration to come up with a position to support the development of Mauna Kea.

FRANK DE LUZ, III
CHAIRMAN

EDC Report No. 50

Adopted: DEC 8 1982

Al M. Inoue, Chairman
Conservation Committee
Sportsmen of Hawaii
Suite 104, 101 Aupuni Street
Hilo, Hawaii 96720

November 22, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, HI 96813

Dear Ms. Parnell:

We appreciate the opportunity to comment on the Environmental Impact Statement pursuant to Chapter 343, Hawaii Revised Statutes and the Rules and Regulations of the Environmental Quality Commission regarding the Mauna Kea Science Reserve Complex Development Plan (SRCD), Mauna Kea, Hawaii.

Due to the lenghty material and the limited time in which to respond, we will be directing our comments on the two which we feel are the most critical areas.

With regard to the Power Line Corridors, the Board of Directors of the Sportsmen of Hawaii voted to recommend that you consider Corridor "C" as the path for the power line from the Saddle Road to "Hale Pohaku." We understand that Corridor "C" follows the existing County Road to Hale Pohaku. The reasons for this choice are as follows:

a) Corridors A and B are not a good choice as this will provide an access to an area which is at the present time difficult to access by the general public. This area serves as a game sanctuary and also an area to be hunted by those not having a 4-wheel drive. This sanctuary also serves as a reservoir for game which filters into other areas, providing better hunting in the surrounding areas.

b) An all-wheather road which is necessary along a power line corridor for emergencies will also present a poaching problem which is quite heavy in that area. Our already understaffed Enforcement Division would be hard pressed to patrol this area.

c) Aesthetically,Corridor "C" would have minimum impact on viewing opportunities as there is an already constructed and paved highway in that area.

The Board of Directors of the Sportsmen of Hawaii also voted to recommend that the road from Hale Pohaku to the summit be kept unpaved because of the following reasons:

1) A paved road would provide extreme hazards during icy conditions for those of us who are unfamiliar with driving on slick, icy roads. Accidents may result from these unfamiliarities. Steep grades in certain areas also compound this problem

....../cont.

2) Open public access to the summit will provide additional hazards for the automobile that is not suited for high altitude operation. Most 4-wheel drives, to maintain low-gear ratio necessary to negotiate the steep grades must also engage in 4-wheel drives which because of the difference in differential may create mechanical problems to the gearing.

3) Additional public areas will also entail desecration and littering which is difficult to control.

We hope that the above recommendations will be agreeable to you. We would be glad to meet with you at any time to further discuss our recommendations. Please feel free to call or write.

Sincerely,

Al M. Inoue, Chairman
Conservation Committee
SPORTSMEN OF HAWAII

AMI:ec

cc: Group 70
924 Bethel Street
Honolulu, HI 96813
Attn.: Ms. Marilynn Metz

AND

University of Hawaii
Vice-President for Administration
2444 Dole St., Room 201
Honolulu, HI 96822
Attn.: Ms. Ginger Plasch

UNIVERSITY OF HAWAII
Vice-President for Administration

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December 1, 1982

Mr. Al M. Inoue, Chairman
Conservation Committee
Sportsmen of Hawaii
101 Aupuni Street, Suite 104
Hilo, Hawaii 96720

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN DRAFT EIS

Dear Mr. Inoue:

Thank you for your comments on the subject draft EIS. We appreciate your input on this project, as received during our earlier discussions and in your comment letter. In response to your two specific concerns:

A. Final Powerline Corridor Alignment - We note the recommendation by your organization; this will be taken into consideration when choosing the final powerline corridor alignment. If corridor "A" is chosen, in order to avoid the possibility of increased poaching, mitigating measures will be taken to restrict access to all but approved vehicles.

Unfortunately, we have to differ with your contention that "Aesthetically, Corridor "C" would have minimum impact on viewing opportunities." Although it is true that this corridor has already been "disturbed," aesthetically, we still maintain that overhead lines in corridor "C" would be the most visible of all the corridors from the most heavily traveled roads in the area, the Saddle Road and the County road to Hale Pohaku.

B. Paving of Summit Road

1. One of the reasons it is proposed that the road to the summit be improved and paved is to facilitate snow removal. In addition, the draft Management Plan states that "If the road is paved, standard vehicles will be allowed to proceed, provided there is no snow or ice on the ground. When snow or ice are present, all vehicles will need to have chains." (Volume I, draft EIS, page 64).

2. The draft Management Plan also states that "Station [the Visitor Information Station] personnel will distribute regulations relating to activities on the mountain including rules for mountain driving." It is also possible that the road will be closed during times it is being de-iced.

3. In order to mitigate the possible impacts of increased numbers of visitors on the summit resources, the draft Management Plan describes a number of proposals to control access to the summit; these include: Information Station and gate to the summit access road at Hale Pohaku, provision for parking at the summit and if conditions warrant it, the establishment of a shuttle bus service.

We appreciate your thoughtful comments on this project.

Very truly yours,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

HSM:pz

Enclosure

cc: Group 70
J. Jefferies/G. Plasch

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GROUP 70

HAMAKUA DISTRICT DEVELOPMENT COUNCIL

. O. Box 637, HONOKAA, HAWAII 96727

December 3, 1982

Office of Environmental Quality Control
550 Halekauila Street, Room 301
Honolulu, HI 96813

ATTENTION: Jaqueline Parnell, Director

We have reviewed the current document, EIS for Mauna Kea Science Reserve Complex, dated November 1982. It has answered adequately the concerns which we expressed previously.

Obviously the EIS or SRCD does not solve all problems, nor does it provide decisions concerning the multitude of issues that are part of the long-term development of the resource of Mauna Kea as a site for internationally superior research in astronomy.

What the document does accomplish is to bring forth in detail the issues foreseen to be involved in this long-range program. It cannot predict the political and economic future upon which such a program depends. As such, the EIS is viable as an instrument in the decision-making process which will be virtually continuous into the projected future to the year 2000.

Thank you for the opportunity for being a part of this development plan and in expressing an input from the Hamakua community.

This statement has been authorized by the Board of Trustees at its of November 18, 1982.

Sincerely yours,

P. Quentin Tomich

P. Quentin Tomich,
Secretary

CC: Group 70
UH Vice-President for Administration

UNIVERSITY OF HAWAII

Vice-President for Administration

December 20, 1982

Dr. P. Quentin Tomich, Secretary
Hamakua District Development Council
P. O. Box 637
Honokaa, HI 96727

Dear Dr. Tomich:

Thank you for your comments on the Mauna Kea Science Reserve Complex Development Plan EIS. We appreciate the interest that you and the Development Council have expressed throughout the planning process.

A Complex Development Plan (CDP), based on the information presented in the EIS, is being prepared at the present time. This plan will specify design and environmental criteria which should be followed in implementing elements of the CDP. It will reflect the concerns expressed in the EIS. The two documents, together with public input at hearings for each individual project, as you state, will provide the basis for decision making to the year 2000.

Very truly yours,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

HSM:

cc: J. Jefferies/G. Plasch
Group 70

2444 Dole Street · Room 202 · Honolulu, Hawaii 96822
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HICA HAWAII ISLAND CONTRACTORS' ASSOCIATION
494 C KALANIKOA STREET • HILO, HAWAII 96720 • TELEPHONE (808) 935-1316

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GROUP 70

December 6, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

RE: YOUR LETTER DATED NOVEMBER 8, 1982

TITLE:	MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT - PLAN (SRCD)
LOCATION:	MAUNA KEA, HAWAII
CLASSIFICATION:	AGENCY ACTION

Dear Ms. Parnell:

The Environmental Impact Statement (EIS) was reviewed by the Hawaii Island Contractors' Association and we have no comment at this time other than it appears quite complete and well done.

Sincerely yours,

HAWAII ISLAND CONTRACTORS' ASSOCIATION

Cy Savage
Cy Savage
President

Copy: - Group 70
Attention: Ms. Marilynn Metz
924 Bethel Street
Honolulu, Hi. 96813

- University of Hawaii Vice-President for Administration
Attention: Ms. Ginger Plasch
2444 Dole Street, Room 201
Honolulu, Hi. 96822

SKI SHOP
HAWAII

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GROUP 70

December 8, 1982

Jacqueline Parnell, Director
Office of Enviromental Quality Control
550 Halekauwila St., Room 301
Honolulu, HI 96813

Dear Ms. Parnell:

The EIS for the Mauna Kea Science Reserve Complex Developement Plan is the single most complete document on the total value of Mauna Kea. Everyone involved has gained a great deal more knowledge and respect for each other and the mountain. I am pleased to have shared in contributing to this document.

I would like to add a few additional notes for use during the implementation of this, and will submit them at a later date.

Our only reservation is to ensure that the public access is properly maintained. It is widely known that the University of Hawaii personnel give false and misleading snow reports to discourage the use of Mauna Kea. If unreasonably restrictive standards in application of the controls are misused to block the recreational usage of Mauna Kea, considerable public opposition to developement will incur.

We would be happy to assist in establishing a reasonable outline of the basic standards for safe and reasonable use.

Sincerely,

Dick Tillson

Dick Tillson
President

cc: Ms. Marilynn Metz
Group 70

Ms. Ginger Plasch
U of H Vice-President for Administration

UNIVERSITY OF HAWAII

Vice-President for Administration

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GROUP 70

December 22, 1982

Mr. Dick Tillson, President
Ski Shop Hawaii
P. O. Box 8327
Honolulu, HI 96815

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN DRAFT EIS

Dear Mr. Tillson:

Thank you for your comments supporting the Development Plan. In answer to your specific concern about authority to close the summit of Mauna Kea:

The Management Plan is in draft form at the present time; additional public input will be solicited before it is finalized. Because the University of Hawaii is responsible for snow removal and deicing of the road, and because UH is also responsible for the safety of people using the road, it is necessary for us to have the authority to close the road when weather is severe or when road maintenance is required. Regarding your allegation, we are not aware of situations where UH personnel give false and misleading snow reports to deter people from using Mauna Kea. If you come across occasions where this occurs, please be in touch directly with Dr. John Jefferies at the Institute for Astronomy.

We will welcome your assistance in developing basic standards for implementing these controls.

Very truly yours,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

HSM:pz

cc: Group 70
J. Jefferies/G. Plasch

HAWAIIAN ELECTRIC COMPANY, INC.
Box 2750 / Honolulu, Hawaii / 96840

RICHARD L. O'CONNELL, P.E.
MANAGER, ENVIRONMENTAL DEPARTMENT
(808) 548-6880

December 7, 1982

ENV 2-1
NV/G

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

RECEIVED
DEC - 9 1982
GROUP 70

Dear Ms. Parnell:

Subject: Draft EIS for the Mauna Kea Science Preserve Complex Development Plan, Mauna Kea, Hamakua, Hawaii

We have reviewed the above Environmental Impact Statement and offer the following comments:

1. Part III, page 26 - Our standard chain link fence height is eight feet high instead of six feet.

2. Part VIII, page 146 - The alternative powerline corridor "A" is within the Palila Critical Habitat and also the steepest. Designing, constructing and maintaining the powerline in that corridor will be very difficult.

3. EIS stated that jeep trails could be used; however, there is some doubt whether the line trucks and/or pole trucks could traverse these trails.

4. Has the use of helicopters been considered in construction?

Thank you for the opportunity to comment on this Environmental Impact Statement.

Sincerely,

R L O'Connell

Richard L. O'Connell
Manager, Environmental Department

JMP:cal

cc: Group 70
Attention: Ms. Marilynn Metz

UoH, Vice President for Admin.
Attention: Ms. Ginger Plasch

UNIVERSITY OF HAWAII

Vice-President for Administration

December 28, 1982

Mr. Richard L. O'Connell, Manager
Environmental Department
Hawaiian Electric Company, Inc.
P. O. Box 2750
Honolulu, HI 96840

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN DRAFT EIS

Dear Mr. O'Connell:

Thank you for commenting on the subject EIS. In answer to your specific concerns:

1. Part III, Page 26 - Height of Chain Link Fence:

   We have been working closely with HELCO representatives on the engineering aspects of the powerline project and we intend to continue this cooperative relationship throughout the design and construction phases of the project. Doing so should ensure that what is eventually built will meet all HECO and HELCO standards.

2. Part VIII, Page 146 - Alternative Corridor A:

   At least some portion of each alternative corridor is within the critical habitat of the Palila. For that reason, the U.S. Fish and Wildlife Service was consulted in an advisory capacity concerning potential impacts on this habitat. As stated on page 150 of the subject EIS, the preliminary opinion of the service is incorporated as Appendix D.

   Environmental, social and financial costs and benefits of each alternative route, as well as each alternative's potential construction and maintenance problems, will be evaluated in selecting the final alignment.

3. Use of Jeep Trails:

   We intend to require that the construction contractor use existing jeep trails, whenever feasible, to minimize the amount of new access roads required. The types of vehicles needed for construction will be one factor evaluated to determine whether use of a particular jeep trail is feasible.

4. Use of Helicopters for Construction:

Yes, helicopters were considered because it was felt that their use would minimize the need for access roads, thus minimizing environmental impacts. Our investigation, however, revealed that helicopters of the size required to perform the heavy construction activities are not available locally. The cost of bringing one into the State would be prohibitive. In addition, unless the helicopter was available for emergency repairs and routine maintenance, an access road would still be needed for these purposes.

Very truly yours,

Harold S. Masumoto

Harold S. Masumoto
Vice President for Administration

HSM:pz

cc: Group 70
J. Jefferies/G. Plasch

CONSERVATION COUNCIL FOR HAWAII

State Board
P. O. Box 2923 · Honolulu, Hawaii 96802

Oahu Chapter
P. O. Box 2923 · Honolulu, Hawaii 96802

Hawaii Island Chapter
P. O. Box [illegible] · [illegible] Hawaii 967[illegible]

Maui Chapter
P. O. Box 416 · Haiku, Hawaii 96708

RECEIVED
DEC - 9 1982
GROUP 70

December 8, 1982

Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila St. Room 301
Honolulu, HI 96813

Dear Ms. Parnell,

The Conservation Council for Hawaii is not anti-telescopes. Most CCH members are members of the scientific community and share in the excitement of discovery that astronomy offers. We feel, however, that the natural sciences have a place in the planning and management of the Mauna Kea Science Reserve and that the draft E.I.S. for the Mauna Kea Science Reserve Complex Development Plan does not reflect that. The unique attributes of the aeolian ecosystem on Mauna Kea are mentioned in this document, yet seem to carry no weight in the conclusions drawn therein.

The CCH feels that the botanical and biological studies contained in the draft E.I.S. are incomplete. Many of the plant and arthropod identifications are left in question. No real study of the dynamics of the aeolian ecosystem has been done. We feel that at least a year of properly funded studies seems in order with a review period for determining management plans related to preserving this delicate ecosystem. The University of Hawaii has the talent and resources for this effort.

The most glaring inadequacy in the draft E.I.S. is the lack of a comprehensive management plan. Even if no further telescopes go on Mauna Kea, a good management plan is needed now. Off-road vehicle use has dramatically impacted the summit area. Expanded recreational use by skiers has, also, heavily impacted the summit. The summit area has been designated a Science Reserve and entrusted to the University of Hawaii. Recreation is not a compatible usage. Skiing is not a significant revenue source on the Big Island. Impacts created by skiers on Mauna Kea can be compared to impacts caused by dune buggies and motorcycles in the fragile desert ecosystems in the Southwestern United States. Limited access and a permit system, we feel, would help control these unnecessary and harmful activities.

The CCH is very concerned about the open-ended nature of this development plan. Many members feel that Mauna Kea already has enough telescopes. Even those members who favor more telescopes are concerned that this plan sets no limits on growth. The wealth that nature offers us shouldn't be destroyed in an attempt to reach an understanding with the universe at large. Hopefully, a balanced approach can be worked out.

Sincerely,

Stephen A. Holmes

Stephen A. Holmes, Pres.

UNIVERSITY OF HAWAII

Vice-President for Administration

RECEIVED
DEC 30 1982
GROUP 70

December 22, 1982

Mr. Stephen A. Holmes, President
Conservation Council for Hawaii
P. O. Box 1222
Hilo, HI 96720

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN DRAFT EIS

Dear Mr. Holmes:

Thank you for your comments on the draft EIS for the Mauna Kea Science Reserve Complex Development Plan. In answer to your specific comments:

1. Botanical and Biological Studies:

   Nearly one-third of the total project budget was allocated to biological, botanical and archaeological studies in order that we might retain the best experts in Hawaii for the surveys. We asked these scientists to respond to your comments; their letter to our consultant, Group 70, is attached.

2. Management Plan:

   A draft Management Plan was presented as Part IV of the draft EIS. As stated in the EIS, "more public input is required before the various elements are finalized." Control of off-road vehicles and skiing is specifically addressed in this plan. This plan cannot be implemented until jurisdiction is transferred from the Board of Land and Natural Resources (BLNR) to the University of Hawaii (UH). This will require, among other things, a public hearing and an amendment to the Mauna Kea Plan. In addition, new regulations must be promulgated through a process proscribed by State Law.

   The 1977 DLNR Mauna Kea Plan states that "winter snow play and skiing will be permitted at appropriate summit areas." In addition, the lease between the BLNR and UH specifically provides for recreational use of the Science Reserve. (A Conservation District Use Permit is required for all commercial activities). Because

BLNR policy allows recreational uses within the Science Reserve, the UH cannot prohibit them. The UH management approach is, therefore, directed towards controlling access, monitoring usage, and enforcing regulations. Your concerns about incompatibility of uses should be addressed to the BLNR.

Once the Management Plan is officially adopted, and regulations have been promulgated, we encourage the Conservation Council to advise the University on ways to make the Management Plan more effective.

3. Open-Ended Plan:

We disagree that the Development Plan is open-ended. The Plan sets limits for growth for the foreseeable future, the year 2000. Any attempt to forecast actions beyond that time would be highly speculative and subject to unquantifiable error. The CDP not only sets the maximum number of permitted telescopes (13) by the horizon year but also specifies the areas where this development can take place. By monitoring the effects of development through the timeframe of the plan, more informed decisions can be made as to the advisability of further development after that date. This, we believe, is the best approach to achieving the balance that you desire.

Very truly yours,

Harold S. Masumoto
Vice President for Administration

HSM:pz

Enclosure

cc: Group 70
J. Jefferies/G. Plasch

B I S H O P M U S E U M
1355 KALIHI STREET • P.O. BOX 19000-A • HONOLULU, HAWAI'I 96819 • (808) 847-3511

17 December 1982

RECEIVED
DEC 21 1982
GROUP 70

Mrs. Marilynn C. Metz
Group 70
924 Bethel Street
Honolulu, HI 96813

Dear Marilyn:

I am a bit perplexed by Mr. Holme's letter to Mr. Parnell concerning the Mauna Kea EIS with which we helped you. On the one hand, given the time constraints under which we worked (field work had to be completed in July, preliminary report tendered by 27 August) there could not possibly have been a better effort made in the assessment of the biota of Mauna Kea. The biologists engaged in the study were the best experts available in Hawaii for the respective organisms covered, and I believe that Mr. Holmes should be made aware of this fact. Therefore, given the time constraints, no contracting group could have provided a more reliable scientific assessment of the plants and insects of the areas covered, and if the recommendations made by the biologists involved are followed, perturbation of the environment should be kept to a minimal level. This particularly would be true if the recommendation concerning off-road travel is strictly enforced. The best management procedures in general for preserving the uniqueness of the area would be, of course, to strictly limit unauthorized access to the area.

The fact that some of the species have not been identified is, of course, directly related to the fact that so relatively little has been known of the ecosystems on Mauna Kea, and the scientists involved with the EIS study are continuing their efforts to the present as these efforts are part of their own research interests. It should be pointed out to all concerned that the biologists that have been involved were not exactly recruited off the streets but were involved because the study represents part of their own interests in areas in which they are expert. It takes a bit of time to properly evaluate, for example, whether a particular lichen has been described before and, if not, to publish a description in a scientific journal. The latter may take up to two years, and until that time the species in question remains officially incognito. This scientific fact does not at all alter the recommendations made by us.

Mr. Holmes, however, is quite correct in his belief that a long-term study of the aeolian system is needed. It is essentially what we have recommended outside of the context of this particular EIS study and, as we stated before the assessment, we hope that along with the other activities of the Institute for Astronomy, there will be funding for some long-range studies; much longer that the one year that Mr. Holmes suggests in his letter.

Sincerely,

Sy

S.H. Sohmer
Chairman
Department of Botany

SHS/za

SKI ASSOCIATION OF HAWAII
P.O. Box 8327 / Honolulu, Hawaii 96815 Recorder Phone

RECEIVED
DEC 13 1982
GROUP 70

December 6, 1982

STATE OF HAWAII
Enviromental Quality Commission
Roy R. Takemoto, Chairman
550 Halekauwila St., Rm 301
Honolulu, HI 96813

Dear Sirs:

We are pleased to have contributed to the Enviromental Impact Statement (EIS) for the Mauna Kea Science Reserve Complex Developement Plan (SRCD).

The inclusion of provisions and controls for the public use of Mauna Kea will enhance the quality of all the activities on the mountain. We highly recommend the adoption of this plan. We hope that we can continue to work together and contibute to the implementation of the plan.

We compliment you on the scope of this EIS. It will help everyone involved to understand and appreciate the total value of Mauna Kea.

A sincere aloha,

Dick Tillson

Dick Tillson
President

Hawaii Island
Chamber of Commerce
Established in 1897 • 180 Kinoole St. Suite 203 • Hilo, Hawaii 96720 • Phone (808) 935-7178

December 8, 1982

Ms. Jacqueline Parnell, Director
Office of Environmental Quality Control
550 Halekauwila Street, Room 301
Honolulu, Hawaii 96813

Dear Ms. Parnell,

Whereas, the Mauna Kea Science Reserve Complex Development Plan outlines tremendous economic benefits to the County of Hawaii, the Hawaii Island Chamber of Commerce requests that the Board of Land and Natural Resources accepts the Environmental Impact Statement, as an adequate assessment of the development of Mauna Kea.

If issues still remain under question, they should be worked out in a manner as acceptable as possible to all interested parties.

We appreciate the opportunity to present input and ask that you keep our organization on your mailing list for further information.

Sincerely,

Walt Southward

WALT SOUTHWARD
President

WWS/SKS:kms

cc: Ms. Marilyn Metz, Group 70
Ms. Ginger Plasch, University of Hawaii

UNIVERSITY OF HAWAII

Vice-President for Administration

December 29, 1982

Mr. Walt Southward, President
Hawaii Island Chamber of Commerce
180 Kinoole Street, Suite 203
Hilo, HI 96720

SUBJECT: MAUNA KEA SCIENCE RESERVE COMPLEX DEVELOPMENT PLAN DRAFT EIS

Dear Mr. Southward:

We appreciate the comments of the Hawaii Island Chamber of Commerce in support of development on Mauna Kea and the adequacy of the draft EIS.

The Hawaii Island Chamber of Commerce will be kept informed of all future progress on this important project.

Very truly yours,

Harold S. Masumoto
Vice-President for Administration

HSM:pz

cc: Group 70
J. Jefferies/G. Plasch